# INCREASING REPRODUCTION

## Genetic benefits in reproduction of *Bos indicus* (Brahman) under harsh condition

**A report for:** NUFFIELD AUSTRALIA FARMING SCHOLARS

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# Foreword

In the last seven years most beef producers in northern Australia have been running at a loss due to higher costs of production which hasn't been met by rising cattle prices, indicating that the northern beef industry is in a very unprofitable and unsustainable state. With one main market in the Northern Territory, live export, the need to breed early maturing cattle is essential to get returns as quickly as possible. Most herds in Northern Australia have a high percentage of *Bos indicus* breed content which allows them to survive and produce under the harsh environmental conditions, however Brahman cattle are known to be less fertile. This, in addition to the higher production costs as a result of nutritional supplements, freight, and management, means beef producers need to look at cheaper and more beneficial methods to improve the fertility within their herd, in an effort to remain profitable.

Genetic selection tools are an essential part of managing fertility in your herd but due to limited data being collected in the *Bos indicus* breed, the ability to be able to select on these traits is very difficult. Good management decisions and knowledge is a key factor in improving reproduction and making a more viable business in beef production throughout northern Australia. Understanding environmental factors in your region can make a huge benefit to profitability in your business.

My research began looking at many different aspects in agriculture throughout Brazil, Mexico, Canada, America, and Scotland while travelling with six other scholars from different agricultural sectors within Australia and a New Zealand scholar. My research into Beef Cattle Production was conducted in Argentina, Brazil, America, and of course Australia through visiting research stations, genetic centres, and speaking with producers, veterinarians, beef technicians, researchers and reading many articles, journals, and books.

Macquarie Group Services Australia Pty Ltd made my travel and research possible for an Australian Nuffield scholarship and this report.

This scholarship has shown me other ideas that could be adopted into my business by measuring estimated breeding values (EBV) and how to increase returns. With producers gaining better knowledge through research being conducted, the demand for bulls with BREEDPLAN is going to increase. This scholarship has also made me realize how important new research is to help producers deal with factors concerning their business and the need to keep up with proven practices to maintain a viable business.

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# Abbreviations

| | |
|---|---|
| ABCZ | The Brazilian Association of Zebu Breeds (in the Portuguese abbreviation). |
| AI | Artificial Insemination |
| A@P | Age at Puberty |
| BLUP | Best Linear Unbiased Prediction |
| BBSE | Bull Breeding Soundness Evaluations |
| CEIP | Special Certificate of Identification and Production |
| CRC | Co-operative Research Centre |
| DC | Days to Calving |
| EBV | Estimated Breeding Value |
| EPD | Expected Progeny Differences |
| GIP | Genetically Improved Program |
| IVF | In-Vitro Fertilisation |
| MLA | Meat &Livestock Australia |
| NT | Northern Territory |
| PPAI | Post-Partum Anoestrus Interval |
| ROA | Return on Assets |
| SS | Scrotal Size |
| TC | Tropical Composite |

# Contents

**Foreword** ..... **3**
**Acknowledgements** ..... **4**
**Abbreviations** ..... **5**
**Contents** ..... **6**
**Executive Summary** ..... **7**
**Introduction** ..... **8**
**Objectives** ..... **11**
**Chapters** ..... **12**
**1.0 Factors Affecting Reproduction of a Cow** ..... **12**
**2.0 Factors Affecting Bull Performance** ..... **13**
**3.0 Ways to Improve Factors Affecting Reproduction** ..... **13**
3.1 Management ..... 14
3.2 Nutrition ..... 14
3.3 Genetics ..... 16
3.3.1 Australian research showing genetic gains to be made in northern fertility ..... 17
3.3.1.1 Beef CRC Female Reproductive Performance Program ..... 17
3.3.1.2. Age at puberty ..... 18
3.4.1.3.Post-Partum Anoestrus Interval (PPAI) ..... 20
3.4.1.4 Breeder Fertility improved through selection in a NT Brahman Herd. ..... 22
**4.0 Brazil** ..... **25**
4.1 Increased Fertility methods ..... 26
4.2 Creep Feeding ..... 28
**Recommendations** ..... **29**
**References** ..... **30**
**Plain English Compendium Summary** ..... **32**

# Executive Summary

In order to meet the future food requirements of the world's population necessitates a dramatic increase in food production. In 2009, the northern beef industry was in its worst state since the 1970's; with an average return on assets (ROA) of 0.3%-2.0 %.( McCosker & Holmes, 2009). The average cost of production over the last seven years has outweighed the return profit, making it crucial for better methods to be adopted in the north to sustain a viable beef enterprise.

The need for greater reproduction from the same number of females is the greatest way to improve profit. The three main factors influencing reproduction are management, nutrition, and genetics. Any one factor on its own won't work to its full ability.

Genetic improvement is the least expensive and quickest way to advance reproduction in Brahmans as it provides cumulative and permanent gains throughout your whole herd. A bull can affect 80% of a herd's genetic progress; therefore it is critical that the right bulls are selected. Fertility EBVs are a good measure to ensure you are putting a more fertile sire into your herd that will produce more fertile females that reach puberty earlier and have shorter days to calving (DC). Decreasing each of these traits will increase the reproduction performance of your herd, producing less wastage from your bull and cow and more offspring.

Very few Brahman bull producers in Australia measure any kind of EBVs and only thirty four measure scrotal sizes (SS) and a further four measure DC in females. This makes it very difficult to select the best genetics in Australia due to only a very few animals being evaluated for fertility EBVs.

Brazil is a real threat to Australia due to the far greater genetic progress being achieved in their *Bos indicus* herds. Brazil breeders are creating much more fertile offspring as well as many other traits in their herd for better returns with artificial insemination (AI) being very cheap, allowing access to a huge range of sires. Breed plan is also the other real reason for Brazil reaching more genetic superior animals. All Studs measure some type of EPD's allowing all buyers to have the opportunity to look at specific traits that can improve their herd.

# Introduction

## Australian beef production

Australian beef production is made up of two areas: North Australia and South Australia largely due to the climate of where beef cattle can be farmed. As shown in the map below northern Australia (red zone) has a larger area farmed due to extensive farm operations. The head per acre ratio is far less in northern Australia as to southern Australia.

*Bos indicus* cattle are predominant in the tropical north area while *Bos Taurus* is the predominant breed in southern region of Australia. The Brahman comes from the *Bos indicus* having short hair and black skin to withstand hot conditions and be more tolerant to parasites. They have increased sweat glands and a larger dewlap to enable a better cooling system.

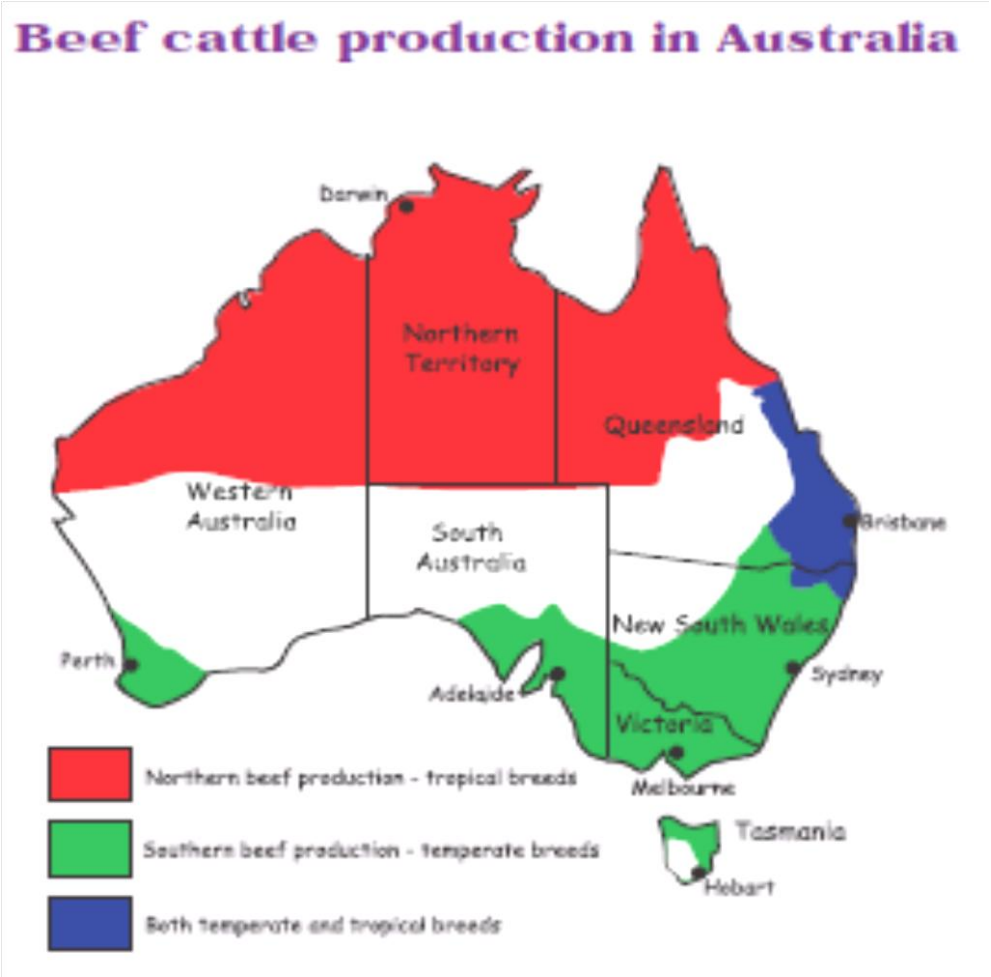


*Figure 1: Beef cattle production in northern Australia*
*Source: MLA 2006 Beef fact sheets*

Profit margins are declining in north Australian beef enterprises due to rising costs of production which are not being paralleled by rising cattle prices. A 2009 report by McCosker and Holmes on the financial position of the northern beef industry found that businesses were largely unprofitable and unsustainable. This situation has not changed; in fact it has worsened with the introduction of the 350kg weight limit on cattle exported to Indonesia and due to the fallout from the live export ban in 2011. McCosker and Holmes stated that *"the extremely poor performance of the extensive breeder herd is an alarming contributor to poor business performance".* One of their key recommendations for the northern beef industry was to put renewed focus on heifer management, breeder performance and bull selection based on objective selection. Reproduction is a key profit driver in northern Australia. In order for businesses to stay profitable they must lift the reproductive performance of their breeder herd.

*Environment*

The north Australian cattle industry is significantly different to southern Australia due to markets, climate, large scale operations, and higher input cost. The environment in the Northern Territory is extremely harsh. Animals have to withstand periods of extreme heat and humidity, an annual protein drought between June to October when the low quality native pasture does not supply enough nutrition to sustain a lactating cow, and many disease and parasite challenges due to the sub-tropical environment. As a result of this, tropically adapted breeds are required. The most predominant breed is the Brahman due to their ability to withstand the harsh conditions. However, Brahmans are also known to have lower fertility than *Bos taurus* breeds.

*Markets*

Markets are very limited for a number of reasons. The most productive animals in this environment are Brahmans, however, the domestic market does not favour Brahman meat due to perceived lower eating quality and price penalties are received. Further, the closest abattoir is 2700km away so the cost of freight alone makes selling beef domestically unprofitable. South East Asia values the Brahman product, however due to cultural, logistical and economic reasons live trade is preferred to boxed meat. Beef production didn't really start to become profitable in the north until Brahmans were introduced and the live export trade began. Rules and regulations are continually changing in our main live export market Indonesia, as a consequence of political involvement. A 350kg weight restriction is in place for our premium market to Indonesia which is requiring producers to breed an early maturing animal and not being able to make greater profit from heavier animals. Selling older cattle is a lot harder due

to weight and age restrictions in the live export market and the distance required to travel for slaughter in an abattoir due to shrinkage of the end product.

*Current selection within the Australian Brahman breed*

BREEDPLAN is a modern genetic evaluation system. BREEDPLAN uses the world's most advanced genetic evaluation system (based on Best Linear Unbiased Prediction (BLUP) technology) to produce EBVs of recorded cattle for a range of important production traits (e.g. weight, carcass & fertility). It is the best tool available to the industry to measure genetic merit of animals for particular traits. BREEDPLAN in the Australian Brahman Association is very small with only 98 studs recording EBVs. In these 98 herds only 34 are recording fertility EBVs through SS and only four are recording DC. This is making it much more difficult to increase fertility but keep a correct structured animal in the Brahman breed due to limited EBVs being collected throughout Australia. The Angus and dairy breeds are good examples of breeds which have achieved significant genetic gain through recording a large number of animals on a large number of traits, allowing for effective genetic selection. Figure 2 below shows that southern breeds have made three times the genetic progress that the northern breeds have. Another disadvantage the Brahman industry has is the number of larger area operations which makes it much more costly and timely to perform EBV recording which impacts on profit margins. Graziers are now starting to value EBV information due to more research being available and the need for greater profit margins and are seeking this information from bull producers.

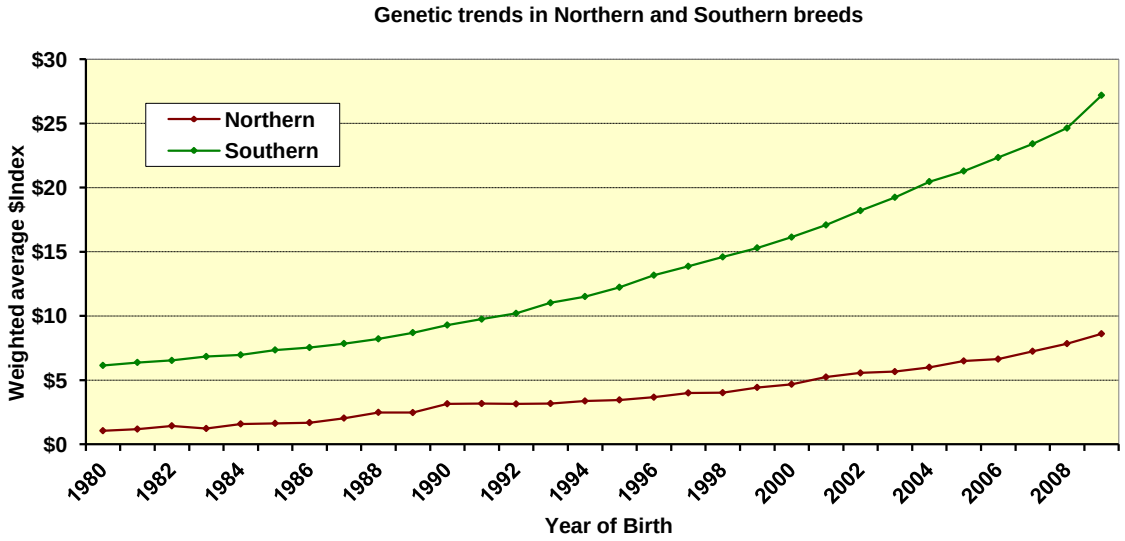


*Figure 2: Comparison of genetic gain in northern and southern breeds due to genetic improvement. Rob Banks MLA –Presentation "Genetic Progress and challenges in northern breeds" 12th November 2010*

# Objectives

- To help producers find a more profitable business through improving fertility in *Bos indicus breeds* while keeping good conformation in harsh conditions.
- To find out how important genetics are to improving reproduction rates.
- The advantages of improved genetics.
- To look at other strategies that businesses are performing for better reproduction to make a more viable business in similar environments.

# Chapters

## 1.0 Factors Affecting Reproduction of a Cow

Reproductive success is a breeder producing a weaner; not falling pregnant, not having a calf; but to have offspring that are going to give a return every year. The reproduction cycle of a cow is the last thing a cow puts energy into. Cows use their energy in an overflow method of four stages. Maintenance is the first stage: how much energy she uses to tolerate her conditions. When the nutritional requirements for maintenance have been met, excess nutrition is then used for producing milk. Once the requirement for milk production has been met, excess energy is then used to maintain body condition. Lastly the nutritional requirements of reproduction are met. If there is not enough nutrition to meet this last requirement, then the cow will not cycle and will not return to pregnancy until either the nutrition in the feed increases, or the calf is removed. Therefore an animal that requires less energy for maintenance and body condition, she is more likely to be able to meet her nutritional requirements for reproduction as well and is more likely to produce a calf every year.

Nutrition is the biggest non-genetic factor affecting fertility in north Australia, due to poor pastures and large cost's involved in buying a high protein supplement. Brahmans are known not to cycle while lactating. Continuous mating does not allow females to correlate their calving period with peek feed conditions.

Disease is a factor that we don't actually know detailed results on but definitely has an affect between conceiving and calving. Some common diseases are pestivirus and vibriosis.

Genetics has the largest influence affecting reproduction. Only a small group of producers in the north have been concentrating on the genetics contributing to their herd for reproduction due to lack of knowledge and data available in BREEDPLAN.

Puberty is becoming later due to selection for larger animals, creating a larger, later maturing breeder. Research has shown the average age of puberty ten years ago was 280kg where now it is 340kg. This is genetic.

Environment can largely affect an animal's survival and performance so using adaptable breeds for you environment is crucial.

## 2.0 Factors Affecting Bull Performance

Bulls in northern Australia are required to walk large distances and still have a high libido in testing conditions. Physical and structural soundness (i.e. feet, stance, joints, gait, limb structure, mouth, and sheath and testicle development) are all extremely vital to a bull's performance.

Nutrition in bulls is slightly different to that of cows however nutrition greatly influences fertility and libido levels of bulls. Bulls fed lower protein levels have smaller testicles and less quantity and quality in their semen. Bulls fed grain supplements have surplus protein levels; this has an effect on their semen quality due to fat deposits in the neck of the scrotum.

Disease is a very quick way to decrease your fertility in your herd with most common diseases being transmitted sexually. For example vibriosis, and trichomoniasis are the two most common diseases affecting herd fertility.

Genetics is also very important. There is little genetic information available on Australian Brahmans. Further, anecdotal evidence suggests that most producers are looking for huge weight gains rather than fertility. A sire has the greatest genetic influence on a herd due to the number of progeny that he sires in his lifetime hence his traits greatly affect the herd.

## 3.0 Ways to Improve Factors Affecting Reproduction

Research shows that reproductive rate is a key driver of profitability, particularly in areas where nutrition is limiting and reproductive rates are low. The three main factors for improving productivity in your herd are management, nutrition, and genetics. All of these techniques need to be used accordingly with each other, for example if you only emphasize one without the other you won't achieve the full benefits of the strategy you're concentrating on.

### 3.1 Management

Management is a key factor in all business as your daily operations systems and your knowledge is relied upon in improving methods that are viable to your business. Having good knowledge of what your end product needs to be allows you to get the most out of your conditions and investment.

Choosing structurally sound animals allows longer use of the animal in their lifetime due to less implications occurring e.g. lameness, better condition.... and having good knowledge on genetic factors and BREEDPLAN when buying sires.

Weaning management is crucial to reproductive performance. By weaning too late you can decrease the next year's conception rate, calving rate, and profit turnover in previous years. Improving paddocks, waters and stocking rates decreases the energy used by an animal and utilises more pastures evenly and will improve nutritional levels.

Disease is a big problem in that no one really has a good idea of what diseases are in their herd and how much they are affecting their production. Vaccines can become expensive but if you can control diseases such as Pestivirus and Vibriosis that affects calf loss it really isn't expensive.

Management is also a big driving factor in nutrition and genetics so you really need to know the best strategies for your animal to increase your productivity. The more you can think like an animal the more productive you will be.

### 3.2 Nutrition

Nutrition is the main non-genetic factor affecting reproduction due to influences it has on improving many traits that are limiting reproduction. Beef Co-Operative Research Centre (CRC) has shown good management in nutritional levels can increase reproduction by 15%. Protein deficiency is the largest problem in herds throughout the north and the cost to feed protein in a viable manner.

Feed and energy requirements for cows will escalate during late pregnancy as the energy in feeds is needed for maintenance, foetal development and mammary gland development. After

calving, energy needs of the breeder remain very high due to maintenance, growth (in first calf heifers), milk production and recommencement of reproductive activities. (2006 MLA).

The energy requirements of a breeder throughout the year are shown in figure 3.

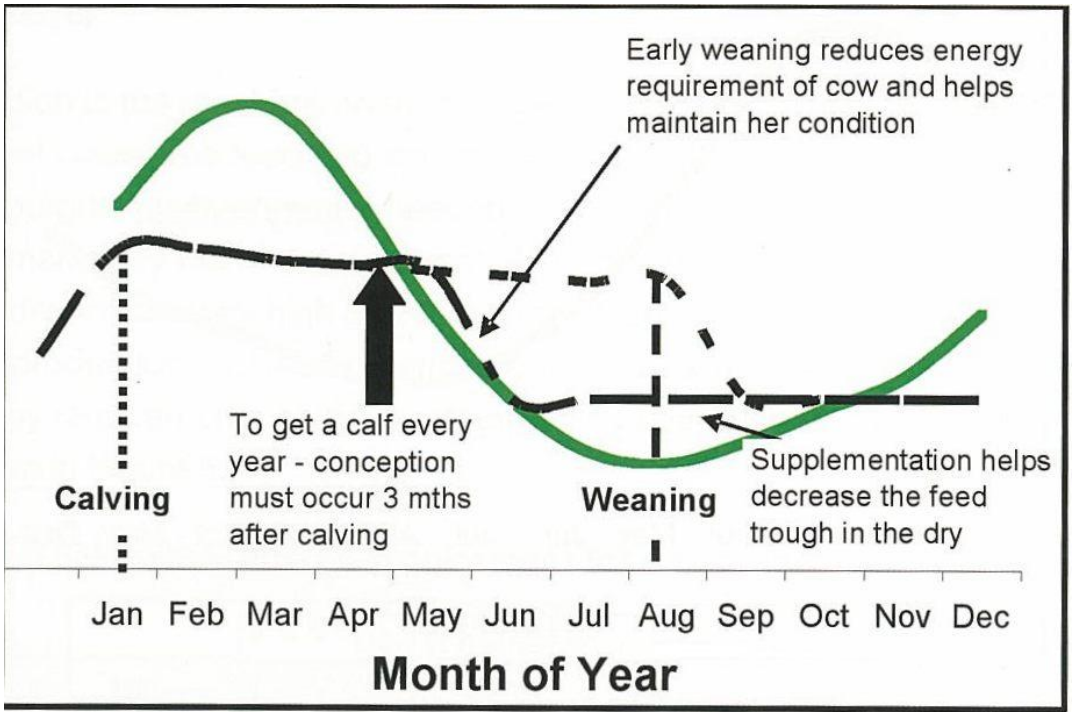


*Figure 3: Energy requirements of a breeder at different stages of reproduction versus energy available in the pasture (Source: MLA, 2006).*

Control mating can reduce out of season calving and match peak nutritional demands with highest quality feed available (calve at right time of year) allowing the animal a greater chance of acquiring the nutrition itself through available pasture and less expense on supplementation. In order for a cow to produce a calf every year she must have high nutritional levels to promote the growth of the next ova to be released with no abnormalities and the ability to take when fertilised. Nutritional setbacks early in life can also affect the ability for earlier maturity and a lower libido which has been evident to have similar characteristic to their offspring.

Nutrition is required so that the animal can express its genetic potential, but a genetically superior animal will always excel compared to the inferior animal regardless of the environment.

### 3.3 Genetics

"Positive genetic selection is considered an inexpensive tool to improve herd profitability, as genetic improvement is permanent and cumulative. The effect of selection of a sire (be a positive or negative trait) will affect your herd profitability for many years." (Renee Golding Primary industries annual extension report 2009 pg 11).

Fertility was thought to have low heritability in cattle and is the cause of some producers' low weaning rates. However, there is growing evidence that some reproductive traits are highly heritable and that selecting on them can lead to increased reproductive performance.

Selecting for reproductive performance in a herd involves two main components; selecting fertile sires and selecting females that have more calves in a lifetime as a result of sound sire selection. Both strategies are important, however sires are responsible for more than 80% of the herd genetic gain, hence it is critical to select bulls with superior genetics.

A bull's genetic merit for reproductive performance cannot be assessed visually but indicator traits can be measured to identify superior bulls. The best measure of an animal's genetic merit is based on their performance, that of their parents and that of their offspring. BREEDPLAN is the available genetic evaluation system which uses the latest technology to develop EBV for particular traits based on the performance data of the animal and its relatives. It allows breeders to monitor and control the genetic progress of their herd and is essential for identifying genetically superior sires.

SS & DC EBVs are the only EBVs specific to reproductive performance. Currently very few breeders are recording SS or mating details to enable the calculation of these EBVs. This suggests that bulls are not being selected for these traits. The seed stock industry must start recording and selecting on these traits in order to make genetic progress in reproductive performance.

Genetics is the most viable and quickest way to improve all factors limiting reproduction. By choosing better genetics for your environment and market it increases profitability in your business. Genetic data also enables you to put finer DNA breeding in your herd and concentrate on certain traits that will increase your productivity.

### 3.3.1 Australian research showing genetic gains to be made in northern fertility

#### *3.3.1.1 Beef CRC Female Reproductive Performance Program*

The Beef CRC's Female Reproductive Performance program recently wound up and was one of the longest running and largest cattle genetics projects in Australia. The research involved 1027 Brahman heifers by 54 sires, 1132 tropical composite heifers by 51 sires and 3500 bull progeny of heifers. The heifers were studied from their birth through to weaning of their sixth calf, while the bull progeny were studied for 2 years. To separate the effects of environment and genetics, daughters from each sire were mated on 4 breeding properties which varied considerably in nutrition and climate. These properties are shown as "Female Research Station" in Figure 4 below. The project found that there is a large variation in reproductive performance traits in Brahmans and that selection can use this variation to improve reproductive rates. This means that there is a real opportunity for producers to lift the reproductive performance of their herd regardless of environmental conditions through selection of animals that are genetically more fertile.

Specifically, the Beef CRC results found a large variation in two important reproductive traits in Brahmans; age at puberty and the time taken to return to cycling after calving (called Post Partum Anoestrus Interval PPAI). These traits are highly heritable and contribute to the lifetime reproductive rate of cows i.e., the number of calves a cow is likely to have in her breeding life.

Of major importance to genetic improvement is that these female traits are genetically correlated to male traits that are easier to measure and this allows selection of bulls that will leave more reproductively sound daughters.

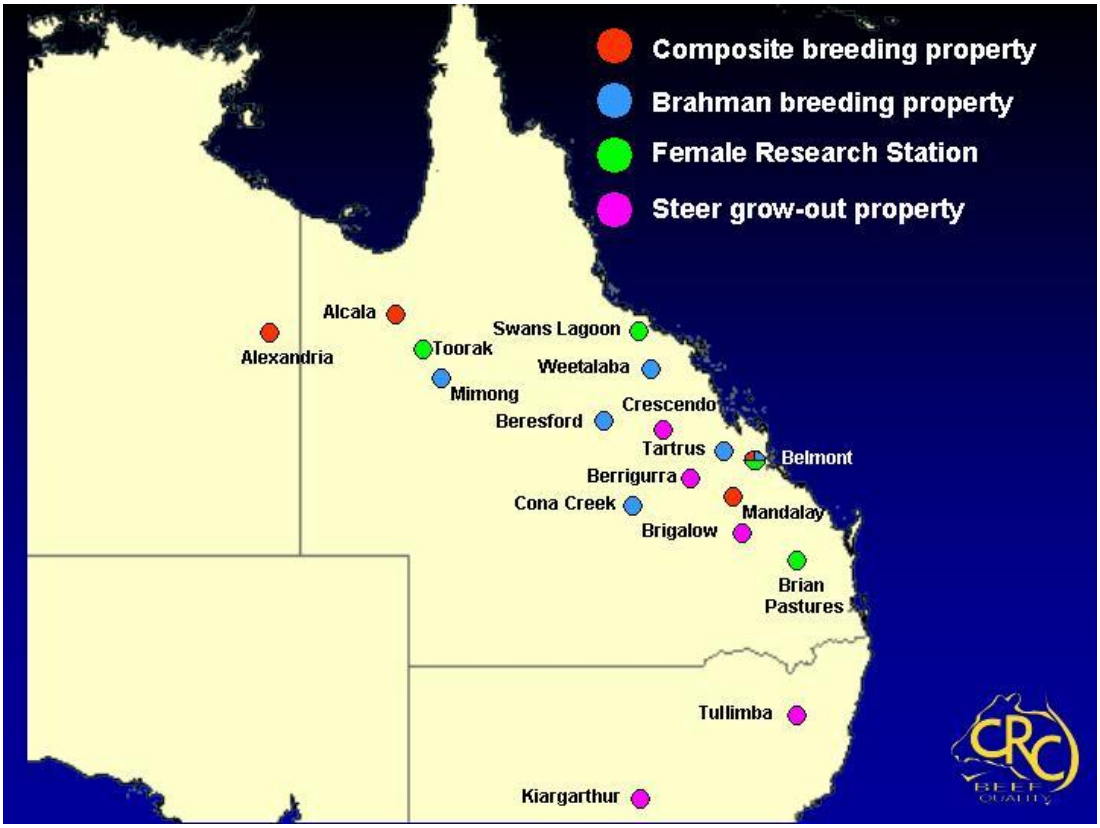


*Figure 4: Location of properties involved in Beef CRC Female Reproductive Performance Program.*
Source Beef CRC

#### *3.3.1.2. Age at puberty*

Age at puberty (A@P) is important in maximising a cow's lifetime reproductive performance as it determines the onset of her reproductive life. Animals that take a long time or require a high live weight to reach puberty are less desirable. Beef CRC research has measured large variation in the age and weight of puberty in Brahman and Tropical composites (Table 1). It was also found that these traits are highly heritable in both breeds.

*Table 1. Age and weight at puberty for CRC Brahman and Tropical Composite (TC) heifers.*

*Source Beef CRC*

| Brahman and TC Traits | Mean | Range |
|---|---|---|
| Age at puberty (months) | 23 | 11-40 |
| Weight at puberty (kg) | 332 | 196-485 |

A critical finding was the large influence of sires on heifer age at puberty. On average Brahman heifers reached puberty at 23 months of age. However, the daughters of the top performing sires (for age at puberty) reached puberty 93 days earlier than the average, while those of the worst performing sires reached puberty 77 days later than the average (a difference of 169 days or 5.6 months).

*Table 2: Age at puberty EBVs for a range of Brahman sires used in the Beef CRC project*
*Source David Johnston, AGBU, 2010*

| Sire | A@P EBV (days) |
|---|---|
| A | -185 |
| B | -145 |
| C | -139 |
| D | -99 |
| E | -85 |
| F | -82 |
| . | . |
| . | . |
| U | 47 |
| V | 56 |
| W | 68 |
| X | 89 |
| Y | 137 |
| Z | 154 |

NB: A sire only contributes to half of the genetic material of his progeny, thus on average his daughter's A@P will be half of his A@P EBV. For example, on average, daughters from Sire A will reach puberty 93 days earlier than the average.

*Selecting for decreased female age at puberty*

A@P is not an easily measured trait in females as it requires regular ultrasound scanning of ovaries. However, there are male traits that are highly genetically correlated with A@P which are easily measured.

Male SS at 12 months is highly heritable in Brahmans and moderately so in Tropical Composites. Critically SS is moderately and desirably correlated with heifer age at puberty for both breed types. This provides the opportunity to select bulls on SS to improve female reproduction. Specifically, selecting bulls with larger, more positive SS, EBV will tend to produce females who reach puberty at an earlier age.

SS is also related to sperm production and semen quality. Bulls with below average SS for their age and weight are likely to have lower semen quality resulting in them siring fewer

calves. Hence it is important to determine if a bull has reached a minimum standard and will produce adequate levels of sperm production. This can be determined through Bull Breeding Soundness Evaluations (BBSE). Bulls should have above average SS at 12 months and at the two year old pre-mating BBSE.

*Table 3. Average scrotal size SS and live weight by breed and age*
*Source Beef CRC*

| | Breed | | Age | | |
|---|---|---|---|---|---|
| | | | 12 months | 18 months | 24 months |
| Scrotal size & live weight | Brahman | SS (cm) | 21 | 26 | 30 |
| | | Weight (kg) | 247 | 353 | 384 |
| | Tropical Composites | SS (cm) | 26 | 30 | 32 |
| | | Weight (kg) | 275 | 369 | 392 |

*Practical considerations*

Identifying early maturing dams and preferentially keeping bulls from them is another practical method of placing selection pressure on age at puberty within the herd. Some methods to achieve this include:

- Culling late maturing heifers (i.e. fail to conceive as 2 year olds)
- Identifying 2yo heifers that conceive earlier in the breeding season
- Joining 2yo heifers for a shorter period or culling late pregnant heifers
- Exposing heifers as yearlings to bulls

#### *3.4.1.3. Post-Partum Anoestrus Interval (PPAI)*

PPAI refers to the period of time between calving and beginning to cycle again. Females that conceive earlier after calving have the potential to produce more calves in their lifetime; hence this is a desirable trait. It was found that PPAI in first calf Brahman heifers is highly heritable.

The Beef CRC found a large genetic variation between sires in the interval between calving and the first oestrus cycle after calving of their daughters. That is, sires have a large effect on the time taken to return to cycling after calving in first calf heifers.

*In the Beef CRC, individual Brahman bulls varied in the lactation anoestrus interval of their daughters from 50 days less than the average to 85 days longer than the average (difference of 135 days or 4.4 months). This can equate to a 40% difference in calving rate.*

*Selecting for shorter return to cycling (shorter PPAI)*

PPAI is difficult to measure. Fortunately there are two useful selection indicators to breed for shorter return to cycling after calving. They are DC EBVs and percent normal sperm in bulls.

*Days to calving EBVs*

DC EBVs are genetically related to return to cycling. The DC EBVs are estimates of genetic differences for the time when a cow is first exposed to the bull (i.e. the bull is put into the mating group) to when she calves. DC EBVs are expressed as the number of days from the start of the joining period (bull/s in) until calving, and should not be confused with gestation length. Cows that do not calve get a penalty in the calculations. The main variation in DC occurs between start of joining and actual conception, although variation does occur in gestation length (a separate EBV). A negative DC means a shorter interval and a positive DC means a longer interval.

Selecting bulls with shorter, more negative DC figures will tend to produce females that return to cycling sooner after calving.

*Percent normal sperm*

The Beef CRC research found that percent morphologically normal sperm at 24 months is heritable and favourably genetically correlated with PPAI. Specifically, females sired by bulls with higher levels of percent normal sperm will tend to return to cycling sooner after calving than those from bulls with lower levels of percent normal sperm.

*Practical considerations*

Identifying dams with shorter PPAI and preferentially keeping bulls from them is another practical method of placing selection pressure on PPAI within the herd. Some methods to achieve this include:

- Controlled joining and culling on pregnancy diagnosis
- Preferentially keeping bulls from dams that have never missed a calf

### *3.4.1.4 Breeder Fertility improved through selection in a NT Brahman Herd.*

The NT Department of Resources has been selecting for fertility in a Brahman herd (SEL) since 1994, using objective selection on fertility traits and the BREEDPLAN genetic evaluation system. Bulls are selected to be retained in the herd through a selection index which includes:

- Yearling SS
- High percent normal sperm as yearling
- Age of dam at first calving
- "Never miss a calf" scores of dam
- 400 day weight

The fertility of the SEL herd was assessed by comparing the pregnancy rates of lactating cows (at the May weaning muster i.e. WR1) in the SEL herd and in an unselected Brahman control (CON) herd. Although the herds were in different paddocks at the Victoria River Research Station, they were stocked at the same utilisation rate and managed in the same way except that the CON herd was continuously mated while the SEL herd was control mated. Therefore only CON cows that were due to calve at the same time as SEL cows (assessed by pregnancy testing) were compared.

Figure 5 shows the proportion of breeders lactating and reconceiving in the SEL and CON herds. Re-conception rates were on average 31% units higher in SEL cows than CON cows, and the differences were significant in all years except 2009.

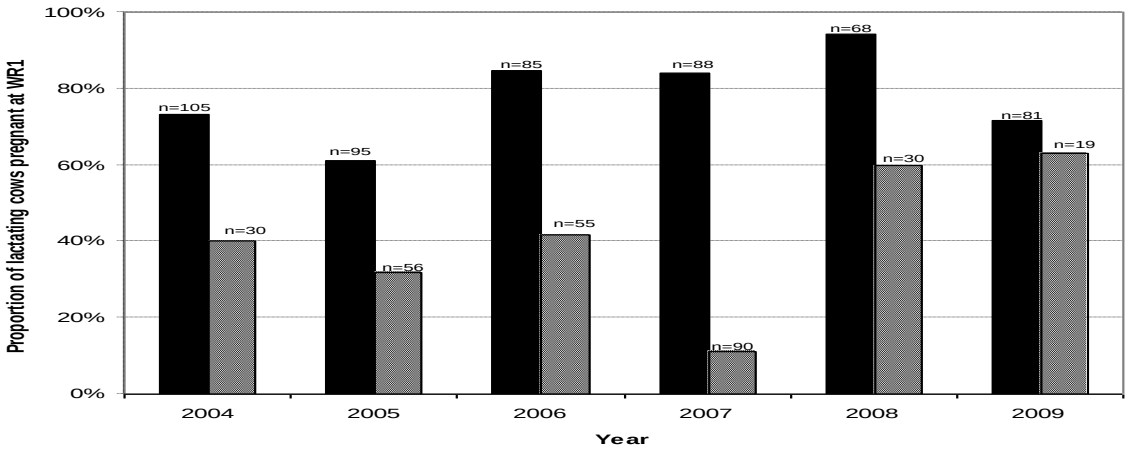


*Figure 5. Proportion of breeders lactating and pregnant at first round weaning muster (May) in the SEL and CON herds. Source, Shatz T 2010*

(SEL herd = solid black columns, CON herd = chequered columns).

A higher proportion of cows returned to pregnancy while lactating in the SEL herd. *Schatz et al*. (2010) also showed that pregnancy rates in yearling mated heifers from the SEL herd were

on average 35% higher than heifers from commercial herds (com), and that BREEDPLAN estimated breeding values for fertility traits (DC and SS) had improved markedly in the SEL herd compared to the Brahman Breed Society average since selection began in 1994 (see figures 6-8 below).

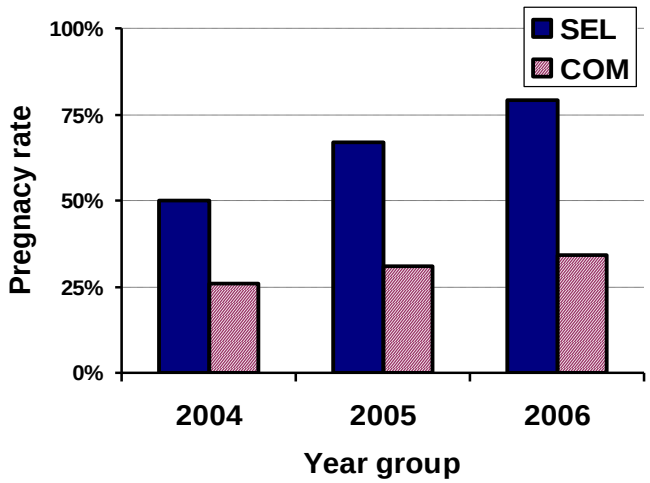


*Figure 6: Pregnancy rate in yearling mated heifers in Selected Brahmans versus control Brahmans. Source, Shatz T 2010.*

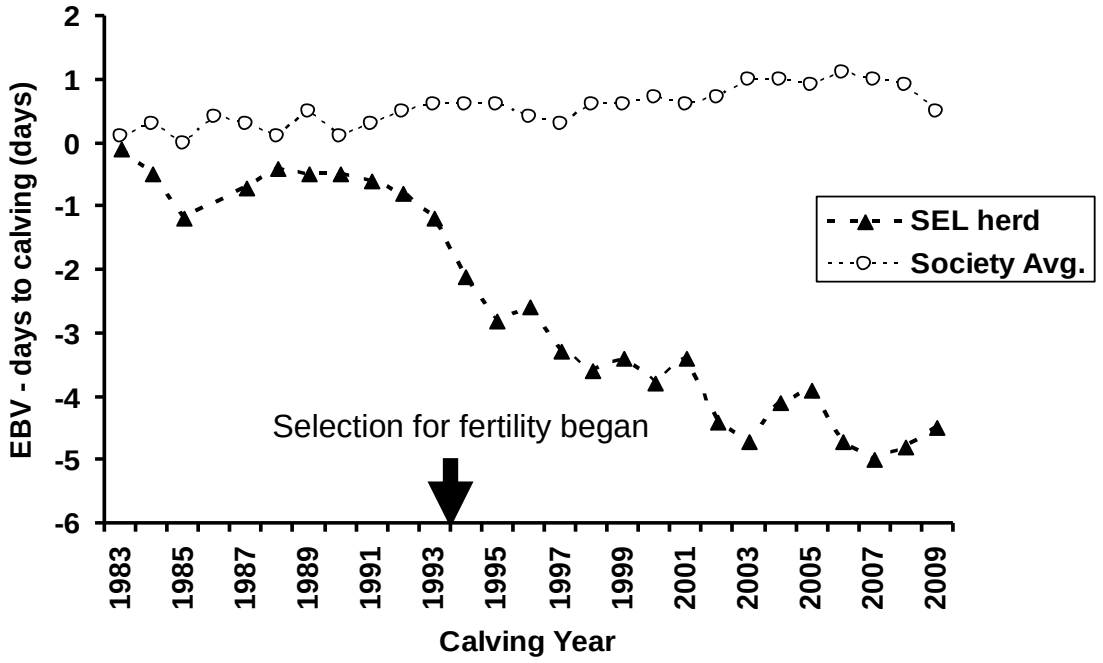


*Figure 7: Change over time in the Days to calving EBV in the Selected Brahman herd versus the Brahman breed society average. Shatz T 2010*

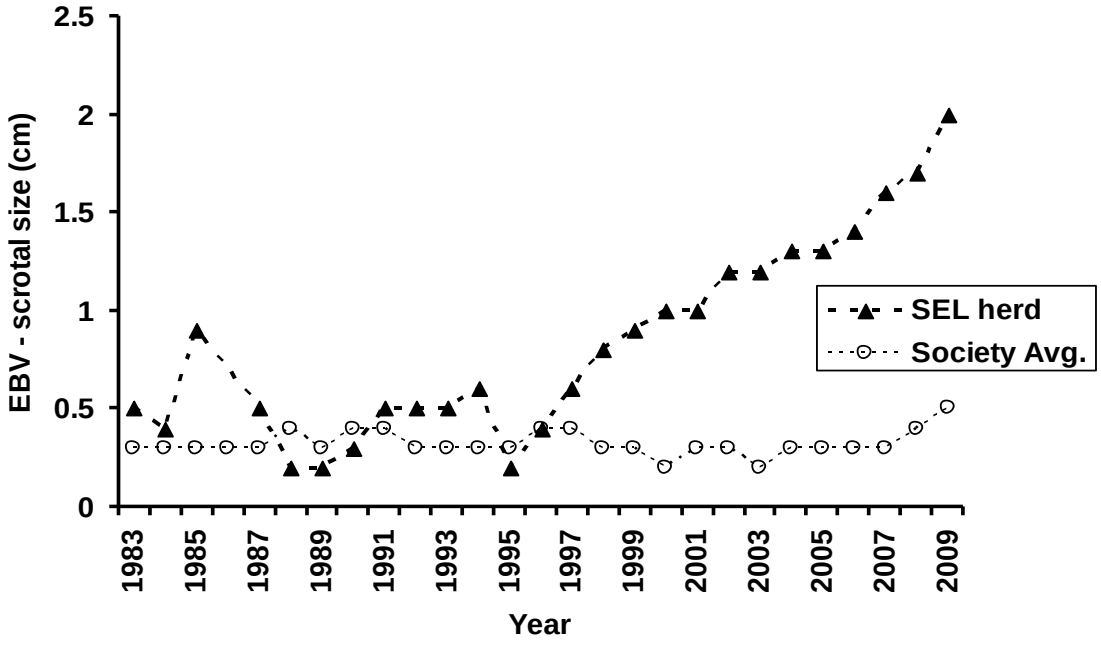


*Figure 8: Change over time in the scrotal size EBV in the Selected Brahman herd versus the Brahman breed society average Source, Shatz T 2010.*

## 4.0 Brazil

Brazil has the largest commercial cattle herd in the world and is the number one beef exporter which is a huge accomplishment due to its disease status. Brazil is going ahead faster than any other country genetically in *Bos indicus* cattle as a result of them performing over 80% of all AI and in-vitro fertilisation (IVF) done in the world. The option to import semen with genetically enhanced data collected is giving them access to the best genetics around the world. With the cost of production being far less and the average price of AI being around $70 dollars it makes it more profitable to AI than natural mate, with average graziers AI 60% of their herd. Profit margins are also decreasing in Brazil making them concentrate on better returns on higher production costs. Cattle pastures are decreasing due to higher returns in farming and the need for greater productivity is inevitable. Brazilian government really stands behind agriculture which is enabling them to conduct large research operations to increase their knowledge and genetics of Bos indicus. Producers with a breeder herd under 500 are given grants from the government to improve the genetics if they AI to allow greater sire selection.

Genetic improvement programs (GIP) similar to BREEDPLAN in Australia are very popular in Brazil. A huge number of animals are involved in these programs and a large number of traits are recorded, giving them a huge database to choose from and much more detailed EPD's (EPDs are the Brazilian equivalent of EBVs). There are two main GIPs in Brazil: ABCZ which is the national organization of all Zebu breeds in Brazil and has over 12 million animals on its database. Over ten million animals have been recorded for weight EPDs and over four million animals for further EPDs. "Special Certificate of Identification and Production" (CEIP) is the other organisation.

Brazil is very big on improving genetics, not just focusing on economic returns which have been proven through the lengthy EPD'S producers are measuring. As quoted by a partner of Uberbrahman "We don't see the farm and the Brahman herd as tools just for producing and earning money. Our work aims to ensure the improvement of the cattle, with a proud feeling of the genetic that enters the place with the other's that acquire it."(Aldo Silva Valente Jr.)

ABCZ is an organisation for all zebu breeds in Brazil for keeping high genetic characteristic in each register breed, obtaining markets and performing research to enable a more profitable business. ABCZ has a finer organisation for each registered zebu breed e.g.; ABCB is the Brahman organisation. Authorized personal within ABCZ inspect all registered animals twice,

the first inspection is when the calf is still on mum to prove the offspring correlates to the donor and that it doesn't have any real characteristic faults. A successful pass into the ABCZ is a brand being placed on the animal's cheek. Second inspection is between 16 months and 24 months; it is then checked for correct breed structure, semen tested and EPD values recorded. If these figures are above the desired level then animals are passed with a brand, placed on its hind leg. Registration with the ABCZ organisation is around 1700R or $1200 which is quite expensive.

CEIP is a Certificate of Identification and Production that has a database of over 5,000,000 animals with EPD'S. A CEIP certificate is much more popular in commercial herds due to it being a little less expensive @1200R or $800. CEIP is a selection program that consists of three organisations CFM, Delta G, and Paint. Each organization has a slightly different GIP but can all be compared to each other in the selection index within CEIP GIP. Each program has different EPD options to allow a viable program for your business. Only animals with exceptional EPD's qualify for the CEIP program but are again inspected twice and are marked with this symbol on their cheek and hind leg. Only the top 20% of bulls and top 20% of females evaluated will be accepted into ABCZ GIP regardless of high EPD's.

### 4.1 Increased Fertility methods

Evaluations are much more viable to do due to intense farming operations, the average operation having one cowboy per 50 head compared to northern Australian operations having 1 cowboy per 500 head. Controlled mating is being used allowing less age variation in end measurements providing more consistency.

Jacarezinho is a cattle company in Brazil using a selection index applied to all progeny to allow the continual selection of more desirable sires. The weighting of the traits within this index has changed over time as certain standards in herd performance are reached. For example in the beginning they focussed on improving the fertility of the herd while building herd numbers. Now they are incorporating other desirable traits such as muscling, early maturity into the index to build earlier maturing, beefier animals with higher carcass weight, which still have high fertility.

They use the Delta G GIP program allowing 20% of each sex being accepted with a CEIP certificate but still has evaluations on their whole herd that are recorded into the Delta G

database. Cows with a calving interval of more than 12 months and heifers failing to conceive after 24 months are systematically culled.

Pregnant breeders are moved into a cell paddock situation with a little holding square in the middle with small shed days before calving. The cows are drafted up into contemporary groups comprising of 180 cows all calving within 15 days of each other. As soon as the calves are born they are captured and taken to the shed to be evaluated for weight, DOB, contemporary group, identification abnormalities and treated with antiseptic on the umbilical cord to stop infection. All male offspring are put into a different paddock to the female offspring making another contemporary group.

EPD evaluations are then carried out as weaners and at 16 months and data are included in the selection index. The Selection Index includes:

- Early maturity (not sexual) 16% - fat deposition score
- Conformation 8% (score of 1-5)
- Muscle 16% (based on Ankony – score of 1-5)
- Scrotal size 14%
- Days to reach 400kg 46% (want cows that return to good condition faster after calving)

A practice they are implementing to improve early reproduction in their herd is mating heifers earlier – at 16 months of age. In Jacerezinho heifer reproduction rate is at 95%. Heifers are mated at 16 months or 300KG at the start of March for 60 days then pregnancy tested after the bull is removed, 24% fell pregnant getting a p branded on them for future reference. By joining this early the heifer doesn't need to be joined until the following year allowing higher body condition, higher pregnancy rates. The re-conception rate in the 16 month heifers was 85%. The rest of the heifers are then joined at 24 months in the following January to calve out in Nov/Dec with 81% falling pregnant and 75% falling pregnant the following year.

## 4.2 Creep Feeding

Creep feeding 1st calf heifers' calves also proved to increase the chance of offspring the following year as well as helping the calf's rumen in the weaning process. In theory it is too expensive to feed the heifer which puts the extra feed into making more milk rather than into increasing their own body condition. Instead they have fed the calves which then require less milk; therefore the heifer can put more into her body condition. One operation creep feeding has increased its reproduction of 2nd calf in the following year by 10%.

The average consumption per calf works out to be 200g/day/head over approximately six months being 36kg for total consumption. The mix is made up of 30% mineral mix (momensin, salt, and trace minerals) @ R$1200/tonne and 70% corn/sorghum @R$486/tonne. Therefore the cost per calf is R$25.

Spike feeding is also used in other operations but this involves feeding the breeder to get better weight gains in their wieners.

*Figure 9: Creep feeding structure at Jacarezinho*

# Recommendations

With smaller profit margins the need to improve reproduction and limit the cost of production is inevitable to make a viable business. An increase in reproduction is the most effective procedure to improve profit margins. Achieving higher weaning percentages allows a greater return out of the same herd base. EBV and selection indexes are objective selection tools which can be adopted more widely for greater genetic progress in Northern Australian herds.

As bulls have an 80% genetic influence within a herd it is essential that the EBV SS is selected when buying sires to create earlier maturing offspring and greater fertility within your herd.

DC EBV is the most important trait within the breeder herd to improve reproduction quicker and have a better lifetime of offspring. Producers need to remember the animals in their business have to be able to have great adaptation to their environment to get maximum performance.

Nutrition is still a major constraint to Northern Australian cattle herds, being one of the largest influences towards economic losses. However herds which are genetically superior or above average with greater production and lower costs per head may be in a better economic position to overcome this huge nutrition problem through less supplementary feeding, and improved management of available pasture. A cattle enterprise aiming to produce 500 weaners per year would be able to do so running less breeders if the improved genetics with the herd is allowing a higher weaning percentage. Feed can also be preserved through running fewer breeders to allow better nutrition through the dry season.

For beef producers to get greater benefit out of Australian Brahman genetics more bull producers have to start measuring fertility EBVs to create much more selection in heritable traits. Northern Australia herds are not going to have a huge benefit gain in reproduction rates within the next ten years due to the lack of selection for fertility traits being used previously. Although the next ten years is also going to be an exciting time in the northern beef industry with so much opportunity for more research and increasing reproduction rates in your herd.

# References


Ashwood Alex (2009), Genetic Change, Brahman news, 163.

Bortolussi G, McIvor JG, Hodgkinson JJ, Coffey SG and Holmes CR, (2005), The northern Australian beef industry, a snapshot. 2. Breeding herd performance and management, Australian Journal of Experimental Agriculture, 45, 1075-1091.

B M Burns, C Gazzola, R G Holroyd, J Crisp, M R McGowan, (2011), Male reproductive traits and their relationship to reproduction traits in their female progeny : a systematic review, 46 (3) 534-553
DOI: 10.1111/j.1439-0531.2011.01748.x

Beef cattle in Australia, (2006) MLA Beef sheets Third edition.

Burns, B.M., et al.,(2010) A review of factors that impact on the capacity of beef cattle females to conceive, maintain a pregnancy and wean a calf—Implications for reproductive efficiency in northern Australia. Anim.Reprod. Sci. doi:10.1016/j.anireprosci.2010.04.010

Corbet, NJ, Burns, BM, Corbet, DH, Crisp, JM, Johnsoton, DJ, McGowan, MR, Venus, BK & Holroyd, RG., (2011), Proceedings Association of the Advancement of Animal Breeding & Genetics, 19: 55-58.

Johnston, D; Barwick, SA; Holroyd, RG; Fordyce, G; Burrow, HM (2006), Beef CRC, Genetics of female reproduction traits

Johnston, DJ, Barwick, SA, Corbet, NJ, Fordyce, G, Holroyd, RG, Williams, PJ & Burrow, HM. (2009) Animal Production Science, 49: 399-412.Johnston, DJ, Barwick, SA, Fordyce, G & Holroyd, RG. Proceedings 9th World Congress on Genetics Applied to Livestock Production, August 1st-6th, Leipzig, Germany.

Johnston, DJ, Barwick, SA, Burrow, HM, Holroyd, RG & Fordyce, G. 8th World Congress on Genetics Applied to Livestock Production, August 13-18, 2006, Belo Horizonte, MG, Brazil.

Nicol. Don, (2011), Genetic Evaluation from raw weights to genomics, Brahman the right choice, 31, 27-28.

McCosker, T., McLean, D & Holmes, P. (2009) Northern beef situation analysis 2009: Final Report. Meat & Livestock Australia: Sydney.

MLA, (2010), Final report Northern Beef situation analysis 2009.

Meat & Livestock Australia, (2007), managing the breeder herd- Practical steps to breeding livestock in northern Australia.

Pimenta Laura, (2011) Brahman: Breaking Boundaries, ABCZ news, year 1 No 3, 8-10.

Rouke P.K.O., Fordyce G., Holroyd R.G., Sullivan R.M., (1993), Mortality, Wastage, and lifetime productivity of Bos Indicus cows under extensive grazing in northern Auatralia.3. Comparison of culling strategies, Aust J EXP AGR, Vol 33, No.2

Schatz T., (2010), Selected Brahmans. Kidman Springs Field Day, Pg 30-32

Schatz TJ, Jayawardhana GA, Golding R, Hearnden MN (2010) Selection for fertility traits in Brahmans increases heifer pregnancy rates from yearling mating. *Animal Production Science* **50**, 345-348.

Valente Jr. Aldo Silva, (2010-2011)The Proposal for a Genetic Jump, Brahman News The World, 2, Pg 86- 88.

# Plain English Compendium Summary

**Project Title:**

Nuffield Australia Project No.:


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**Objectives**

How to make northern beef operations more viable.
Genetic benefits in the reproduction of Brahmans in North Australia
Methods we can adopt to make better reproduction rates

**Background**

The average beef producer in Northern Australia has been running at a loss or very little profit due to increase in cost of production compared to the lack of increase in their return. The need for greater reproduction is required to get maximum return out of your business from the same herd base. Reproduction is best utilised when performed with good management and nutrition

**Research**

A global focus program that went for six weeks travelling to Brazil, Mexico, Canada, America, France, and Scotland. The next ten weeks I travelled to Argentina, Brazil, and America looking at research stations, genetic centres, and other producers. Books, Journals, and Research experiments conducted in Australia.

**Outcomes**

Cost of production is rising all through the world in beef production creating smaller profit margins. Improved reproduction rates are required to obtain a sustainable business. Key factors affecting reproduction are Management, Nutrition, and Genetics. All three factors need to be utilised together for optimum results however a superior animal will always perform better than inferior animal even under poor conditions.
Genetics are the quickest way to increase reproduction due to the gains being permanent and cumulative in their offspring. Bull selection is an important tool as he represents 80% of the genetics of your herd and has significant heritable traits that will affect the reproduction of his offspring.

**Implications**

Producers need to implement better procedures and gain an understanding of Management, Nutrition, and Genetics to enable a sustainable business. BREEDPLAN must become a priority in bull producers especially fertility EBVs to allow greater genetic gain in the Brahman breed. Breeding cattle isn't a hobby any more its science and producers must look at innovative procedures and research to maintain a viable future.