Grazing and Genetic Options to Grow the Beef Business

A report for NUFFIELD AUSTRALIA FARMING SCHOLARS

by Ray Vella

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Foreword

The aim of my Nuffield study was to investigate which breeds of cattle best produce quality beef in harsh environments. Because of our reliance on export markets and because of our high cost of production in Australia compared to other major beef exporters such as India and Brazil, our long term market security has to be targeted at a high quality product. The problem for producers in dry harsh tropics of northern Australia is that both the breeds and the finishing systems are more amenable to production of manufacturing beef.

My research focused on visiting and evaluating successful cattle grazing/breeding operations, research stations, universities, veterinarians, being run productively and efficiently in other countries. The aim is to incorporate their more successful concepts and initiatives into Australian farming enterprises, with sufficient flexibility to suit every individual grazing capacity. The unpredictability of Australia's climate and the spiralling cost of labour and fuel compound the challenges facing Australian beef producers. They must pursue more profitable management decisions in marketing by using good genetics through bull selection whilst improving soil health to develop a sustainable business.

It is hoped that this study will benefit cattle producers in all areas of Australia that are focused on maintaining healthy soils and producing cattle of high quality by utilising simple visual selection tools in conjunction with the use of EBVs as a secondary tool.

While travelling with seven other scholars from different agricultural backgrounds within Australia and Canada, my research began looking at many different facets of agriculture throughout America, Mexico, Brazil, Canada and New Zealand. My individual studies were accomplished in Brazil, America, Canada and also in Australia where I attended a holistic management course.

Meat and Livestock Australia Ltd made my travel and research possible, providing funds and support for this Australian Nuffield Scholarship and report.

Not only has this scholarship given me an opportunity to gain an immense amount of knowledge regarding my study topics but has also emphasised the importance of targeting the right market to suit each property.

Acknowledgements

I am eternally indebted to numerous people and organisations for making my Nuffield journey memorable. These are:-

- My wife Leah, and our children Kurt, Kayla and Beau. Without their support, dedication and encouragement I would not have been able to embrace the full Nuffield experience.

- Jim Geltch and Nuffield Board for believing in me and allowing me to represent Nuffield Australia as their scholar and giving me the confidence to get the job done.

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- My fellow Nuffield Scholars, Natalie, Bryan, Rhys, Damian, Ryan, Dave and Crosby for their friendship, experienced through our Global Focus Program.

- My hosts from around the world, thank you for the hospitality, time and knowledge which assisted me in my Nuffield journey.

Abbreviations

AI	Artificial Insemination
EBV	Estimated Breeding Value
EPD	Expected Progeny Differences
IVF	In-Vitro Fertilisation
MLA	Meat & Livestock Australia
FTAI	Fixed Time Artificial Insemination
DM	Dry Matter
PPAI	Post Partum Anoestrous Interval
DTC	Days to Calving

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Executive Summary

Cattle producers around the world face rising input costs to their business every year while commodity prices remain constant and the amount of productive land is slowly declining. The world's population is growing with predictions of it reaching nine billion people by 2050 and some of the most productive land is being converted into housing development. This is forcing farmers around the world to be more productive with less land mass available.

America is a perfect example. Their cow herd numbers are at an all time low but they are producing more beef per animal through the benefits of genetic improvement. In addition, the corn prices are at record highs and this is forcing feedlots to purchase older, heavier cattle to enter the feedlot resulting in less feeding days.

Selecting superior genetics that is not over-fed from the day it is born and excels in a number of traits can save time and money. With the average age of a cattle producer being over 50 years and experienced labour being difficult to source, it is important to select animals for genetic traits which address worker safety and more efficient productivity. Such traits include; temperament, poll genetics, parasite resistance, and easy birth weights. With the availability of accurate data (EBVs and genomics) from birth to processing, more cattle producers can determine their income for that beast by the futures index market.

With increased forage quality the challenge is to use each leaf of pasture whilst maintaining soil health, so that the benefits from improved herd fertility will accrue, producing more dollars per acre, along with reductions in pesticide use and fertilizing requirements.

Too many cattle producers are not aware of the harm they doing to their soils by not grazing their pastures efficiently and effectively. With the implementation of well maintained and healthy soils, along with the correct herd selection tools, the beef industry in Australia has potentially a very positive outlook for a profitable future.

Introduction

Pasture Management

Soil health is the heart and soul of every farming operation and for a Central Queensland beef producer it is critical to increasing production and ultimately kilograms over the hook. Australia is renowned for its harsh climate, being one of the driest continents on Earth. It is broken up into two main categories, a non-brittle and a very brittle environment. Understanding the local environment and how well available rainfall is distributed throughout the year, together with how quickly dead vegetation breaks down, will determine individual pasture management practices. One of the most economical forms of control of forage management is through the manipulation of the animal impact on the land, with animals disturbing the soil for new seedlings to grow, eating 50% of the forage and leaving 50% on the ground to break down and supply the soil with ground cover and organic matter providing feed for the soil biota. Also, as the animals migrate in a pasture, they fertilize the ground as they go. The balance of the grazing system throughout the growing season and dormant season must be right as the effects of over-grazing with no rest period can exhaust the soils. The effects of some type of disturbance to pastures and soil types at the right time of the year can have a very profitable outcome to a business with some soils having to be managed more aggressively than other soil types. Sub-tropical and tropical environments are one of the hardest environments to manage because of the rapid growth, humidity and high-intensity rain systems and where the majority of the rainfall falls within three to four months. The tropical grasses have a C4 carbon pathway which means they grow faster and taller but contain more fibre and less nitrogen and digestible energy than their temperate counterparts and therefore are less productive.

Beef Genetics

Living in a sub-tropical cattle tick infected area, there is a need to retain at least 30% Brahman breed influence. Australia's beef production is predominately made up of three areas, the Northern Australia – where tropical breeds predominate, Southern Australia – which is restricted to temperate breeds, with a mixture of both temperate and tropical breeds in between, as shown in the figure below.

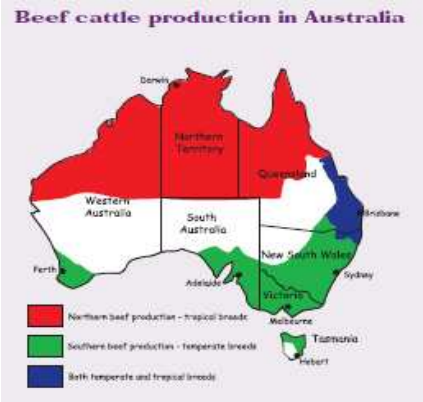

Figure 1: Beef cattle production in Northern Australia
Source: MLA 2006 Beef Fact Sheets

The Brahman cattle would have to be one of the most adaptable breeds for the tropics. However, they are known to have a lighter carcase weight and lower fertility than some *Bos taurus* breeds. In addition, cattle with a higher *Bos indicus* content are known to have a higher proportion of calpastatin, the enzyme that slows the breakdown of protein in the carcase. Eating quality studies have revealed that the cuts affected by *Bos indicus* content are essentially the same ones affected by treatment of the animal with Hormonal Growth Promoters (HGPs). *Bos indicus* beef is generally regarded as having a lower eating quality and is generally less suited to the high quality meat trade.

Objectives

- To help producers find a more profitable business by improving beef genetics through better bull selection tools and effective forage management.
- To look at other ranchs' strategies that are performing effectively in harsh environments.
- To find genetics most suited to forage-based feeding systems.
- To investigate the advantages of maintaining healthy soils through the use of mechanical disturbance, prescribed burning and planting legumes into pastures.
- To look at the advantages of hot-fence weaning concepts.
- To investigate the advantages of Artificial Insemination (AI) and Fixed Time Artificial Insemination (FTAI) techniques over natural mating practices.

Chapter 1: Grazing systems and methods

1.0 Cell Grazing

Cell grazing is one of the most influential management tools. A workshop by Kirk Gadzia from RegenAG Holistic Management taken place at Greenvale, Northern Queensland, from the 7th to the 9th of November 2011 spoke of principles using animal impact and by controlling high yielding forages which produce great amounts of bio-mass feed. In these circumstances, these grazing paddocks can double their carrying capacity in conjunction with profitable returns on weight per acre. At Embrapa, Sao Carlos, Brazil, they have the advantage of a high rainfall which allows them to adopt a goal of grazing pastures for a maximum of three days. These cattle would consume 50% of the available forage matter and leave 50% of ground cover to obtain beneficial soil moisture.

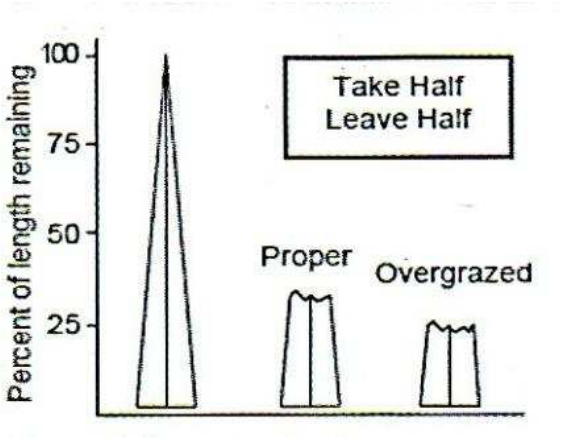

Figure 2: Comparison of percentages of a plant's productivity being properly grazed and overgrazed

Source: South Dakota Coalition, Greener Pastures

Most cattle producers attending the holistic grazing course practiced a calculated assessment of animal days per hectare for each individual paddock size. It is preferable to plan a successful grazing system based on an estimate how much forage is on hand per hectare, how many days can be grazed in a single year, and the most important aspect of the plan, leaving a recovery time sufficient for forage and root systems to rejuvenate. With the availability of more paddocks, you have greater control over grazing time on each individual pasture to prevent selective grazing. Over-trampling, especially in the high rainfall area where bogging occurs and over-grazing to reduce the remaining ground cover will damage

the pasture if a mob is left too long in a paddock. The rest time is essential to allow for the recovery of the pastures to rejuvenate, as judged by visual assessment.

As stated above, the RegenAG Holistic Management workshop conducted by Kirk Gazdia, spoke of the importance of calculating animal days per hectare to measure fodder production and intake. The table below represents a simple measuring tool which can be implemented in any grazing system.

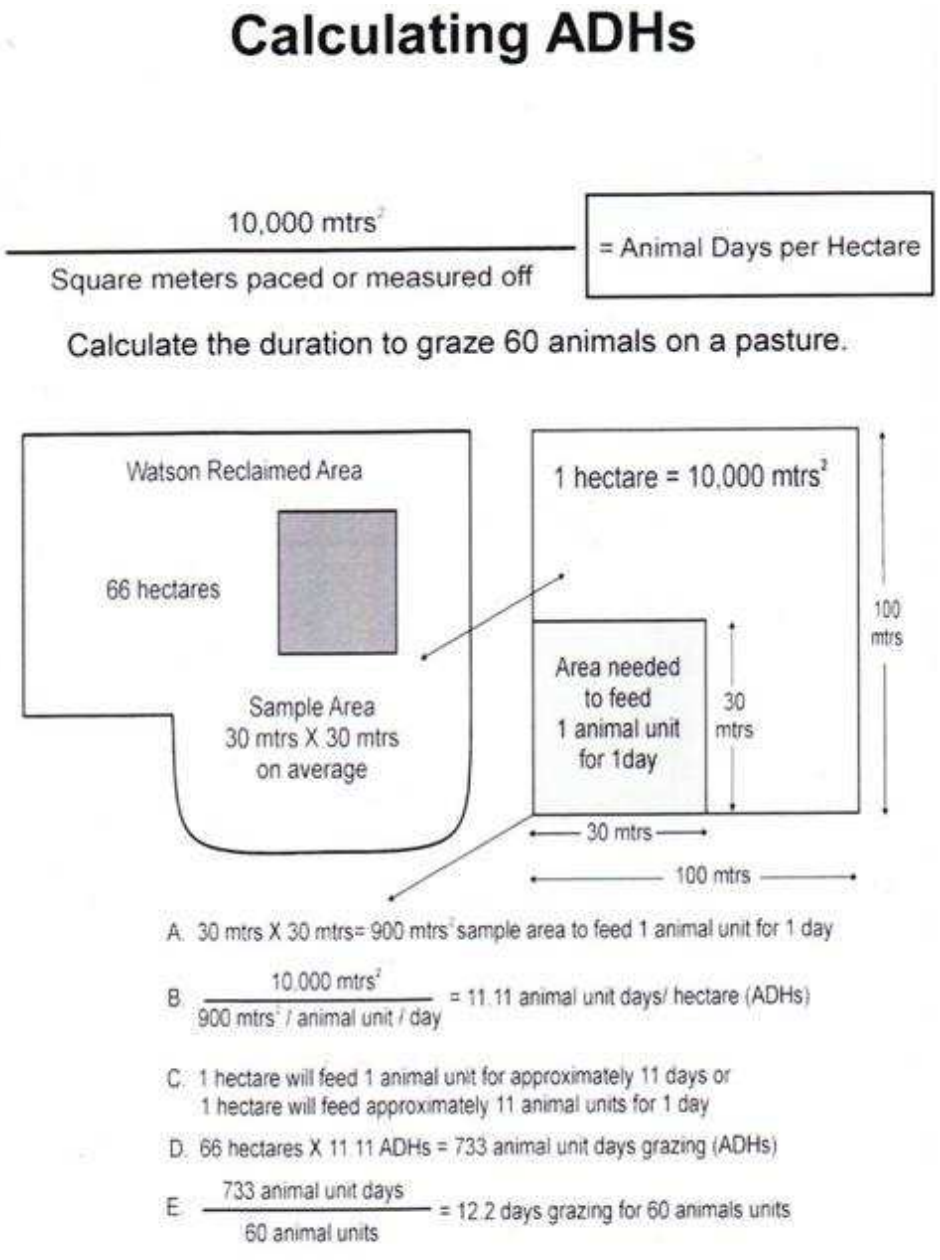

Figure 3: Calculating Animal Days per Hectare

Source: RegenAG Holistic Management Workshop

Advantages of Cell Grazing in all areas

Graziers who practice cell grazing report the following advantages:

1. Cell grazing increases awareness of both cattle and pasture performance. When cattle are frequently moved, their temperament and stress levels will be lower because of more visual contact with human interaction, allowing most graziers to reduce labour requirements when handling cattle. At the Blair Ranch, Sturgis, South Dakota, they move their cow herd of approximately 500 head on a range of between a one to five day basis depending on paddock size, seasonal conditions and pasture quality. This paddock move was easily managed by one person as the herd was familiar with the routine.
2. By containing the cow herd in smaller paddocks the bulls do not have to travel great distances to serve cows and this will allow the bulls to more easily distinguish which cows are cycling as compared to larger paddocks where bulls often stay close to watering points.
3. In a well-managed cell grazing system in most areas, carrying capacity can be increased due to the effects of reduced animal impact, increasing healthier plant and soil life. For example, at Embrapa, Sao Carlos, SP, Brazil, it was evident that through the efficiency of their well managed grazing system, the pastures and herd were thriving.
4. Keeping cattle in one big mob will reduce localised selective grazing on pastures. This "spot-grazing" effect is a form of over-grazing in which spots or patches of a pasture are grazed too frequently. Spot-grazing occurs during periods of active forage growth when livestock graze spots in pastures while allowing other areas of the paddock to become unpalatable. The re-growth of the grazed forage in spots is often more palatable than the forage left un-grazed so the livestock grazing frequently re-graze new growth of these spots. Spot-grazed paddocks have uneven forage heights and the forage in the grazed spots may become weak and thin if cattle remain in the paddock too long (Guide, 2009).
5. Cell grazing will help break the tick and worm cycle. The cattle tick spends the parasitic stage of its life on the one host. This stage takes approximately 21 days during which time the tick changes from a minute larvae to a nymph and finally an adult. Adult females feed slowly for about a week before rapidly filling with blood just

prior to detachment. Then they drop onto pasture, lay up to 3,000 eggs and die. Eggs hatch to produce larvae which infest the pasture until picked up by a suitable host or they die. In the north of Queensland, ticks lay viable eggs year round. Further south, the reproduction cycle slows during winter. Heavy rain during the wet season can interfere with tick reproduction. One of the methods suggested by Department of Agriculture, Fisheries and Forestry (2012) is to spell pastures to reduce the tick burden. Tick larvae can survive from four weeks to five and a half months with total exposure from the time the female dropping to the ground until the larvae are dead is longer in winter and also were moisture is present. (PR)

6. Promote evenness of grazing and puts pressure on less palatable species in the pasture.

7. Disadvantages of Cell Grazing

8. Watering points must have the ability to supply larger amounts of water in a short period of time because of the larger herd sizes.
9. Cell –grazing is time consuming, involving more labour in some businesses, especially when moving breeders with young calves.
10. The larger herds can cause bogging in high congestion points during wet weather.

1.1 Mob Grazing

To understand mob grazing, imagine how millions of bison moved for centuries without fences. They grazed in huge herds, spending short periods in certain areas and moving on after leaving their manure and urine on the pastures or after being chased by predators. They might not return for months or a year, allowing grasses to utilize the fertiliser provided by their droppings and to fully recover. Stocking density is determined by the animal kilograms per hectare. A dry cow eats approximately 60-70% of the plant, but only the top 30% of the plant meets the nutritional needs of a wet cow or feeder steer (Smith Thomas, 2012). When the land and its conditions are good, on a successful intense grazing system there is the ability to increase the stocking rate of up to 50%. Layout and design of a paddock's watering point and portable fences becomes important for saving time and money. Mob grazing also may lead to increased plant diversity which is beneficial for nutritional needs of cattle and health of the land.

Pastures are more resilient when they contain a diverse mix of both cool and warm season grasses and broadleaf plants. This diversity assists with drought tolerance. Certain plants are always grazed severely, while others are less palatable, even if a cow remains there only a short time, it will always eat its preferred plants. On the other hand forcing stock to eat the less desirable species ensures these species do not dominate the sward. It is pertinent to extend recovery time to accommodate for the highly palatable plants or they will die out. During a RegenAG Holistic Management Workshop, it was stated that rest periods are the key, and the more paddocks you have, the better control of recovery time, resulting in restoring soil organic matter in a few years and increasing productivity. Mature plants also provide a canopy for other plants to grow up into, protecting them from heat and drying out. If there isn't enough variety and graze too often, the management of the grasses will result in them looking like a lawn.

When entering the growing season with an abundance of moisture, there is the opportunity to shorten the rest period. However, as soon as the season changes, the recovery period can be increased from 30 days for the wet season and up to 60-90 days for the dry season leaving 40-50% of ground cover if possible at all times. Trampling is a means to feed the soil biology by leaving forage on the ground (Moreira, 2012). Figure 4 below was taken at Embrapa, Sao Carlos, Brazil, showing an example of a successful three day grazing system in a high rainfall area with effective rest periods for sufficient plant growth.

Figure 4: Photograph taken at Embrapa, Sao Carlos, Brazil (mid April)

1.2 Watering Points

On average, a beast will drink 50 litres of water per day, depending on some variations to environmental and climatic conditions. Clean water is a vital factor of producing high yields of beef per hectare. The infrastructure at a watering point must be thought out thoroughly to handle large numbers of cattle watering at the same time. The distance to watering points and location is another key factor of maintaining effective weight gains as it prevents cattle from burning excessive energy reserves in walking to waters.

If the water supply is of poor quality, the cattle are not out grazing in paddocks as the cattle will stay around the watering point until they reach their daily consumption, resulting in reduced forage intake. Studies have shown that cattle conduct 77% of their grazing within 400 metres of their water source, (South Dakota Grassland Coalition). Calves can gain up to 113 grams more per day when their mother has access to clean water. Cattle with access to clean water in tanks gain as much as 226 grams more per day compared to stock that consume poorer quality water from dams, (South Dakota Grassland Coalition).

1.3 Soil Types

When planning new fencing infrastructure, an up-to-date aerial map of the property is essential. Soil types should be rated for their carrying capacity, forage quality, elevation, drainage, depths of actual topsoil and the mineral requirements needed for that environment. The most accurate way to determine soil types in a paddock that experiences a lot of soil changes is to soil test those paddocks. This will give a snapshot of the nutrients in the soil and assist to decipher which nutrients are required to make the soil more productive. Seasonal conditions have a dramatic effect on recovery time in forage growth and weight gain in the cattle herd. Water points in some of these areas will rely upon seasonable rainfall patterns. Some land types have to be grazed for longer periods to maximise the full production values at that time and need a longer rest period in the dormant seasons. A property with varied soil types has to take advantage of different seasons to achieve good forage intake per head when nutrient value of the forage is high.

1.4 Ground Cover

Ground cover has a very important effect on living organisms in soils both above and below ground level. This ground cover insulates the life in the soil from temperature and moisture extremes over short periods. Ground cover protects the soil surface from the damaging effects of rainfall seasons, as it slows the energy of the rain drops by absorbing it in the

cover, compared to the bare soil which would be subject to severe soil erosion. Good ground cover will improve pasture productivity in the long term by maintaining a healthy root system for the plant. The plant root system develops over time as organic matter breaks down and allows absorption of more water, the plant will grow larger and deeper and be more resistant to drought conditions. The ideal forage residue left after grazing would be 50% of leaf area so that the plant can continue to carry out the process of photosynthesis (South Dakota Grassland Coalition). Keeping soil temperatures under 15°C ensures healthy living organisms to retain the moisture levels in the soil. Organisms in a healthy soil cycle will break down nutrients, which can then be taken up again by plant roots. There can be over a billion living organisms in a five cubic centimetres of healthy soil.

One of the biggest positives in the near future for Australian farmers is the importance of carbon sequestration. By keeping a healthy pasture cycle, more carbon can be stored by the stems and roots of plants and some stored in the soil. Consequently, improving soil health should be one of the key goals in a farmer's management plan.

1.5 Grass Species

Grasses are often divided into two groups; cool and warm season grasses, based on their season of growth. The cool season grasses have their peak of growth when temperatures are between 15°C and 25°C, when they often have the ability to tolerate frosts and still retain some activity or growth (spring and early summer). Some examples of cool season grasses are the spear grass *(Austrostipa)*, wheat grass *(Elymus scaber)* and wallaby grass *(Austrodanthonia)*. Spear grasses are a cool season tufted perennial grasses which are found in all states of Australia but predominantly in the southern half of Australia. It's well known for its high tolerance to drought and less fertile and acidic soils. Wheat grass is an all year green perennial grass which is found in all Australian states except the Northern Territory and is more common in districts with cool winters. Wallaby grass is a native tufted perennial grass which grows in areas of Victoria, Western Australia, South Australia, New South Wales and Tasmania.

The warm season grass varieties prefer high temperatures from 25°C to 35°C for ideal growth (early summer and late summer). These grasses are dominant through the tropical and sub-tropical zone. Some varieties of the warm season grasses are Queensland bluegrass *(Dichanthium sericium)*, Mitchell grass *(Astrebla)* and windmill grass *(Chloris truncata)*. Queensland bluegrass grows in all states of Australia but grows principally in northern

Australia. This grass is a leafy tufted perennial grass. Mitchell grass grows mainly in northern Australia where rainfall is dominant in the arid and semi-arid areas of inland Australia which receive an annual rainfall of between 250mm to 550mm. There are several species of Mitchell grass which are a tufted perennial grass growing in summer. Windmill grass grows in Victoria, South Australia, Western Australia, southern parts of Queensland and throughout New South Wales. Windmill grass can be either annual or perennial and forms a rounded tussock usually less than 50cm tall.

Due to their differences in maturity rates and forage production, the right mix of warm and cool season grasses is essential to a successful grazing management system from the tropics to the desert. Depending on the property location, land may be dominated by either cool season or warm season grasses. Occasionally, achieving a mix of warm and cool season species may require seeding pastures or portion of pastures to the group that is not abundant.

1.5.1 Mekong Briz™Antha

Whilst in Brazil, one of the grasses used in pastures in Brazil was Mekong Briz™Antha, (*Brachiaria brizantha)* which is a true tropical and tufted grass species requiring greater than 1,000mm of summer dominant annual rainfall. There is potential for good production under irrigation where annual rainfall is less than this. It is best suited to coastal growing conditions but can grow in tropical regions in altitudes up to 2,000m. For example, a cut the leaf will have grown up to 12mm in one hour.

Mekong Briz™Antha is a relatively new cultivar in the Australian pasture market. Originating from South America this species is being used to replace much of their existing *Brachiaria decumbens* (signal grass) pastures mainly due to its production capabilities making it very suitable for intense grazing systems. Mekong Briz™Antha will grow on a wide range of soil types from sandy loams through to heavier free draining clay soils with soil pH levels between four and eight. Mekong Briz™Antha has shown that it is able to handle high levels of soil aluminium, common in acidic soils below the pH level of five. While free draining soils are preferred, Mekong Briz™Antha can withstand periodic water logging for up to one month at a time. In order to achieve full production potential from the Mekong Briz™Antha, soil fertility needs to be relatively high and annual supplementary fertilizer application may be necessary. Typically Mekong Briz™Antha seed quality is an issue because of the nature of the seed development. Up to 50% of the seed produced is often empty or of low quality. It is

recommended that Mekong Briz™Antha be planted in a combination with signal grass or Rhodes grass to provide quick feed and ground cover whilst the Mekong is establishing. It can be grazed 60 days after sowing. The broad leaf of the Mekong Briz™Antha makes it easy to identify when it is sown with signal grass and sowing rates will depend on the desired plant density (Figure 5).

Figure 5: Photograph of Mekong Briz™BrizAntha in Brazil

1.5.2 Alto Pan™icum

Alto Pan™icum (Panicum maximum) is in a league of its own when it comes to comparing the giant panics of the grazing world. It is another exceptional forage that is grown in Brazil, mainly for dairy and beef cattle operations. It is a true tropical grass species requiring 1,000-1,500mm of summer dominant annual rainfall with up to 28% higher dry matter yield compared with guinea grass pastures. Alto Pan™icum has an excellent leaf to steam ratio of 80%:20% with the suitability for the production of hay and silage. As for Mekong Briz™Antha, there is also potential for production under irrigation where annual rainfall is less than this. The leaves are sensitive to harsh frost. It is best suited to regions under 1,000m above sea level with average daily temperature greater than 20° C. Alto Pan™icum will grow on most free draining soil types as long as there is sufficient fertility to sustain the production of high levels of dry matter (up to 85 tonne of DM/ha/yr). Alto Pan™icum is not tolerant of salinity and extended periods of water-logging. Soil pH should be near 6.0 to 7.5 with no aluminium toxicity for maximum performance. The Alto Pan™icum seed can often contain high levels of dormant seed resulting in delayed germination after planting. The best establishment results for Alto Pan™icum will be achieved by shallow planting (no greater than 10mm) into a fully prepared seed bed, with some degree of compaction to ensure excellent seed/soil contact.

While Alto Pan™icum can be planted into mixed pastures, it would be recommended to be sown by itself to make grazing management easier and to best maximise the production capabilities. Once established, Alto Pan™icum should be regularly grazed not allowing plant height to exceed one metre, with grazing continuing down to a minimum of 0.3 of a metre before grazing animals are removed. This species of grass was most commonly used in an intensive grazing dairy system where it would run 40 head of cattle on 0.6 ha for three days with a rest period of 28-32 days (Moreira, 2012).

Figure 6: Photograph of Alto Pan™icum at Embrapa, Sao Carlos, Brazil after a 20 day rest period (mid April).

1.6 Planting Legumes into Pastures

With the incorporation of legumes into grass-only pastures, an increase animal performance by 40-60kg/head/year can be achieved. When considering the planting of legumes in pastures, choose the most appropriately adapted varieties suited to the soil type and rainfall. Legumes can also increase nitrogen fixation and cycling by 20-50kg N/ha/year for stylos, 60-75kg N/ha/yr for Leucaena leading to improved grass growth and pasture quality (Johnson, B., Buck, S., Peck, G., 2012). Stylo (*Stylosanthes guianensis var. guianensis)* is a legume that is suited for humid tropics and subtropics. It can survive long dry periods and persists in areas with average rainfall as low as 800mm. Stylo prefers well drained, open textured soils from sands to light clays, but is poor on heavy clays (Pastures Australia, 2008).

One of the legumes studied was the plant Leucaena *leucocephala*. Wild Leucaena arrived on the coast of northern Queensland in the late 1800s but it was not until the 1960s that the first forage variety was released by the CSIRO. Leucaena is a highly productive legume where

it is generally grown on deep fertile soils in sub-tropical, humid environments where annual rainfall averages 600-800mm. Leucaena has a deep root system from 5-6m with a life expectancy of 30-40 years. The main varieties of Leucaena are Peru, Cunningham, Tarramba and Wondergraze (a hybrid of Leucaena).

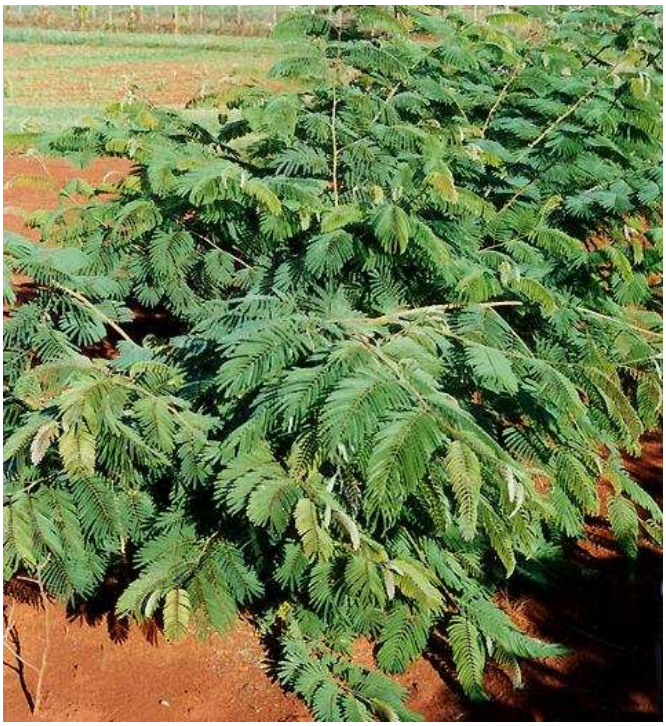

Figure 7: Photograph of Leucaena taken by Ben Mullen

Source: Website, Tropical Forages

Over 75% of Leucaena growth occurs in the summer months when maximum temperatures are over 25°C. All varieties are susceptible to frost, but mature plants cannot be killed and will grow in soils with a pH level above 5.5. Leucaena has a very high protein level in its young leaf of 21-31% and can reduce methane production by grazing animals by 20-40%. Much of the nitrogen generated by Leucaena is returned to the soil and is used by the companion grasses, reversing the nitrogen rundown seen in pure grasses, therefore, improving grass quality and quantity. If Leucaena is planted in a pasture system, cattle that have been grazed on a Leucaena/grass pastures will gain up to 250-300kg of beef per year at the high stocking rate of one head/two hectares, (Meat & Livestock Australia, 2007).

In an irrigated Leucaena pasture you this can be increased up to 3-6 head/hectare year-round depending on amount of water applied and produce a live weight gain of more than

1,000kg/ha/year. With an efficient water use program applying 4-5 mega litres/ha/year, most cattle need to eat at least 35-40% of Leucaena to produce a gain of 1kg/head/day.

When planting Leucaena the most common practice is to use double rows about 50-100cm apart. Row spacing on a dry land field are 8m apart. Under irrigation, row spacings at least 5m apart are recommended and sowing rates of 2kg/ha or 1 seed every 5-10cm in the row in twin rows at a depth of 3-5cm. For a successful strike rate, Leucaena seed should be scarified to break dormancy and to allow germination with some nodule bacteria (Rhizobium strain) so that good root establishment is achieved. Fertilizer application is also recommended.

When preparing the land for cultivated grass strips it should be clean of any grass or weeds, and deep-ripped before planting, as one of its faults is slow establishment, taking 6-12 months (1.5-2metres tall) until it should be grazed. Once planted, the best chemical to use to keep competition out is a chemical called Spinnaker 700 WDG. The cost of establishment is about $250 to $350 per hectare if the producers are using their own equipment and time. Leucaena should be cell grazed to keep it at a controllable height. Usually good management practice by the use of animal impact will keep it sustainable, but if Leucaena is not managed correctly, mechanical control methods, such as mowing, will have to be used.

Leucaena contains an amino acid called mimosine which is broken down by rumen bacteria to a toxic compound, DHP. These toxic compounds, causes hair loss (mainly from the brush of the tail and the poll of the head) and poor growth rates. By introducing a bacteria which was taken from the stomachs of cattle, sheep and goats from tropical countries where animals have grazed on Leucaena for centuries, can break down DHP to a non toxic compound. This rumen bacteria (*Synergistes jonesii)* was imported into Australia by CSIRO and has been made available through Queensland Primary Industries and Fisheries to cattle producers. The bacteria is given to new animals by drenching them with an inoculum (The Leucaena Network). As per information provided by the Department of Primary Industries and Fisheries, the price of the inoculum is $123 for a 500ml bottle plus freight. It is suggested by The Leucaena Network and Department of Primary Industries and Fisheries that at least 10% of animals in the herd be inoculated with 100ml of culture prior to entering the crop. The bacteria are readily transferred between animals grazing together. It is thought that this transfer between animals occurs when animals cough or lick the coats of other animals. The bacteria are anaerobic (rapidly killed by the presence of oxygen). To prevent the need for

drenching new animals when they go onto Leucaena, it is advisable to manage the herd so that there are always cattle present that have had contact with others that you know have the bacteria.

The biggest downside to the plant is a bug called a psyllid (*Heteropsylla cubana)* which is about 1-2mm long. It is native to South America that travelled to Australia by air. The female lays up to 400 eggs on a very young shoot where they are lodged between the fold of the leaflets. The eggs are oval, 0.3mm long and 0.1mm wide and can hatch in 2-4 days and become adults at 10-16 days old. The psyllid thrives in humid areas resulting in up to 50-80% of leaf matter being lost, sub humid areas can lose up to 20-50% production. The build up of psyllid population can be reduced by periods of sustained rain (or irrigation), or one or two days of hot and dry temperatures above 35°C. Frost will also eradicate the psyllid. The Leucaena psyllid damages the plant by its sucking action with both the nymphs and adults feed by sucking from the phloem of the developing shoots and young foliage. The insects release drops of sticky fluid on the leaves causing the leaflets to stick together. The overall effect is to prevent the growth of new leaves. It is vital to examine the growing points and young foliage for the presence of psyllids, and consequent leaf loss, to assess the extent of any damage. Frequently, where psyllids have been active, there will be no new leaves for a distance of up to 30 cm from the 'growing point', representing a loss of up to 10-12 leaves, or several months' growth. This can be readily seen from a distance. As per a media release by the Department of Primary Industries and Fisheries, 16/01/2008, the management key is to break the insect's life cycle by stocking heavily to remove the developing shoots and young leaves where the psyllids lay their eggs and the nymphs and adult insects suck the sap. It was also suggested to spray with Dimethoate insecticide will give 3 to 4 weeks control but is only cost-effective if infestation threatens establishment of young crops. Pesticide label withholding periods must be adhered to for stock grazing treated Leucaena.

As described in the publication, "*The Leucaena Psyllid"* by RA Bray, calculating the damage caused by the psyllid is difficult. Within the first 2 years of invasion by psyllids in the Philippines and Indonesia, defoliation was sufficiently severe to reduce cattle weight gains and stocking rates dramatically. Recent reports would suggest that psyllid damage is sometimes reduced and stocking rates have in places returned to normal. In experiments in north Queensland and Indonesia the effect of psyllids on dry matter yield was examined by

comparing the yield from plots sprayed with insecticide and unsprayed plots over a period of 1 year (Palmer *et al.* 1989). In north Queensland total production when psyllids were not controlled was reduced to about 45% of that in the sprayed treatment. At one site in Indonesia, total yield was reduced by about one-third, while at the other there was no effect of psyllids on yield. In southern Queensland, annual losses of leaf production of over 50% have been recorded (Bray and Woodroffe 1991). Stem (wood) yield was even more severely affected. However, it is likely that losses in the drier areas of central Queensland are less, probably of the order of 20%.

The MLA publication *"Leucaena: A guide to establishment and management (2007)"* contains more information on growing Leucaena in northern Australia.

1.7 Mechanical Disturbance

One of the yield losses in any cropping and livestock business is compaction, as soil compaction prohibits moisture from infiltrating to depth. Soil compaction is caused by normal farming activities including using tractors, implements, vehicles, cultivations, livestock and irrigation. Direct drilling has the benefit of preventing the soil from being exposed to wind and water erosion and the effect of reduced traffic minimises soil compaction. Zero cultivation avoids degradation of soil structure. It also ensures that the remnant native pastures are not destroyed and will respond immediately when it rains. Soil microbes are also returned to the soil and these beneficial organisms aerate the soil. This helps the break down the organic matter and makes nutrients available. As increased organic matter is retained and broken down, soil structure is improved by this organic matter, making it more porous for better aeration and water infiltration. Other brands of direct drilling can have the same affect however, one product called, Agrowplow which is used in Australia and overseas to improve soil fertility and promote higher pasture yields by the use of a tyned implement through mechanical disturbance. Agrowplow was originally manufactured in Australia (Agrowplow, 2012). It is having tremendous effects in Canada on yields in cropping and beef production systems. There are two main types of Agroplow. The first type is the Agrowplow (Figure 8), which is designed for root bed renovation in all soil types and conditions. It sizes range from two to 29 shanks, with every individual shank (450mm long) requiring 20-25 horsepower. The second product is the AgrowDrill (Figure 9) which costs $45/acre including diesel, to operate. The AgrowDrill is a versatile direct drill

seeder with a recoil tyne and Baker boot. A hydraulic lift coulter bar with 35.5cm swivels coulters and two large hopper bins, the front bin holds 20 bushel and the second bin holds 16 bushels. It has a twin distributor metering system with a working width of 12ft wide, 8 inch tyne spacing with 22 row tynes. One of the AgrowDrill's models, the AgrowDrill 510 can establish crops and pastures without any prior tillage once the control and reduction of vegetation and weeds is achieved by either chemicals or livestock or both.

Livestock that were grazed on a grass pasture that had been tilled with the Agrowplow put on at 997.9 grams per day (Finn, 2012). Most of the ranchers were using the AgrowDrill to plant legumes back into their pastures to achieve better yield and soil fertility with the main variety being lucerne.

Figure 8 : Photograph of Agrowplow

Figure 9: Photograph of AgrowDrill

1.8 Prescribed Burning

Plants vary in their response to fire. The manner in which plants are affected by fire is largely determined by their biological characteristics and fire behaviour. Fire readily kills some plants, rejuvenates others and some may even require fire to exist. Some of the biological effects of fire include:-

- Control woody weeds and prevention of patch grazing.
- Sprouting – some plants have the ability to sprout when the above ground portion has been burned. Sprouting can occur from roots, rhizomes, base of the trunk, branches, below ground root crown and grass crown.
- Seed Adaption – some seeds require heat to germinate, or are tolerant to higher temperatures.

- Growth Stage - for some plants, the stage of growth determines the degree of damage from fire. If the bud zone is not well developed the plant may be more susceptible to fire.
- Stature – fire effectiveness is determined by the growth form of the plant, combined with the density of fuel surrounding it.
- Woody plants – over time, plants have developed many adaptive traits that allow them to survive different fire frequencies, intensities and seasonal timing of fire, traits such as bank thickness, fire resistant, foliage. The ability of plant tissue to withstand fire depends upon the amount of heat it receives. Most plant cells will die if the heat temperatures reach between 50-55°C, (Taylor) .
- Grasses – many perennial grasses are better adapted to fire than woody plants because of differences in the location of growing points. In most grass species the growing points are located near or below the soil surface. In some cases, grasslands require fire to survive.
- The disadvantage of fire is that it removes all ground cover and this can lead to increased soil loss and wind and water erosion. Paddocks should be spelled after a fire to ensure that the young grass regrowth has ample opportunity to establish root reserves.

At the Canyou Ranch in Sonora, Texas, the beneficial effects of prescribed burning on cedar trees which is a threat to the Edwards Plateau, a major water aquifer in Texas.. This study was conducted by Dr Charles Taylor and his team at the Texas Agrilife Research Academy for Ranch Management. Later on, the treated country was grazed by goats. An adult cedar *(Ashe juniper)* tree can consume 32 gallons of water per day and has a very thick canopy cover growing up to 4.57 metres tall. It was estimated in 1995 that 0.9 million hectares of the cedar tree was present in the drainage and recharge zone of the Edwards aquifer.

The research station at Sonora has been effectively carrying out prescribed burning and animal impact with goats at the Edwards plateau since 1986. The station mainly undertook a practise of summer or winter burning with a rest period of four months and then grazed for twelve month with goats. They never graze in the same season following burning in their rotational grazing system.

Prescribed fire has proven to be an efficient and cost effective method of cedar removal and control as compared to other more expensive methods. Burning is beneficial as it does not disturb the soil, and leaves a clean seedbed and temporarily raises the level of soil nutrients for better establishment and growth of new vegetative cover.

With the implementation of the abovementioned management tools consisting of appropriate grazing of paddocks together with adoption of planting more palatable pastures, it will only be useful if it is achieved in conjunction with efficient and productive cattle.

Chapter 2: Beef Genetics

Genetics is an important tool to create productive and profitable cattle. With the utilisation of high quality genetics, the producer has the ability to improve the profitability of the enterprise. Factors such as growth rates, feed efficiency, meat quality and yield are all affected by the genetic history of the herd.

One of the main focuses producers must incorporate when selecting cattle is to outline a business goal and their target market specifications. This will assist in selecting the correct bull or cow to improve the genetics of a herd.

As described in a Newsletter from the Southern Beef Technology Services (SBTS) – "*Better Bull Selection – Decisions Using Selection Indexes",* advises producers as follows:

Tips for Using Selection Indexes in Bull Selection to Suit your Environment

- *Identify the selection index of most relevance*
- *Rank animals on selection index*
- *Consider individual EBVs of Importance*
- *Consider other selection criteria of importance*

Identify the Selection Index of Most Relevance

The first step when using selection is to identify the index that is of most relevance to the particular production system in which the animal is going to be used. For seed stock producers this may be the production system of their bull buying clients.

Once the Selection Index of most relevance has been identified, the bull available for selection should then be ranked on that particular selection index. The following selection indexes are now calculated for animals in each respective breed.

BREED	NO.	SELECTION INDEXES
Angus	4	Long Fed/CAAB, Heavy Grass Fed Steer, Short Fed Domestic, Terminal
Hereford	4	Supermarket, Grass Fed Steer, Grain Fed Steer, EU
Shorthorn	3	Domestic Maternal, Export Maternal, Northern Maternal
Limousin	4	Domestic Terminal, Self Replacing, Heavy Steer Terminal, Vealer Terminal
Red Angus	3	Supermarket, Vealer, Northern Steer
Charolais	3	Domestic, Export, Northern Terminal
Murray Grey	3	Supermarket, Long Fed Export, Heavy Grass Fed
Simmental	4	Domestic Terminal, Export Maternal, Northern Terminal, Vealer Terminal
South Devon	3	Vealer, Supermarket, Export Maternal
Santa Gertrudis	2	Domestic Production, Export Production
Belmonts	2	Domestic Steer, Export Steer
Brahman	2	Jap Ox, Live Export
Brangus	2	Domestic Steer, Export Steer
Wagyu	1	Fullblood Feedlot

Figure 10: Better Bull Selection Using Selection Indexes
Source: Tropical Beef Technology Services, Winter 2012.

These indices must be used in conjunction with visual assessment of fitness for characters including:

Temperament (Docility)

Structure

Fertility

Then Use EBVs.

There are two methods that a beef producer can follow regarding the implementation and use of genetic improvement strategies; one is natural mating and the other is Artificial

Insemination (AI). Both methods has its' advantages and disadvantages. Firstly natural mating is very cost effective with low labour costs involved and conception rates being high however, in order to purchase quality bulls can be very expensive. The advantages of AI is the accessibility of superior genetics, better weight gains, narrowing the mating cycle down to a uniform calf crop. With this in mind, AI can be more labour intensive and conception rates may not be as high.

2.1 Heterosis

Heterosis (hybrid vigor) can have a huge impact on the net return. The main benefits recognised from a properly planned crossbreeding program is the heterosis gained by crossing breeds that complement each others' traits.

Research provided by The Samuel Roberts Noble Foundation Inc. (Ardmore, Oklahoma), showed that crossbred cows can have many advantages:-

- 6% higher calving rate
- 4% higher calf survival rate
- 38% increase in longevity
- 23% increase in lifetime productivity.

Another great characteristic of crossbreeding is the prospect of combining breeds that have specific strengths and weaknesses that will complement each other, resulting in an animal with the best traits of those breeds, such as the Beefmaster breed.

Evidently, the effect of the breeds involved in a crossbreeding program can play a huge role in increasing pre-weaning weight and post-weaning gain. A 2010 study by the Samuel Roberts Noble Foundation Inc., shows the direct effect of a breed can influence weaning weight by more than 31kg and post-weaning gain by more than 39kg. Additionally, the maternal effect of the breed influences weaning weights by more than 39kg.

2.2 Utilizing Artificial Insemination & Fixed Time Synchronisation

One of the most efficient and practical means of introducing superior genetics into a beef cattle herds is the use of artificial insemination in conjunction with fixed time synchronisation. With inadequate oestrus detection and lack of trained personnel to

implement the AI program in a cattle herd, the use of hormonal treatment of females can bring synchronous follicular wave and ovulation which allows for FTAI. This will lead to cattle being inseminated with oestrus detection to gain the appropriate pregnancy rate. As shown below FTAI has the ability to increase the percentage of cows in calf.

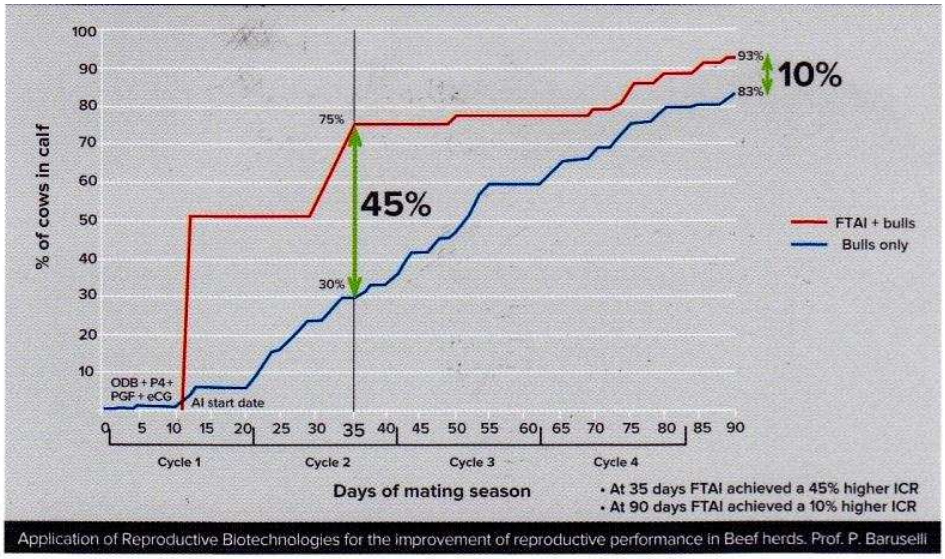

Figure 11: Comparison of in calf rates between FTAI protocol & natural joining

Source: Bayer Reproduction, 'BoSynch™ For accelerated genetic improvement in beef cattle'

'Of interest to the northern Australian beef industry is the ability to compact the calving interval through the use of ovulation synchronisation treatments. Recent studies have demonstrated that after ovulation synchronisation, FTAI and exposure to bulls up to 78% Bos indicus heifers and 86.7% of Bos Taurus heifers can conceive in the first two oestrous cycles of the mating season.' (Bayer Reproduction, 2012)

However, these results are not very common in the extensive regions of the dry tropics and further research is being conducted by MLA to ensure higher results can be routinely achieved.

In the above demonstration, FTAI resulted in heavier calves at weaning and females calving earlier in the season, therefore, permitting more time to re-conceive, with the opportunity of a female to fall back into calf within a 12 month period.

By not confining the mating period to a smaller time frame, can result in loses of between 15-26kg of weaning weight after each oestrous cycle. Earlier calves have more time to grow, so they are heavier by weaning time. This is shown in the figure below:-

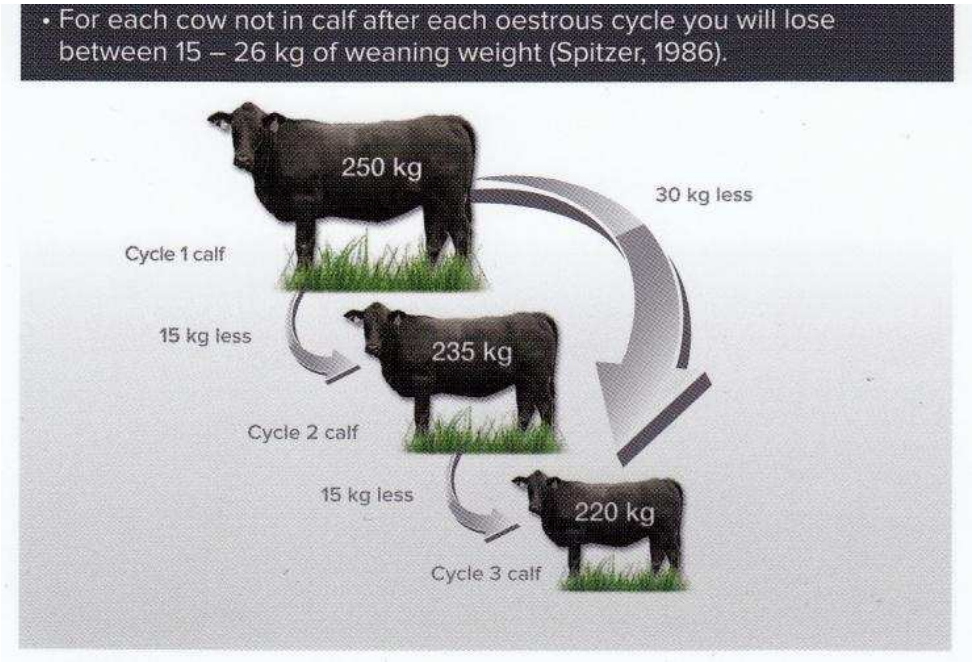

Figure 12: Earlier calves are heavier

Source: Bayer Reproduction, 'BoSynch™ For accelerated genetic improvement in beef cattle'

Good nutrition and having maiden heifers above their critical mating weight is absolutely paramount to achieving good FTAI rates. For the first synchronisation, the majority of cattle producers need to put maiden heifers on a high protein forage diet to achieve high conception rates.

Advantages of FTAI

- The utilisation of sexed semen to sustain high quality replacement heifers or herd bulls.
- The ability to access sires of proven genetics that cannot be physically purchased within the budget.
- Labour commitments are minimised to a small time frame.
- The potential to breed relatively economical sires of high genetic traits that can be used in the herd.
- More precise breeding records.
- Uniformity of calf crops.

Disadvantages of FTAI

- Requires trained labour for oestrus detection and decent yarding facilities to draft females.
- Price of semen can be costly if sourcing superior genetics.
- The possibility of potential lower calving percentages.

2.3 Bull Selection Criteria

Selecting a herd sire is one of the most important decisions a cow-calf producer makes. A herd bull contributes half the genetic makeup of his calves and plays an essential role in herd genetic improvement. Some of the key bull selection criteria consists of eye muscle area, marbling, growth traits, temperament and scrotal size.

2.3.1 Eye Muscle Area and Marbling

The actual eye muscle area can be measured by scanning in the live animal using ultrasound equipment. The size will be reported as an EBV for eye muscle in cm^2 which gives additional indication of the degree of muscling in the animal. The amount of intra-muscular fat is scored in carcases as a marble score. In the live animal the ultrasound measurement at the $12/13^{th}$ rib provides a percentage of intra-muscular fat in the eye muscle (Department of Primary Industries Qld, 2003).

2.3.2 Growth Traits

Growth traits include weaning and post-weaning growth performance. Growth performance information available on performance tested bulls may include average daily gain, weight per day of age, adjusted weaning weights and weight ratios within contemporary groups. A contemporary group is a group of cattle of the same sex and age-managed under similar conditions.

2.3.3 Temperament

Temperament is repeatedly equated with docility with it being as important trait through its effects on factors such as growth rate and meat quality. Recent studies by the CRC (Cattle and Beef Quality) into alternative methods to measure docility have identified three simple options, flight time, crush test and yard test. Flight time is the time an animal takes to pass through the cattle crush to a predefined distance, hence the greater the time, the more docile the animal. Crush test requires restraining the animal in the cattle crush and recording the response of the animal as the handler approaches. The yard test involves the

animal to stand in the corner of a large holding pen and animal's response is recorded as it is being approached.

2.3.4 Scrotal Size

Research conducted in 2009 by the Australian Beef Cattle Co-operative Research Centre (CRC) assessed scrotal circumference, growth, semen and hormonal traits in 2,212 Brahman and Tropical Composite bulls from weaning through to two years of age. This research discovered:-

- Scrotal circumference has medium to high heritability and therefore consequently has great potential to genetically enhance this attribute in Brahman and Tropical Composite cattle through measurement, assessment and selection.
- Scrotal circumference is linked to libido and fertility.
- Reasonable genetic associations are evident between semen traits and scrotal size.

A higher yearling bull scrotal circumference in Brahman and Tropical Composite bulls is genetically associated with a great number of bull's progeny producing sperm at 12 months of age and having a high percent normal sperm morphology at 24 months of age.

Source: Scrotal Circumference A Must for Tropical Bull Breeders, Tropical Beef Technology Services

The use of BREEDPLAN scrotal size EBVs, is the best method available to achieve this. Scrotal Size (SS) EBVs are estimates of the genetic differences between animals in scrotal circumference at 400 days of age.

It is suggested that scrotal measurements should be conducted at 400 days to detect bulls reaching puberty at a young age. When the bulls are measured, it is important that not just a selection of bulls are measured but the entire mob should be assessed, with all measurements recorded by the same person to ensure consistency.

2.4 Bull Selection

Places visited to investigate different methods of selecting bulls for their cow herd consisted of Brazil, Canada and America. Their selection process included tools such as selecting and

joining their herds based on individual performance EBV records, and ranging through to selection on visual conformation.

2.4.1 Brazilian Bull Selection

Brazilian beef producers at the CFM Ranch have been using the database of CEIP (Certificate of Identification and Production) with over 5 million animal EPD records for over thirty years. CFM and other ranches (such as Delta G and the Paint organisation) all utilise this computer database. When the mating season is active at CFM Ranch they choose a selection index within the CEIP database which will select the ideal herd sire to mate with each individual cow through AI. For example, if a cow is lacking in one of the EPD traits, the index will automatically select the best sire to improve this weaker trait of the female. The CEIP is known to be one of the more readily used databases in Brazil due to it being more economical at $800. The four major traits CFM used in their selection criteria are weaning weight, weight gain after weaning, muscle score and scrotum circumference.

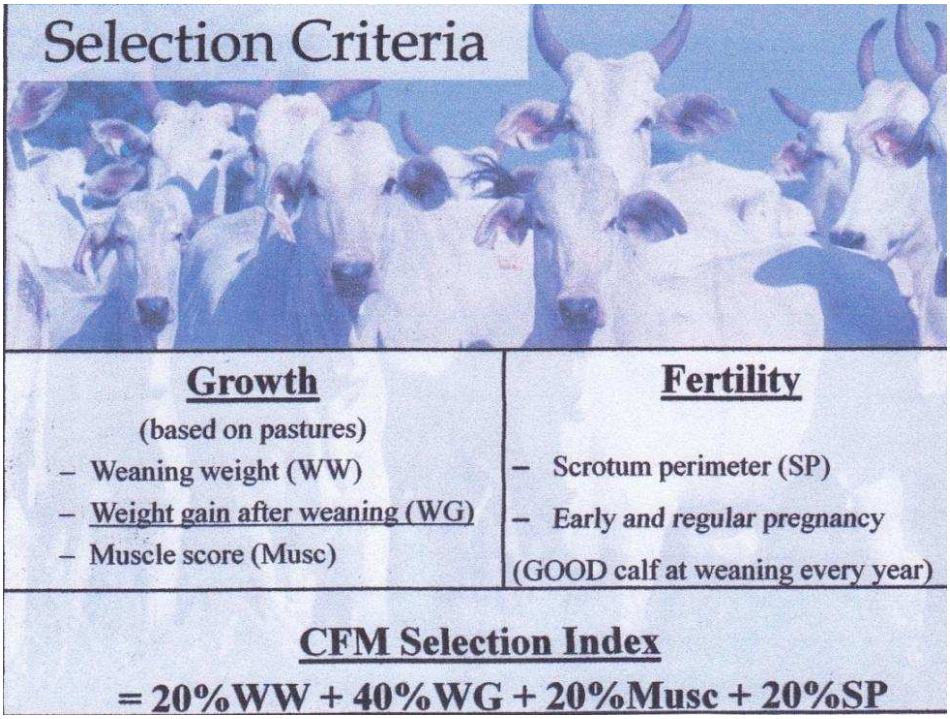

Figure 13: CFM Selection Index

Source: CFM Personal PowerPoint Presentation

All CFM sires must have a high percentage of EPD records in all these traits to enable eligibility for use in their herd. The CFM only retain the top 15% of the sires to be used on their herd with the remaining being sold at their annual bull sale. All the CFM herd is

recorded through an identification system by tattoo, tag and fire brand which can be traced from the calf through to the slaughter house.

2.4.2 American Bull Selection

American bull selection is very similar to the selection criteria of Brazil, for one example the Angus breeders can access a bull selection index to improve genetic traits in their herd. Some of the ranches will concentrate on selected bloodlines that which have been shown to improve the specific traits required.

2.5 Cow Fertility

As stated in an Article in the *Brahman News*, *Reproduction – Oestrus & Puberty, by Alex Ashwood (March 2012, page 42),*

"In suitable environments most heifers reach puberty at 30-40 percent of their adult bodyweight. In poor environments heifers may not reach puberty or develop persistent cyclic ovulations until they reach a higher percentage of their adult weight despite adequate frame scores."

One of the best EBVs available to measure cow fertility is the Post Partum Anoestrous Interval (PPAI). This EBV trait that encompasses PPAI is called Days to Calving (DTC). Some Brahman and Nelore studs would expose their maiden heifers at a younger age of 16 months at 280kg and then after 90 days they would perform an ultrasound to pregnancy test the female and measure the foetal size. The heifers that were in the top 20% would be retained in their stud herd. On an average, Brahman heifers reach puberty at 750 days of age (Bulletin, 2012).

Simple practise to use to improve fertility:-

- Select bulls from cows with low DTC EBV's.
- Select stud bulls from cows that have a history of rearing a calf each year.
- Select herd bulls that have good semen traits – Percent Normal Sperm and semen motility.
- Select bulls high high EBV's for SS and that have a high scrotal circumference.
- Pregnancy test cows and keep individual cow data.
- Measure cow's gestation length.
- Select cow which maintain a good body score at weaning time.

- Join maiden heifers at a younger age and select replacements from those that conceived earliest.
- Cull all breeders that produce a weaner every second year.
- Cull late maturing heifers.
- Identifying heifers that conceive earlier in a breeding season

All cows should have a calf every year regardless of their age after their first calf.

2.6 Natural Mating

A prime example of a very productive and proven practice of natural mating was at the Lasater Ranch who improved their conception rates from natural mating by a process of natural selection in their herd. The Lasater Ranch is family owned and is located in eastern Colorado. The Lasater's have been ranching since 1882 and have been in Colorado since 1948. The ranch occupies approximately 12,300 hectares of short paririe grass near the town of Matheson with 300 mm precipitation and run 1,000 head of Beefmaster breeders. Their entire herd is fed solely on grass forage with salt and minerals; feeding some hay in the winter if necessary, but No grain is added to the diet.

Lasater Ranch is the founder of the famous Beefmaster herd which has been established for over 70 years by Tom Lasater. The Beefmaster is a composite breed that contains bloodlines of a Brahman, Shorthorn and Hereford breeds. The Ranch has been a closed herd for over 40 years.

The Lasater ranch practice a very strict selection process, call the "Six Essentials'.

"Each of the Six Essentials is equally important to hitting the target of producing optimum cattle. Removing any of the Six Essentials results in the animal's productive value being greatly diminished."

Lasater, T (nd).

"Multiple trait selection means compromise and will eliminate individuals who may excel in single trait (for example weight), but do not meet the optimum criteria outlined in the Six Essentials. Nature itself culls out extremes.

We believe that optimum cattle are those that will sustain long-term profitability through the efficient conversion of forages into lean beef for the least possible cost."

Lasater Ranch

The Lasater Ranch Selection Program:-

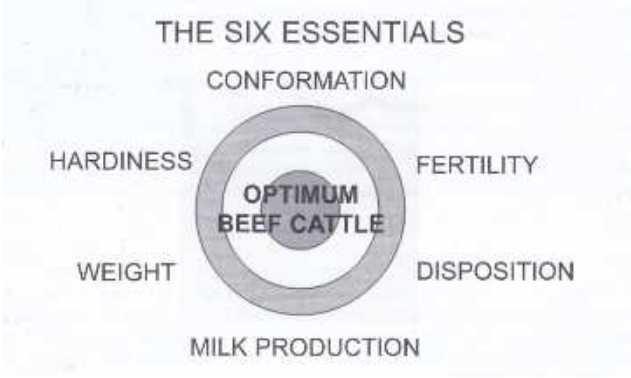

Figure 14: The Six Essentials

Source: Lasater Ranch Brochure

Disposition

Having been raised under identical range conditions, the difference in disposition between individuals is apparent during the first several days following weaning. Those with poor dispositions are culled. Thereafter disposition is judged continually and animals which exhibit unacceptable behaviour are culled from the herd.

Fertility

Bulls retained for use in their herd are bred to maiden yearling heifers at approximately 14 months of age. All breeding has occurred in large multiple-sire herds for more than fifty years, so that the bulls with the highest libido and the strongest competitive instincts have produced the most progeny. Less fertile bulls or those less willing to compete have little or no progeny.

Females are first joined at 14 to 15 months of age. All groups are bred under range conditions during a 45 day breeding season. To remain in the herd, a female would need to calve as a two year old and every successive year and actually bring an acceptable calf weighing around 272kg to the weaning pen each year. This basic production rule has been enforced for nearly 60 years.

Weight

The top 15% of bulls to be retained as herd sires are selected based upon weaning weight, post weaning gain and yearling weight. Weaning weight primarily measures the milking ability of a bull's dam, but also gives an indication of a bull's own growth potential. Post weaning gain (12 months post weaning), measures how efficiently weight is gained and is a

combination of weaning weight and post weaning gain and therefore is the most important weight used in selection. Approximately 85% of the heifer crop is retained for replacements. Only defective heifers or those that appear unable to reach puberty at 14 months of age are culled at weaning. After that time, a cow is not culled based on her own weight but for weaning a lightweight calf and females in the herd do not get culled for age.

Conformation

Conformation is defined as "type on the hook and not type on the hoof". Muscling, along with length and width of hindquarters is emphasized in the selection of bulls as potential herd sires. Animals with any type of structural defects such as problems with their feet, legs or frame are culled from the herd.

Hardiness

Hardiness is exemplified by those animals that relentlessly carry on their production assignments year after year in a range environment with minimum assistance. For example, in their herd, first-calf heifers are expected to calve out on the range with no assistance. These criteria favour those individuals that are able to carry on production with minimal intervention and with the least cost.

Milk Production

Only bull calves with above average weaning weights are considered as potential herd sires. These bulls will most likely sire daughters that will perpetuate the heavy milking characteristics demonstrated by their individual dams. Lightweight calves, both bulls and heifers, are culled at weaning. Dams weaning bottom-end calves are also culled from the herd.

Advantages of the Lasater Beefmaster Breed

- No chemical treatment is used on their entire herd (only vaccinated as calves).
- Bulls are grown out the way nature intended, on grass, so they are healthy, more athletic and last longer than bulls that have been pushed on feed. Bulls that demonstrate fleshing ability when developed on forage pass these traits onto their daughters, resulting in easy-keeping cows. Bulls developed on forage have fewer problems with fertility and feet. They handle heavier workloads and won't fall apart when they are put into service. The Beefmaster breed is very adaptable to harsh climates all around the world. The main selection criteria for bulls are

scrotal circumference greater than 30cms at 12 months, weight gains over the 100 day period post-weaning, and the rib eye area and marbling. This strategy increases fertility by natural means as Beefmaster have a conception rate of 95% plus.

- Very low labour cost involved in the breeding program.
- Most Beefmaster bulls would average a weight gain of 1kg plus per day on just forage.

Disadvantages of the Beefmaster cattle

- With a composite breed you will not get a consistent herd because of the diverse gene pool.
- The prevalence of poll gene in the Beefmaster cattle is very low.

Figure 15: Photograph of a Lasater Ranch Bull

Source: Lasater Ranch website, www.lasaterranch.com.

2.7 Hot Fence Weaning

To the cow/calf operation a successful weaning is second only to having a high percentage of live calves. Upwards of 80% of the annual income from this sector is generated at weaning, with a major component relying on a successful weaning process and supplying the next person down the beef chain (stocker yearling or feedlot operation) with a healthy calf that will grow efficiently. How successfully a calf makes it through this process has a huge impact on future performance at the feed yard and on the hook. In addition, a well planned and executed weaning management program can positively impact cow breeding efficiency. To maximise immunity before calves are faced with weaning, producers should plan first round vaccinations and de-worming. This can take place as early as 2-4 months of age at branding

time. The important thing is to get that first round of vaccinations in prior to weaning day. Weaning is not combined with high stress events like castrating, de-horning and branding. All these processes should have been performed several weeks or months prior to weaning. Other major stress factors for the weaner are the change in diet from milk/grass to grass/concentrate and being placed in a pen. If weaners are introduced to feed prior to weaning their mothers help educate them to eat and they become accustomed to the taste. Do not rule out early weaning of up to 150 days instead of 205 days, especially in a drought year. Early weaning can be an effective tool to help improve reproduction and forage availability by reducing nutrient requirements of the cows. It was stated in an article in the Working Ranch magazine that Oklahoma researchers reported that cows consume about 1% of their body weight less after early weaning, which equates to about 5.44kg per day for a 544kg cow.

In fence line weaning, cows and calves are placed on opposite sides of a strong fence but still have come visual contact with each other, subsequently the stress of separation is lessened after a few days of this weaning process. The best system is to wean cows in a pen and leave weaner calves outside in a neighbouring pasture with good feed, as a cow certainly goes through stress during this time, but obviously they are older and have better immune responses. Weaning the calves on grass has an advantage for calves as it is consuming familiar feed and has a dust free environment. The majority of the time and variation of feed quality, the calves will maintain their weight or gain as much as 4.5kg in a five day period (Blair, 2012).

Advantages of fence line weaning

- Maximises weight gain of calves, by reducing stress in a dust free environment.
- The stress level of a lactating cow will be minimised.

Disadvantages of fence line weaning

- Must have good strong fencing and pens and preferable suitable for smaller mob of weaners.
- Cattle must have good temperament and be easy to handle.

Recommendations

One of the keys to success in any business is to know the basics of the core business and to understand the key profit drivers, enabling a business to maintain an advantage over its competitors. Some of the key areas in which most beef producers can improve are nutrition through grazing management, genetics and business management, as follows:

1. Knowing the market that best suits each environment and selecting the most appropriate breed of cattle that can perform in that area should be the number one key priority for any beef producer.

2. In order to maintain a productive herd, select bulls on sound breeding objectives with economically related genetic information in the form of EBVs, select for as few traits as necessary and those that are highly heritable. If Breedplan data is not available, then one of the major techniques a bull purchaser can use is to get to know the history of the stud's genetics on a personal basis by visiting the bull breeding property and seeing firsthand how the livestock adapt and perform in their environment. Above all, select bulls that are fertile and able to pass the desirable genetic traits to the progeny.

3. Adopting the correct long term carrying capacity for each property, ensuring pastures are routinely spelled and using animal impact and maintaining good ground cover helps retain moisture and organic matter levels in the soil. Improving soil quality in turn will reduce the cost of feeding and decrease the pressure to sell cattle at the wrong time as a result of limited forage available for livestock.

4. The importance of stocking rate in maintaining pasture utilisation and determining animal production is paramount. The implementation of legumes and a variety of grass species will provide the required nitrogen for the soil which in turn will produce protein for the herd.

"Live as though you are going to die tomorrow, farm as though you will farm forever." – (Anon)

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Plain English Compendium Summary

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Objectives

- How to maintain and develop healthy soils under your pastures.
- Improving herd selection tools to gain better genetic traits in your herd to produce more beef.

Background

Hardy cattle that reliably produce in harsh conditions must have the correct genetic traits to survive in Northern Australia's climate. A profitable and sustainable enterprise needs more efficient cattle.

Research

The global focus program included six weeks travelling to America, Mexico, Brazil, United Kingdom, Netherlands, Canada and New Zealand. The remaining ten weeks included studies in Brazil, America, Canada and also in Australia visiting ranches, genetic centres, research stations, universities and completing a holistic management course.

Outcomes

Ongoing management of pasture must be maintained to maximise productivity and resilience of the rangeland pastures. This means improving your pasture through methods of efficient grazing management, planting legumes into pastures and prescribed burning in the correct land areas. Implementing good pasture management will result in a more productive herd. Other management innovations, such as hot-fence weaning, will further improve herd performance. The utilization of beef genetics through the use of better bull selection will result in superior genetics, and emphasise the importance of cow's fertility. and also the advantages of hot fence weaning.

Implications

Cattle producers need to be more aware of the impacts of over-grazing their rangeland, which will result in lower productivity in their herds. Implementing good pasture management will benefit the herd and improve the soil, leading to higher productivity.
A crossbreeding program is essential in retaining a viable commercial breeding business in Northern Australia, when combined with performance-based selection for specific traits in each breed. This process should include visual selection of bulls for temperament and structure.

Publications

Nil