MEAT & LIVESTOCK
AUSTRALIA

On farm

Meeting post weaning market specifications for the live cattle export trade to South East Asia

MLA Project Number NAP 3.111

Final Report prepared for MLA by:

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Abstract

This project, which was carried out by the NT Department of Business Industry and Resource Development between 1998 and 2003, investigated ways that NT feeder cattle could meet future SE Asian market specifications and thus avoid over-fatness at slaughter. Two strategies were proposed, crossbreeding with later maturing breeds and the marketing of bulls. Weight, age and fatness relationships were investigated in an experimental feedlot in Katherine for three breeds (Brahman, Droughtmaster and 1/4 Charolais) and for bulls, steers and heifers. From this work, maturity type growth curves were drawn as a basis for future trading by specification. The results showed that in comparison to Brahman steers, when slaughtered at the same fatness, 1/4 Charolais steers had a 10% weight advantage, Brahman bulls a 15% advantage and 1/4 Charolais bulls a 28% advantage.

Since late maturing breeders have a large liveweight, their survival and productivity is a potential problem in the extensively managed production systems of the semi-arid tropics. A trial was therefore conducted at Victoria River Research Station (Kidman Springs) in the Victoria River District to compare the breeder herd efficiency of 1/2 Charolais breeders against Brahman and Droughtmaster. The conclusion was that the breeding herd efficiency (31.7 kg per 100 kg of cow mated) of the 1/2 Charolais breeders was comparable to the other breeds, but their loss of condition was a concern. However a proportion as high as 50% Charolais genes would never arise under the criss-cross breeding system proposed, and it is suggested that a lower proportion of late maturing genes would be able to combine feedlot advantages with hardy and productive breeders.

The recommendation to consider the marketing of bulls instead of steers poses obvious management difficulties. A trial in the Victoria River District therefore demonstrated the use of short scrotum bulls (artificial cryptorchid) as a possible strategy.

An earlier project had proposed that a two stage production system with most post weaning production taking place on improved pasture in the Douglas Daly district would lead to a substantial increase in the number of NT steers available for export. Post weaning systems were therefore investigated on both improved pasture at Douglas Daly Research Farm and on native pasture on Mt Sanford Station in the Victoria River District.

Note on Authorship

When this work was started, the responsible NT Government Department was called the Department of Primary Industry and Fisheries (DPIF). In 2002, DPIF became part of a larger department and was renamed the Department of Business Industry and Resource Development (DBIRD). In July 2005, the department was reformed as the Department of Primary Industry, Fisheries and Mines (DPIFM). References to documents from the time of DPIF and DBIRD are referred to with their original name.

This project was initiated and run by Peter Ridley while he was principal researcher with DBIRD. Peter retired in October 2003, with the fieldwork complete and the project part written up. Tim Schatz was principally responsible for completing this report. The main conclusions from this work are therefore Peter Ridley's, but final responsibility for content remains with the Department of Primary Industry, Fisheries and Mines.

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ACRONYMS

ADG	Average daily gain
BHE	Breeding herd efficiency
Bra K	Kidman Springs Brahmans
Bra MS	Mt Sanford Brahmans
1/2 Ch	50% Charolais x 50% Brahman
1/4 Ch	25% Charolais x 75% Brahman
DBIRD	Department of Business Industry and Resource Development (formerly DPIF)
DDRF	Douglas Daly Research Farm
DM	Droughtmaster
DPIF	Department of Primary Industries and Fisheries
DPIFM	Department of Primary Industry, Fisheries and Mines (formerly DBIRD)
ELW	Empty liveweight
FCMW	Fat corrected mature weight
FLW	Full liveweight
HSCW	Hot standard carcase weight
KRS	Katherine Research Station
ME	Metabolisable energy
MLA	Meat and Livestock Australia
MT	Maturity type
MTG	Maturity type growth
NR	Not relevant
NS	Not significant
PS	Pasture saving
PWE	Post weaning efficiency
R&D	Research and Development
SRW	Standard reference weight
SS	Short scrotum
VAP	Value adding potential
VRD	Victoria River District
VRRS	Victoria River Research Station (Kidman Springs)
WA	Weaning age
WR1	First weaning round
WR2	Second weaning round
WW	Weaning weight

EXECUTIVE SUMMARY

This report summarises the results of a project (NAP 3.111) conducted between 1998 and 2003 by the NT Department of Primary Industry, Fisheries and Mines (DPIFM) with support from Meat and Livestock Australia (MLA).

The project's main aim was to provide information to enable the industry to tackle an emerging problem of over-fatness in Brahman cross cattle in SE Asian feedlots. Two main solutions are proposed. Firstly it is considered that to meet market specifications in the future, producers are likely to require an understanding of the mature weight of breeds (from which propensity to put on fatness can be predicted under known feedlot conditions), and thus be able to match the maturity of their cattle to their clients requirements. In many cases this is likely to involve breed combinations that include later maturing (large European) breeds. Secondly, the industry should be aware that the choice of finishing steers, heifers and bulls provides a range of options for meeting fatness targets within each breed.

Much of this report is devoted to an explanation of Maturity Type Growth curves, their potential use by producers and feedlotters, and as a basis for a future value-based description system. The purpose of this description system would be to give all partners in the live trade a common language to describe feeder cattle detailing how they are likely to perform in the feedlot and at slaughter. This would provide an opportunity for clients to offer premiums for suitable cattle, and it was felt that it would enable north Australia to retain market dominance as the SE Asian market becomes more sophisticated.

This project also further developed a scenario drawn up by Peter Ridley in 1994, in which he proposed that the industry should move towards a two stage process. Native pasture would be used predominantly for breeding and weaners would be grown on improved pasture further north, a more efficient system that he estimated would double the number of weaners produced in the region.

The project examined other practical implications of the proposed strategies:

1. Since later maturity was shown to lead to advantages in the post weaning and feedlot phases, the project also set out to demonstrate that those breed combinations could be produced successfully in the Victoria River District.

2. Since the project demonstrated that producing bulls was an efficient way of getting lean carcases, the use of short scrotum bulls was investigated as a practical measure for managing this on station.

3. Since the proposed description system requires an accurate estimation of age, a dataset was collected to derive a guide.

4. Components of the post weaning system that affect production were studied on improved and native pasture.

What this project has shown

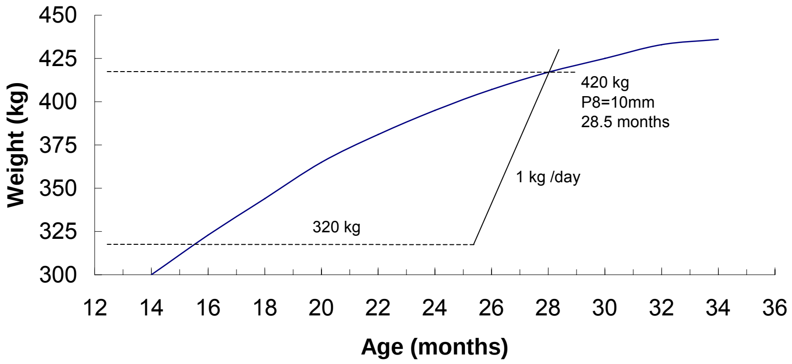
This project has achieved the following outcomes of relevance to the north Australian cattle industry.

1. Producers in the northern half of the NT have become aware of fatness as a production and marketing issue, and understand the terms early, medium and late maturing cattle breeds.

2. Maturity Type Growth curves based on mathematical equations have been derived for Brahman, 1/4 Charolais and Droughtmaster steers, heifers and bulls. These allow producers to predict the performance of their cattle in SE Asian feedlots in terms of carcase weight and fatness.

3. Weight for age at constant fatness graphs (such as Figure 1) were derived which would allow feedlotters, who know the maturity type, to derive the weight and age of feeder cattle that they would need to buy to meet their requirements at slaughter.

Figure 1: Brahman Steers Weight & Age when P8 fat depth = 10mm



In the example given in Figure 1, if feedlot growth rates are 1 kg/day, and the feedlotter wants to slaughter in 100 (±20) days, at 420 (±20) kg and 10 (±5) mm P8 fat, he or she would need to purchase Brahman feeder steers that are 320 (±20) kg liveweight and 25.3 (±2) months of age.

4. Simple methods of estimating breeding herd maturity type and individual age (±2 months) were derived.

5. This project demonstrated that cattle varied considerably in potential value adding (the weight gain possible in the feedlot before the feeder exceeds either maximum carcase weight or target carcase fatness).

6. 1/4 Charolais progeny were shown to have a considerably greater value adding potential than straight Brahman.

7. It is suggested that many Katherine region stations could produce late maturing progeny equivalent to 1/4 Charolais without adversely affecting their productivity. The 1/2 Charolais and Brahman herds that produced the 1/4 Charolais progeny are the first stage of a 2-way criss-cross breeding system. The genotype of succeeding generations will eventually settle down to between 1/3 and 1/6 Charolais, and there will never again be a generation with as little as 50% tropically adapted genes. Although the 1/2 Charolais cows in Nutwood-Boab paddock on Victoria River Research Station (Kidman Springs) lost weight and had a slightly higher mortality rate than straight Brahman, they maintained a weaning rate of 82% and a Breeding Herd Efficiency of 31.7 kg weaned per 100 kg of cow mated.

8. The advantages of rearing bulls as a way of marketing lean carcases was demonstrated, and the short scrotum/artificial cryptorchid treatment was demonstrated as method of achieving this market result without adding to station management problems. It was demonstrated that an understanding of the characteristics of steers, heifers and bulls gave producers and feedlotters considerable flexibility in meeting market weight and fatness targets without having to change breeds.

9. The basis of a value based description system for the live cattle trade was described.

10. Some of the information from this project will not be directly relevant to producers until the market in SE Asia increases in sophistication, and pays premiums or discounts for cattle that do or do not meet their evolving market specifications. However the NT cattle industry is now more prepared for that day when it comes.

11. A scenario by Peter Ridley (1994) showed that it would be biologically efficient for the industry to partition its production system so that areas of native pasture would be used exclusively for breeders and weaners would be grown out on improved pasture further north. Fully developed and fully implemented, this scenario could double the number of locally produced steers eligible for export. Practical issues since then have impeded the planned development of Douglas Daly farms, but there has been steady interest by pastoral companies in the purchase of depots and growing out properties in the Douglas Daly and further north.

12. Factors relating to cost effectively maximising weaner performance on improved pastures on Douglas Daly (stocking rates, supplementation and weaning weight) and on native pastures on Mt Sanford (weaning weight and pasture spelling) were demonstrated.

INTRODUCTION

Background

This project arose from two separate sources of information available in the mid-1990s.

The first was *A Scenario for the Northern NT Beef Industry* (Ridley 1994a). This study used herd figures from Victoria River Research Station (Kidman Springs) and Douglas Daly Research Farm as a model, and related the feed requirement for different animal classes to the native pasture resources of the Katherine region and the potential improved pasture resource of the Douglas Daly. It concluded that the most biologically efficient scenario would be for the industry to partition its production system, so that the Victoria River District and other areas of native pasture would be used predominantly for breeders, and weaners would be grown out on improved pasture further north. Many of Australia's leading cattle companies, from Sir Sidney Kidman onwards, have reached similar conclusions. Peter Ridley estimated that if fully developed and fully implemented, this scenario could more than double the number of locally produced steers eligible for export (75,400 increasing to 162,500).

The second source was observations by Geoffrey Beere (a consultant) and others working in SE Asia that a proportion of the Brahman cross cattle sent as feeders to SE Asian feedlots were too fat at slaughter. This extra fatness represented a production waste for these clients and had the potential to damage the NT's reputation as a future supplier of suitable feeder cattle. It was proposed that the Asian trade would eventually insist on more stringent market specifications and it would be in the NT industry's interest to be able to predict these trends and be prepared.

Objectives of Project

The contract between the MLA and DPIF (now DPIFM) for NAP 3.111, signed in 1998, specifies the following objectives.

By December 2001, identify cost effective opportunities for the NT beef industry to:

1. *Double the number of weaners and thus the number of exportable live feeder cattle available from the NT breeder herd,*

2. *Supply feeder cattle of suitable temperament, condition score and maturity type which meet the performance requirements of feedlot operators in SE Asia from a range of nutritional regimes and turn-off specifications,*

3. *Avoid supplying cattle with a high probability of being too fat at turn-off from SE Asian feedlots,*

4. *Maintain or enhance the ease of management and efficiency (kg calf weaned/ 100 kg cow mated) of breeding herds grazing native pasture in the northern half of the NT.*

The MLA later approved two years extension to the project, when fieldwork was disrupted by exceptionally heavy rain and burst pipes.

Approach to Meeting Objectives

The first objective follows on from Peter Ridley's *Scenario for the Northern NT Beef Industry* (Ridley 1994a). Weaners were grown out on buffel grass pastures at Douglas Daly Research Farm (DDRF) with a comparative group grown on native pasture at Mt Sanford, and husbandry factors affecting their growth rate such as stocking rate, supplementation and weaning weight were investigated.

The bulk of the experimental work addressed objectives 2 & 3. An experimental feedlot was set up at Katherine Research Station where feeder cattle were fed until they reached a specified level of fatness. The diet was chosen to achieve an average gain of 1 kg/day, which was considered a typical level of performance in SE Asian feedlots in the mid-90s. Fatness was measured ultrasonically at the P8 site and carcase measurements were taken from a proportion of cattle to relate ultrasonic measurement to actual fat depth. From the feedlot work, maturity type growth curves were drawn up for Brahman, 1/4 Charolais and Droughtmaster steers, bulls and heifers. A separate investigation was carried out on Camfield Station in the Victoria River District into the use of short scrotum bulls (artificial cryptorchid) as a possible way that producers could take advantage of bulls' lean carcases without having to deal with extra management problems. Experiments were conducted on native pasture at MT Sanford and on improved pasture at DDRF to quantify the effects of various management practises on post weaning growth and turnoff specifications (and hence value adding potential).

Objective 3 involved extensive communication with the industry on the issue of over-fatness and ways that could be overcome. This led to the basis of a value-based description system for future trading.

For Objective 4 the productivity and survival of first cross Charolais-Brahmans, cows run in a criss-cross breeding system with Brahmans, was investigated at Victoria River Research Station (Kidman Springs). The use of later maturing progeny has obvious potential advantages for Asian feedlotters seeking lean carcases, but this strategy presents challenges for stations running breeders in the semi-arid tropics. This project set out to test whether choice of a suitable proportion of late maturing genes would make it possible to combine improved market suitability of progeny with optimal breeder performance from their parents in the VRD.

The Form of This Report

Part 1 of this report entitled *Principles of Maturity Type Growth (MTG) Curves and Selling by Description* was written by Peter Ridley and represents the main conclusions from this project. Part 2 presents the experimental evidence on which these conclusions are based. Many of the experiments were complex so only summary tables are included in the text. More detailed results are attached in the appendices.

1.0 PRINCIPLES OF MATURITY TYPE GROWTH (MTG) CURVES AND SELLING BY DESCRIPTION.

This section covers the principles of maturity type growth (MTG) curves; how they are developed and what they can be used for.

When cattle are sold by description, MTG curves can be used to determine value adding potential and end-se suitability.

1.1 Development of MTG Curves

Purpose

To provide a scientifically sound and commercially robust basis for estimating the age that groups of cattle of specified mature size (maturity type) will need to be to meet a specified range of weight (kg) x fatness (P8 fat depth).

Standard Reference Weight

MTG curves in this report are based on the concept of standard reference weight (SRW) described by Corbett *et al.* (1990). They state that SRW is:

> "the liveweight that would be achieved by an animal (of specified species and breed) when its skeletal development is complete and its empty body contains 250 g of fat/kg."

This concept has been adapted given the realities of the field situation in the Katherine region, to provide a variable called fat corrected mature weight (FCMW).

This report assumes that a bovine has reached its mature size when variations in liveweight caused by factors other than gut fill (which includes pregnancy) result only in changes in dissectible fat (i.e. no change in bone or muscle). Its FCMW is its empty liveweight (ELW, 24 hrs no feed 16 hrs no water) at a specified time of year and level of fatness (i.e. mm fat depth at the P8 site), when it has reached its mature size.

MTG Curves

An MTG curve is a graphical representation of the relationship between:

- empty liveweight (ELW kg), and
- age (months),

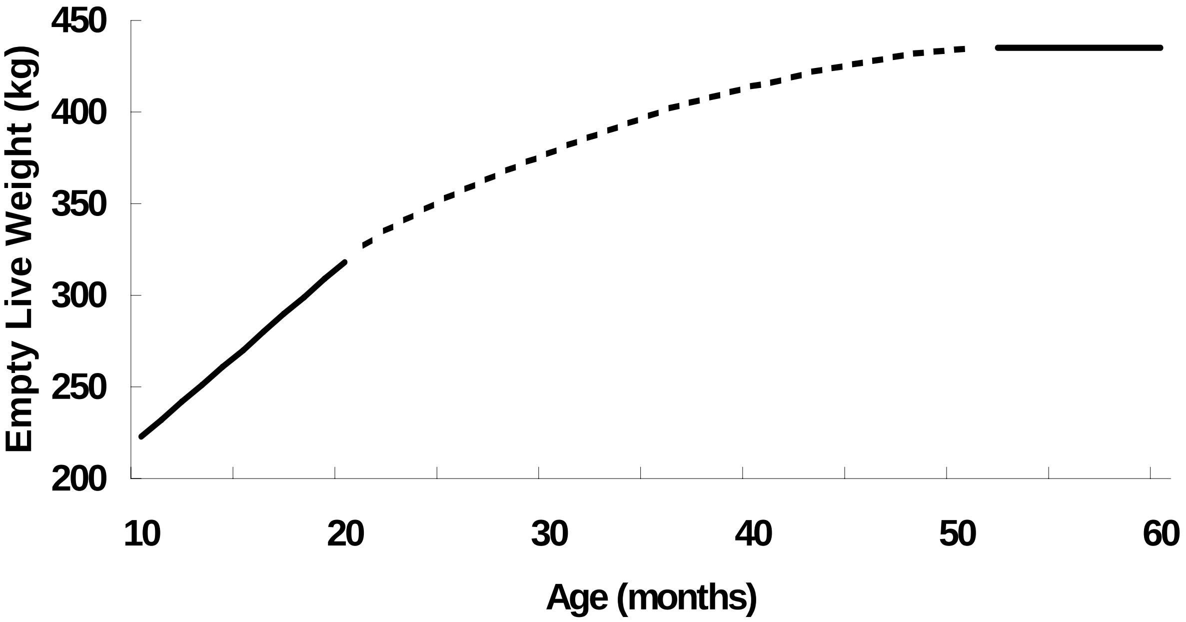
of a sample of cattle of:

- specified maturity type at,
- specified fatness (P8 fat depth in mm)

as they progress at this specified fatness, from a young age (say 10 months) to their mature weight as young adults (say 5 years age). This is shown in Figure 2 where P8 fat depth has been held constant and the three dimensional relationship (fatness x weight x age), has been presented as a two dimensional graph.

The axes of this graph are weight and age. P8 = 10 mm is a commonly used target mid range fatness for beef carcases for the supermarket trade servicing Westernised populations in Australia and SE Asia. The choice of P8 = 10 mm in MTG curve Figures in this report reflects this market specification.

Figure 2: MTG Curve Brahman Females.



The only normally readily available category of cattle within a breed, with an appropriate range in age and fatness to facilitate the estimation of a representative MTG curve, is the breeding herd (weaner and yearling heifers, replacement breeders and adult cows).

It is essential to have a very wide range in fatness in the adult population used to derive a representative MTG curve (i.e. the regression between its ELW and P8 fat depth) and data should not be used from individuals with P8 < 2.5 mm.

In the work reported here:

- the ELW of the representative population of adult breeding cows was measured at the first weaning round (to minimise the effects of pregnancy),
- the constant from the linear regression of ELW (Y) on P8 fat depth (x) was taken as the adult breeder's FCMW (i.e. P8 equals exactly zero),
- adult breeders with P8<2.5 mm were not included in the regression analysis because cattle weight loss can continue long after P8 fat depth equals zero. P8 measurements less than 2.5 mm are likely to be mainly a layer of empty adipose tissue cells and connective tissue.

Four Basic Relationships

1. *The Interrelationship between ELW (kg), Age (months) and P8 Fat Depth (mm) in Young Brahman Steers and Heifers.*

Table 1 contains data from feedlot Projects 2.3.1 and 2.3.2. It shows treatment combination means at slaughter. The Hi and Lo headings refer to the group target fatness at slaughter (P8 fat depth). Cattle in different cells in Table 1 had access to the same feed over different time periods to provide the range in mean P8 values at slaughter shown (i.e. the weight and fatness differences between cells in Table 1 were nutritionally induced). All cattle in Table 1 were slaughtered to verify the ultrasonically measured group P8 measurements.

Table 1: Interrelationship Between Weight, Age and Fatness

Year of Weaning	Sex	ELW		P8 mm		Age (months)	
		Hi	Lo	Hi	Lo	Hi	Lo
1996	Steer	403	356	10.2	7.1	23.1	20.9
	Heifer	353	316	13.3	6.2	21.1	20.6
1997	Steer	256	250	5.5	3.8	11.5	11.5
	Heifer	247	220	8.5	4.5	12.4	10.6
1997*	Steer	369	-	9.6	-	19.8	-
	Heifer	293	-	10.0	-	18.7	-

** Project 2.3.1 data*

The individual data values were subjected to multiple regression analysis, (separately for steers and heifers), to predict ELW (Y_S or Y_H) from P8 fat depth in mm (x_1), and age in months (x_2).

EQ 1 $Y_s = 3.32\,x_1 + 10.8\,x_2 + 115.9$ $r^2 = 0.87$ n = 29 $P < 0.001$

EQ 2 $Y_H = 2.12\,x_1 + 9.4\,x_2 + 108.6$ $r^2 = 0.77$ n = 29 $P < 0.001$

In both data sets both x_1 and x_2 made a statistically significant contribution to the variation of the Y variable. These two equations provide the basis for two partial provisional MTG curves.

2. *The Relationship between ELW and P8 Fat Depth in Three Cow Genotypes.*

Table 2 shows the relationship between ELW (Y) at the first weaning round (April/May) and P8 fat depth (x) in Brahman (Y_{Bra}), Droughtmaster (Y_{DM}), and half Charolais half Brahman ($Y_{1/2\ Ch}$) cows at Kidman Springs. These cows were the source of steers and heifers used in the research work in this project.

Table 2: ELW vs. P8 Fat Depth in Three Cow Genotypes.

Equation	Genotype	ELW (kg)	X P8 (mm)	Const	Sig.	n
EQ3	Bra K	Y_{Bra}	3.5	400 (100)	P< .001	216
EQ4	DM	Y_{DM}	3.2	411(102.5)	P< .001	81
EQ5	F1	$Y_{1/2\ Ch}$	3.6	461 (115)	P< .01	51

These three regressions constitute partial provisional MTG curves for females of the respective genotypes.

The regression coefficients in Table 2 were not significantly different and provided a pooled value of 3.5 (i.e. each increase in P8 value of 1 mm = 3.5 kg increase in ELW for all three breed samples).

3. *The Relationship between ELW and P8 Fat Depth in Two Brahman Herds.*

Table 3 shows this relationship for the Brahman herds at Kidman Springs and Douglas Daly Research Farm (DDRF). The Kidman Springs herd was acquired in 1996 as purebred (not stud) pregnant cows from several properties in Queensland.

The DDRF Brahman herd began two decades earlier when Brahman bulls were first mated to a herd of NT Shorthorns. Only Brahman bulls were used thereafter. This herd can also be described as purebred (not stud) Brahman.

Table 3 shows the equations to predict ELW from P8 fat depth for cows whose age was 4.5 years or more and whose P8 fat depth was greater than 2.5 mm at the first weaning round (April/May), in these two herds.

Table 3: Equations to Predict ELW in Adult Cows in Two Brahman Herds

Location	ELW (kg)	X P8 (mm)	Const	Sig.	n
Kidman Springs	Y_K	3.5	400	$P< 0.001$	216
DDRF	Y_{DDRF}	3.0	408	$P < 0.001$	117

Table 4: Predicted ELW at Different Levels of P8 Fat Depth in Two Brahman Herds

P8 (mm)	Predicted ELW (kg)	
	Kidman Springs	DDRF
0	400	410
5	418	423
10	435	436
15	453	449
20	470	462

The predicted ELWs in Table 4 using these equations, suggest there is very little difference in mature size between these two Brahman herds with quite separate origins. This supports the view that differences in mature size between commercial Brahman herds may be relatively small and unimportant.

4. *Estimation of Brahman Weaner Age.*

The manager of a property in the Katherine region provided a data set, which enabled the relationship between weaner age (Y in days) weaning weight (x_1 in kg) and day of year of weaning (x_2 three dates over a 5 week period), to be examined. These steer weaners and their dams were grazing native pasture until they were weaned.

Multiple regression analysis provided the equation:

$$Y = 0.73 (x_1) - 0.015 (x_2) + 14.8 \qquad r^2 = 0.76 \quad n = 49 \quad P< 0.001$$

Weaning date did not account for a statistically significant amount of the variation in Y, so the final equation became:

$$Y = 0.73 (x_1) + 13.5 \qquad r^2 = 0.76 \quad n = 49 \quad P< 0.001$$

Given that 76% of the variation in weaning age was accounted for by variation in weaning weight it was decided to use the following formula for estimating the age of weaners from the Kidman Springs herd:

$$\text{Weaning age, days} = \frac{\text{Weaning Weight minus Birth Weight}}{\text{Growth Rate Birth to Weaning}}$$

Weaning weight (kg) is easily measured as ELW at weaning. Birth weight is assumed to be 30 kg. Growth rate (birth to weaning) can be estimated by measuring the remaining pre-weaning growth of calves too small to wean (< 100 kg), at the previous weaning round.

The Kidman Springs herd has two weaning rounds (May and October). Calves are weaned down to 100 kg (i.e. calves lighter than 100 kg are turned out with their mothers, to be weaned at the next weaning round).

Scrutiny of the relevant data from the Kidman Springs herd suggests that it is safe to assume growth rates in suckling calves of 0.65 kg/d in the Dry Season (for calves weaned at the second round muster) and 0.85 kg/d in the Wet Season (for calves weaned at the first round muster). These figures were calculated from the growth of unweaned calves between musters (Schatz 2001). Much of the between-year variation in pasture availability (and its potential impact on calf growth) in these two seasonal periods, appears to be buffered by the lactating cow from her body reserves.

Provisional MTG Curves

1. Brahman Females

EQ2 and EQ3 (Table 2) can be used to construct an incomplete provisional MTG curve for Brahman females of constant fatness. Such a curve where P8= 10mm is shown in Figure 2.

There is a gap between about 20 months age and 50 months age (dotted line) in this curve. A freehand curve can be drawn connecting these two points (i.e. the dotted line) to provide a complete provisional MTG curve for Brahman females (see Figure 2). In subsequent MTG curves in this report, the monthly data points in Table 8 will be used to present the MTG curve as a dotted line. Each dot will represent the increase in weight necessary each month to maintain P8 = 10 mm.

2. Brahman Steers

EQ1 and EQ2 can be used to construct partial provisional MTG curves at constant fatness (P8 = 10mm) for Brahman steers and heifers respectively, between the ages of about 10 and 20 months (see Table 5 for calculations).

Table 5: Estimating ELW in Yearling Brahman and 1/4 Charolais Steers and Heifers

Age (mo)	Equation	Sex	P8	+ Age	+ Const	= ELW kg
10	EQ1	Steer	= 33.2	+ 108.0	+ 115.9	= 257 (115)
10	EQ2	Heifer	= 21.2	+ 94.0	+ 108.6	= 224 (100)
20	EQ1	Steer	= 33.2	+ 216.0	+ 115.9	= 365 (115)
20	EQ2	Heifer	= 21.2	+ 188.0	+ 108.6	= 318 (100)

The values in brackets indicate that Brahman steers have a 15% greater mature size than Brahman heifers (i.e. weight at the same age and fatness) at both ages.

A complete provisional MTG curve can now be drawn for Brahman steers by using weights that are 15% greater than the provisional Brahman female MTG curve, at each increment of age.

3. Three Cow Genotypes

The regression equation constants in Table 2 represent the FCMW of the three genotypes (Brahman, Droughtmaster and 1/2 Charolais). The values in brackets beside these constants indicate that the Droughtmasters and 1/2 Charolais were about 2.5% and 15% respectively, heavier (FCMW) than the Brahmans.

Provisional MTG curves can now be drawn for Droughtmaster and 1/2 Charolais females by using values for weight that are 2.5% and 15% respectively greater than the values for Brahman females at any given age and P8 fat depth.

4. Charolais x Brahman Crossbred Genotypes

Data from Project 2.1.2 provided an opportunity to test an assumption that when the Charolais content in Charolais x Brahman crossbreds was halved (by substituting Brahman genes), the difference in FCMW between the new crossbreds and the Brahmans would also be halved.

Table 6 shows the ELW, P8 fat depth and estimated age of Brahman and 1/4 Charolais heifers at turnoff in May. In Table 8, ELWs have been estimated by substituting the relevant values for P8 fat depth and age in to EQ 2. In the case of the two 1/4 Charolais groups, the estimated ELW has been multiplied by 1.075 to correct for the assumed difference in FCMW between Brahmans and 1/4 Charolais.

Table 6: ELW, P8 Fat Depth and Age in Brahman and 1/4 Charolais Heifers

Geno	Year	n	ELW (kg)	P8 (mm)	Age (mo)	Est. ELW	Difference (kg)
Bra K	1997	21	295	10.0	16.9	288	-7
	1998	14	273	8.3	16.2	278	+5
1/4 Ch	1997	21	290	6.3	16.4	296	-6
	1998	20	288	7.0	16.1	289	+1

The estimated ELW values in Table 6 show good agreement with the actual values within years and genotypes and between genotypes and this supports the assumption, that halving the Charolais content will halve the effect of Charolais genes on mature size.

If 1/2 Charolais have a FCMW 15% greater than the Brahman it follows that 1/4 Charolais have the FCMW 7.5% greater than Brahmans and EQ 3 in Table 2 can be modified as shown in the equation:

$Y_{1/4\ Ch}$ = 3.5 x + (400 x 1.075) x = P8 mm FCMW = 430 kg

The FCMW of 1/6 and 1/3 Charolais cows that evolve in a criss-cross crossbreeding system using Brahman or F1 bulls on alternate generations can be similarly derived:

$Y_{1/6\ Ch}$ = 3.5 x + (400 x 1.05) x = P8 mm FCMW = 420 kg

$Y_{1/3\ Ch}$ = 3.5 x + (400 + 1.10) x = P8 mm FCMW = 440 kg

5. 1/4 Charolais Steers

Table 7 shows the actual ELW and age of four sets of 1/4 Charolais steers from the KRS feedlot. The estimated ELW at the same ages, for 1/4 Charolais heifers in Table 7, is derived from Table 8. The mean ELW for the steers is 64 kg or 17% greater than the mean ELW for the heifers at the same average age and fatness.

The MTG curve for 1/4 Charolais steers is therefore assumed to be 17% heavier than that for the 1/4 Charolais heifers.

Table 7: ELW for 1/4 Charolais Steers and Heifers

Actual 1/4 Ch Steer Age (mo)	Actual 1/4 Ch Steer ELW (kg)	Estd 1/4 Ch Heifer ELW (kg)
21.5	404	355
26.9	464	390
20.2	405	345
25.6	455	382
23.6	432	368

6. Bulls

Ridley (1984) reported that when Hereford male calves were randomly assigned to be left entire or castrated and their FCMW assessed as described elsewhere in this report, relative to the FCMW cull heifers from the same herd and calf crop, the bull vs. steer difference was the same as the steer vs. heifer difference (when all had the same P8 measurement).

Corbett *et al.* (1994) also indicate that the SRW difference between steers and the two alternative sex categories is equal.

Provisional MTG curves for bulls were therefore derived from the steer curve of the relevant genotype by increasing the steer weights at any given age by the same percentage as the steer weight differed from the corresponding female value. The adjustment factors are shown in Figure 3.

7. Six Provisional MTG Curves

Figure 3 shows the adjustment factors (in brackets) that were used to derive monthly weights, from the weights of the original Brahman female MTG curve

Figure 3: Factors Used to Derive MTG Curves

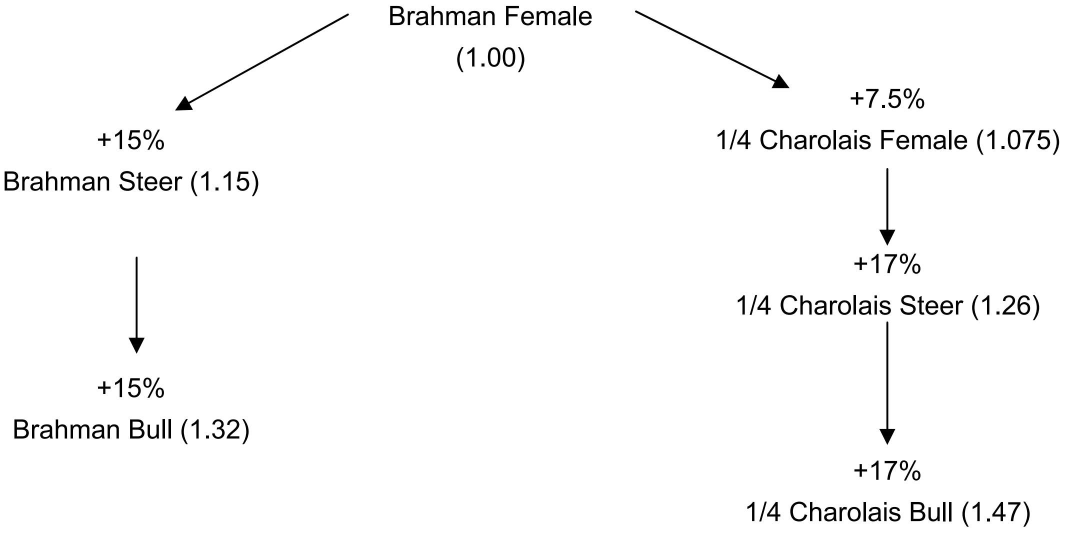


Table 8 provides the monthly weights for six provisional MTG curves that were tested in Project 2.3.1. This information is presented graphically in Figure 13 in Section 2.3.1.

Table 8: Numerical Values for Maturity Type Growth Curves (ELW kg, P8 = 10 mm) for Heifers (H), Steers (S) and Bulls (S) of Two Genotypes.

Age (months)	Bra H *(1.00)*	Bra S *(1.15)*	Bra B *(1.32)*	1/4 Ch H *(1.075)*	1/4 Ch S *(1.26)*	1/4 Ch B *(1.47)*
10	223	256	295	240	280	328
11	232	267	307	249	292	341
12	242	278	320	260	304	356
13	251	289	332	270	316	369
14	261	300	345	281	328	384
15	270	311	357	290	340	397
16	280	322	370	301	352	412
17	290	334	384	312	365	427
18	299	344	395	321	376	440
19	308	354	407	331	388	453
20	317	365	418	341	399	466
21	325	374	429	349	412	478
22	333	383	440	358	422	490
23	340	391	449	366	428	500
24	347	399	459	373	436	511
25	353	406	467	379	444	519
26	358	412	473	385	450	527
27	363	417	480	390	457	534
28	368	423	487	396	463	542
29	373	429	493	401	469	549
30	377	434	499	405	474	555
31	382	439	505	411	480	562
32	386	444	510	415	485	568
33	390	449	516	419	491	574
34	394	453	521	424	496	580
35	398	458	526	428	501	586
36	402	462	532	432	506	592
37	405	466	536	435	509	596
38	408	469	540	439	513	600
39	411	473	544	442	517	605
40	414	476	548	445	521	609
41	416	478	550	447	523	612.
42	419	482	554	450	527	617
43	422	485	558	454	531	621
44	424	488	561	456	533	624
45	426	490	563	458	536	627
46	428	492	566	460	538	630
47	430	495	569	462	541	633
48	432	497	571	464	543	636
49	433	498	573	465	545	637
50	434	499	574	467	546	639
51	435	500	575	468	547	640
52	435	500	575	468	547	640

1.2 Testing Provisional MTG Curves

The Katherine Research Station Feedlot (Project 2.3.1)

In two successive years, male weaners of five sex x genotype combinations were grazed on improved pasture and selected at random for placement in the Katherine Research Station (KRS) feedlot (Project 2.3.1), either half way through their first post weaning Wet (January/February) or in the following Dry Season.

In the feedlot these animals were fed *ad libitum* a sorghum based ration containing 35% roughage and at least 12% crude protein. This ration was aimed at providing a growth rate of 1 kg/d in Brahman steers.

Each sex x genotype group was fed separately and their P8 fat depth was monitored ultrasonically. As they approached a group average of P8 = 10 mm, arrangements were made to have them slaughtered. This enabled the ultrasonic measurements to be verified on the carcases.

Table 9: Actual vs. Predicted ELW at Feedlot Turnoff

Geno	Sex	n	Actual ELW (kg)	Actual P8 (mm)	Actual Age (mo)	Estd ELW (kg)	Difference Estd - Actual	
							Kg	%
DM	S	9	369	8.7	19.3	369	0	0
		12	417	10.6	26.1	419	+2	+0.5
		9	371	9.7	19.3	365	-6	-1.6
		11	382	9.0	22.6	392	+10	+2.6
Bra K	H	10	293	10.0	18.0	299	+6	+2.0
	S	9	369	9.6	19.8	365	-4	-1.1
		8	375	9.3	23.6	397	+22	+5.5
		9	362	9.8	18.6	352	-10	-2.8
		12	382	8.9	23.5	391	+9	+2.3
	B	9	429	7.8	21.0	439	+10	+2.3
		7	472	8.1	25.9	466	-6	-1.3
		9	429	10.4	19.3	423	-6	-1.4
		14	479	8.6	25.9	478	-1	0.2
1/4 Ch	H	10	329	8.1	19.4	329	0	0
	S	9	404	8.9	21.5	409	+5	+1.2
		11	464	9.8	26.9	457	-7	-1.5
		9	405	9.0	20.2	405	0	0
		11	455	9.6	25.6	447	-8	-1.8
	B	9	519	9.3	23.0	503	-16	-3.2
		11	522	8.1	29.0	542	+20	+3.7
		9	478	9.1	22.4	492	+14	+2.8
		11	569	10.0	29.7	552	-17	-3.1

In Table 9, for each sex x genotype group, the actual mean ELW immediately before trucking for slaughter was compared to the estimated ELW for that combination at their actual age and P8 fat depth (i.e. compared to their provisional MTG curve value at P8 = 10 mm as shown in Table 8).

Because the actual average P8 depth at slaughter varied from the target of 10 mm (as a consequence slaughter date being affected by the availability of abattoir space), the group's actual ELW was adjusted using the relationship 1 mm P8 equals 3.5 kg established earlier in this report (p. 13). Most adjustments were small, and all reduced the difference between the two ELW values.

The difference between the two ELW values is shown as estimated ELW minus actual ELW in the eighth and ninth columns of Table 9.

Considering the small numbers of animals in each group (n in column 3 Table 9), Table 9 shows that there was very good agreement between the two ELW values. Only one sex x genotype set (Brahman steers) had a difference of more than 5%.

Table 10 shows that within each of the five male sex x genotype categories in Table 9 the differences between the two ELW values within each sex x genotype set tended to cancel out.

Table 10 Sex x Genotype ELW Difference Means

Geno	Sex	n	Estd ELW – Actual ELW
DM	S	41	+1.5 kg
Bra K	S	38	+4.25 kg
	B	39	-0.75 kg
1/4 Ch	S	40	-2.0 kg
	B	40	+0.25 kg

This supports the view that these differences within each sex x genotype set are probably random sampling errors and the provisional MTG curves do not appear to be systematically biased (i.e. too high or too low).

1.3 Utilisation of MTG Curves

Purpose:

To describe some potential uses for MTG curves.

MTG curves are seen as being the key component of an objective process for estimating:

- relative value-adding potential (VAP),
- end-use suitability,
- relative break-even value,

in groups of feeder cattle, where:

- VAP is defined as the weight gain possible before the cattle become over fat for the target market,
- end-use suitability is defined as the capacity to meet the target weight range x fat range required by a particular market, given commercially relevant growth rates,
- break-even value is defined as the price/kg ELW for different groups of feeder cattle that results in no difference in profit or loss per head between them at feedlot turnoff.

VAP as defined above, directly affects:

- per head profitability when feed costs are low relative to the value of the carcase gain that they provide (and vice versa),
- the scheduling of feedlot turnoff to meet the anticipated level and pattern of demand (i.e. meat wholesalers and retailers).

It indirectly affects the production cost of feedlot beef through:

- the proportion of each animals time that is spent in the inefficient period of rumen adaptation to high energy feedlot rations,
- the number of replacement animals required per year to keep the feedlot full. This is particularly important when the pre-feedlot transport cost per head is high (as it is from Australia to its main markets in SE Asia and the Middle East). Other per head costs with a similar effect include animal health treatments, quarantine and slaughter costs.

End-use suitability is a commercially significant issue where:

- cut portion-size and/or acceptable fat content are commercially important,
- in wet markets in SE Asia and elsewhere when there is a significant discount on frozen beef. Daily throughput dictates the upper limit of carcase weight in small wet market businesses if the amount of carry over (frozen overnight) is to be minimised.

The use of VAP and end-use suitability specifications by feedlot operators, when writing supply feeder-cattle contracts, will depend on the degree to which their needs for these characteristics are currently being reliably met by feeder cattle from northern Australian. Their unmet needs and the cost-effectiveness of techniques that are available to meet these needs, will determine the extent to which price differentials emerge for specified ranges of these two variables. Such price differentials will be the primary basis for any financial rationale for change (identification of age at weaning and adjustment of progeny maturity-type i.e. MTG curve) in the feeder cattle production sector.

Relative VAP and End-Use Suitability.

This section of the report illustrates how an MTG curve can be used to estimate VAP and the ELW component of end-use suitability. It will explain why there have been adverse changes in these characteristics in feeder cattle exported from northern Australia to SE Asia over the past 10 to 15 years.

Figure 4, drawn from data provided in Table 8, shows the curved relationship between weight and age that forms the MTG curve for Brahman steers. Each dot represents the weight x age combination necessary to maintain P8 fat depth at 10 mm. The two triangles in this Figure provide two 1 kg/d growth lines (the longest side or hypotenuse) with the intermediate and shortest sides covering 100 kg and 100 d respectively.

Each triangle has an extension of its base to a point labelled X. This point is at the assumed mean weight and age combination at which the group of steers, which the triangle represents, left their property of origin. Twenty one days later they began their period in the feedlot (the start of the hypotenuse).

Triangle B represents a group of steers that were sold at the end of their first post weaning Wet. Triangle A represents an identical group that was retained and not sold until the end of the Dry. It has been assumed that the second group maintained its weight through the five-month Dry Season before sale.

Where the hypotenuse (or its extension in the case of Triangle A) cuts the MTG line it provides an estimate of the weight and age at which target fatness (P8 = 10mm) would achieved (Triangle A = 420 kg, 27.5 months; Triangle B = 375 kg, 21.0 months).

The line that runs parallel to the hypotenuse in Triangle A intersects the MTG curve at a point that reflects the effect that a 50 kg increase in weight at the start of the feedlot phase would have on final weight and age at P8 = 10 mm (405 kg, 25.5 months).

In Triangle B, the line that starts at the base and diverges from the hypotenuse is a 1.5 kg/d growth line. It intersects the MTG curve at 365 kg, 20.0 months.

Figure 4: Brahman steer MTG curve (P8 = 10 mm)

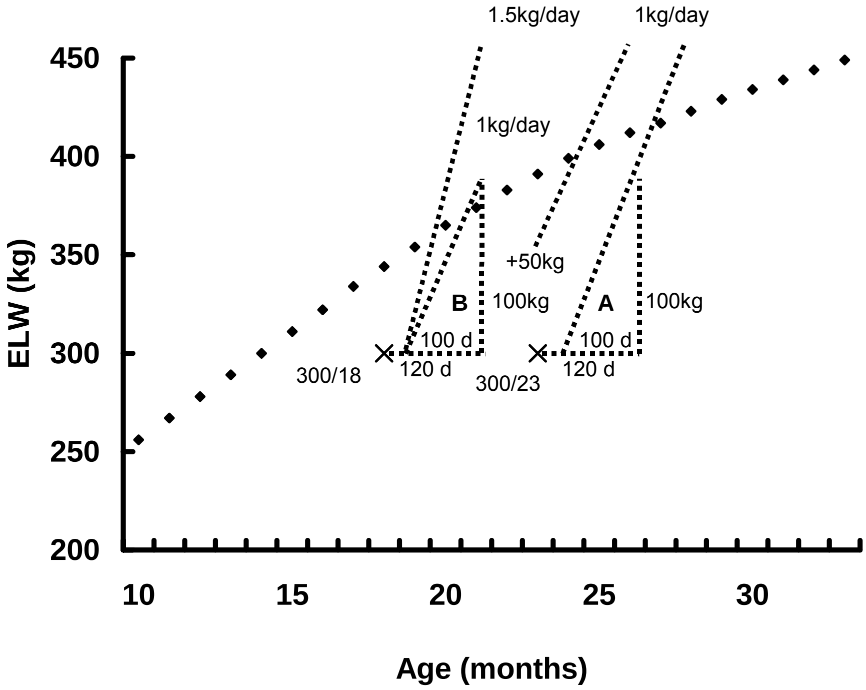


Table 11 shows the effect of these selected changes in age, initial weight and growth rate in the feedlot on the length of the feedlot phase, VAP and the ELW component of end-use suitability (final ELW).

Table 11: The Effect of Some Variations in Initial Weight, Initial Age and Feedlot Growth Rate (ADG) on VAP.

Initial Wt	kg	300	300	300	350	300	350
Initial Age	mo	18	18	23	23	30	30
Feedlot ADG	kg/d	1.0	1.5	1.0	1.0	1.0	1.0
Final ELW	kg	375	365	420	405	465	455
VAP	kg	75	65	120	55	165	105
Feedlot Time	d	75	33	120	55	165	105

The last two columns in Table 11 relate to typical liveweights and ages of feeder cattle exported from the NT to SE Asia in the late 1980s and early 1990s. Data from Kidman Springs and anecdotal reports from the Katherine region (Sullivan and Stockwell *pers. comm.*) indicate that prior to the widespread use of N supplements in the Dry and P supplements in the Wet, steers were at least 12-18 months older than at present before they reached shipping weight (ELW = 300-350 kg).

Other anecdotal data (Beere and Blakeley *pers. comm.*) indicate that feedlot growth rates in SE Asian feedlots less than 1.0 kg/d were not uncommon a decade or so ago. This would have also contributed to higher VAP even if target P8 values were only 3 mm (i.e. 7 mm x 3.5 kg/mm = 24.5 kg lower weight at target fatness).

Clearly VAP will be increased by:

- later maturity (higher MTG curves),
- lower initial weights,
- greater initial ages,
- lower feedlot growth rates,
- greater turnoff fatness (the MTG curve increases 3.5 kg in weight for each 1 mm increase in P8 fat depth),

Because the impact of effects listed above vary as a consequence of the non-linear MTG weight x age relationship, they are not numerically constant. To reduce the need for a potentially confusing set of specifications, this report unless otherwise stated, will use the term relative VAP for groups of feeder cattle whose MTG curve, ELW and age are specified and whose feedlot growth and market P8 fat target are held constant at 1.0 kg/d and P = 10 mm respectively.

The major reduction in age at embarkation that has occurred in the past 15 years or so has resulted in the serious decrease in VAP about which SE Asian feedlotters complain. This problem may manifest itself as serious over-fatness at slaughter if cattle are fed for a specific time period rather than selected for slaughter at a target fat specification by competent visual assessors.

The only solution to this decrease in VAP while retaining the productivity gains achieved in the feeder cattle production sector, is to increase the effective mature size of feeder cattle by one or more of the following:

- using appropriate hormonal growth promotants,
- marketing bulls rather than steers

- cross breeding with later maturing genotypes.

The first option appears to have about half the effect of the second. The first two strategies do not result in an altered cow size. The third strategy does involve an increase in cow size with a reduction in optimal stocking rate. This may be offset by an improvement in growth rate and weaning percentage when *Bos taurus* genes replace *Bos indicus* genes without reducing the adequacy of the environmental adaptation of the crossbreds.

1.3.1 The Role of MTG Curves

The precise way in which the concept and detail of MTG curves are used by industry participants will depend on:

- the cost-benefit ratio (the extent to which their profitability and/or operational efficiency are improved),
- the simplicity and ease of implementation of any operational changes,
- their market power/position.

This section of the report will identify some major potential uses of MTG curves and following sections will provide some detail relevant to these uses.

MTG curves can provide:

- the basis for the construction of a value-based description system to enable:
    - feedlotters to specify the characteristics of feeder cattle that will meet their expectations for relative VAP and end-use suitability and to differentially price cattle that will not meet their expectations;
    - beef cattle producers to reliably identify feeder cattle of specified relative VAP and end-use suitability for their feedlotter customers; and
- a method of:
    - determining the capacity of progeny of a particular herd/genotype of cattle, to cost-effectively meet defined market relative VAP and end-use specifications;
    - estimating the change in mature size necessary to improve the capacity of the herd's progeny to meet these defined market specifications.
- an approach to the estimation of the age at which bulls, steers or heifers a specified mature size will reach a specified weight range x fat range combination. (This is relevant to both the development of a value-based description system for feeder cattle and deciding if a particular herd needs to alter its mature size to better meet its client's requirements for feeder cattle.)
- an explanation of both the cause of and some biological solutions to the current problem of over-fatness at slaughter in cattle sourced from northern Australia, when they are turned off from SE Asian feedlots (see the Relative VAP and End-Use Suitability section of this Report)
- in addition to these market orientated uses, MTG curves are likely to be useful in large individual herds (say greater than 500 adult breeders) to estimate target pre-calving weights aimed at minimising lactational anoestrus and inter-calving intervals in both replacement breeders (maidens and first calvers) and adult cows.

The additional information required is:

- the average foetal age/conceptus weight at the start of calving (for first calvers),
- the optimal weight/P8 fat depth for recommencement of fertile oestrus after calving.

1.3.2 Value Based Description System

A value-based description-system for feeder cattle is one in which the description criteria can be used to segregate the animals in to subsets of different VAP and market (end-use) suitability (i.e. subsets of different intrinsic value for a specific end-use or market).

The sections of this report dealing with the development and testing of MTG growth curves indicate that the principal variables that determine the intrinsic value of a sample of feeder cattle for a specific market are:

- age
- ELW
- maturity type

This report has already described a simple and commercially adequate method of identifying age at weaning and thereafter, and it is normal commercial practice to measure ELW of feeder cattle at the change of ownership (i.e. ex property of origin as a basis for calculating price per head).

Maturity type is primarily dependant on sex (bull vs. steer vs. heifer) and breed, with an as yet unquantified but probably small between-herd within-breed contribution. Most herds in northern Australia are Brahman and this report provides limited evidence that between commercial Brahman herds, differences in mature size (FCMW) may be negligibly small.

Where a more precise estimate of individual herd MTG curve (or FCMW) is required and arrangements can be made for ultrasonic P8 measurements to be taken, these should be timed and taken as described earlier (24 hour wet curfew at the first weaning round in May/June).

If the herd being sampled does not have a wide range of fatness (say 3-30 mm) then the calculation of a regression between ELW and P8 measurement could be misleading. The alternative is to calculate the mean ELW of those cows $\geq$ 5 years age $\geq$ 2.5 mm P8 fat, and adjusted this ELW to a P8 of 10 mm by adding or deducting 3.5 kg for each P8 mm to be corrected. This adjusted ELW can then be compared to the ready reckoner (Table 8 or a future improved version thereof) and the MTG curve (or FCMW) for females in that particular herd identified.

The MTG curves for that herd's steer and bull progeny can then be deduced from its female MTG curve if the difference in their mature size is known. Limited data in this report suggests that for commercial Brahmans the adjustment factor is 15% and for later maturing 1/4 Charolais it may be 17%.

The work described in this report would form the basis of commercial value-based description system. The next stage should be a commercial scale market-place test. A proposal to carry out such a test was proposed to LIVECORP's R&D Committee but it was not supported at the time.

1.3.3 Feeder Cattle Specifications

For Buyers

To illustrate the use of the principles of MTG curves and the suggested value-based description system that are relevant to buyers, assume the feedlot operator wishes to set the buying specifications with the following end-use specifications in mind:

ELW = 420 ±20 kg (carcase 225 ± 15 kg)

P8 = 10 ±5 mm

Also assume that he or she plans to use a least-cost ration that will support growth of 1 kg/hd/d and wishes to buy feeders with 100 kg VAP.

The feedlot operator refers to the ready reckoner (see Table 8 for an example) and identifies the age which a range of maturity types (eg. Brahman steer, Brahman bull, 1/4 Charolais steer) will have to be to meet the slaughter specification for weight and fatness.

The feedlotter assumes that it will take approximately 21 days from the time the feeder cattle are mustered for weighing selection, on the property of origin in northern Australia, until they commence feeding in the feedlot in SE Asia. Given that it takes 100 days for them to gain 100 kg on the ration to be used, then on average the feeder cattle needed will be (100 + 21)/30 = 4 months younger than when they are to be slaughtered.

This feedlot operator's ideal (highest priced) buying in specification for Brahman steers would be:

ELW = 320 ±30 kg

Age = 23.5 ±2 months

The ELW range (±30 kg) reflects the fact that the weight range in the original weaning weight group (±20 kg) is likely to have increased since weaning.

For Brahman bulls (see Table 8) the age specification would change to:

Age = 16 ±2 months

For 1/4 Charolais steers the age specification would change to:

Age = 18 ±2 months.

For Sellers

It is a long time since wool producers stopped sending unsorted whole fleeces to market for a middle-man to sort in to lines of different end-use suitability and different value-adding potential.

What do the northern feeder-cattle producers do with their product?

As is the case for wool classing, sorting feeder cattle in to lines of common relative VAP and end-use suitability is a job best done on the property of origin.

Because of the past failure or inability of sufficient southern feeder cattle producers to provide animals of reliable and specified feedlot performance, a new industry activity called "backgrounding" has evolved in southern Australia. This response to the needs of the Australian feedlot industry for such cattle has not yet occurred in northern Australia in relation to the needs in the equally sophisticated elements of the SE Asian feedlot industry. It is inevitable that this need will have to be met.

The southern backgrounders are profit driven. They inevitably absorb a significant part of the total “profit” available for the whole feedlot beef production sector. Northern backgrounders, should they emerge, would be no different. The cost is still ultimately borne by the feeder cattle producer because they are still price takers by virtue of location in the market chain! (Note: preparing feeder cattle for a boat trip is adaptation, not backgrounding.)

However a widely understood, credible (proven to be reliable), objectively based and value based description system capable of cost-effectively segregating feeder cattle in to groups of similar (within-group) relative VAP and end-use suitability, could provide a more cost-effective alternative.

The absence of such a system is the main stumbling block to the adoption of this key component of an economically efficient northern feedlot industry. (Yes, northern feeder cattle producers are part of a northern feedlot industry whose feedlots happen to be located in SE Asia).

Only when differential prices emerge for feeder cattle with different relative VAP and/or different end-use suitability, will beef cattle producers receive valid market reports and valid price signals. Only then will they have a financially rational basis for decisions relating to the collection of relevant information (see age colour tagging below) and modification the maturity-type of their feeder-cattle, to optimise profitability.

So much for the economic and philosophical imperatives facing the sellers.

When feeder cattle producers in northern Australia become both aware of and see financial benefit in responding to the needs of their clients in SE Asia, they will need to know the age and maturity-type of their feeder cattle when they are offered for sale.

The Value Based Description System section of this report describes how a herd’s MTG curve for females may be estimated.

The simplest commercial way of accurately estimating age is to weigh weaners at weaning and differentially colour tag them into weaning weight ranges (of say 40 kg). The mid point of each weight range can be assumed to be the average weight of the group. The formula described earlier in this report can then be used to calculate the average age of each colour tag group:

$$\text{Weaning Age, days} = \frac{\text{Weaning Weight - Birth Weight}}{\text{Growth Rate}}$$

Birth weight can safely be assumed to be 30 kg and the growth rate of calves prior to weaning can be measured as described earlier (or assumed values of 0.85 kg/d in the Wet and 0.65 kg/d in the Dry used until property specific values become available). Using this approach for a group of say 141 to 180 kg weaners:

$$\text{Weaning age, days} = \frac{(160 - 30)}{0.85} \quad = 153 \text{ days} = 5.1 \text{ months}$$

To establish the groups current age at any time weaning age is added to the time that has elapsed since weaning.

The feeder producer will then be in a position to negotiate prices ($/kg ELW) with a buyer who is familiar with and prepared to use the system well before the buyer arrives to inspect the cattle. If the price per head offered is acceptable to the producer, all that remains to be done when the buyer arrives is to identify the cattle that meet the agreed specifications and price, and arrange their transport.

At this stage, it may be necessary to cull a few extreme earlier or later maturing individuals drafted when using this process, using condition scoring or frame score.

This approach is likely to find its first commercial application as a mechanism for ensuring reliability of performance of feeder cattle when trading partners wish to establish and maintain a long term business relationship (i.e. a supply chain alliance) and enter in to forward trading arrangements of mutual benefit.

Such arrangements enable fine tuning of procedures to optimise cost-effectiveness and ensure equitable mutual benefit.

2.0 EXPERIMENTAL WORK

The experiments undertaken in this project are separated into 3 sections:

- Growing feeder cattle on improved pasture (2.1).
- Growing feeder cattle on native pasture (2.2).
- Measuring mature size (feedlot experiment [2.3]).

2.1 Growing Feeder Cattle on Improved Pasture.

Purpose

This field of activity documented in the environment of future production, for first weaning round weaners, from weaning to the end of their first post weaning Wet, the effects of:

- property of origin,
- weaning weight range,
- castration,
- sex (bull vs.. steer and steer vs.. heifer),
- genotype,
- supplementation,
- stocking rate,

on:

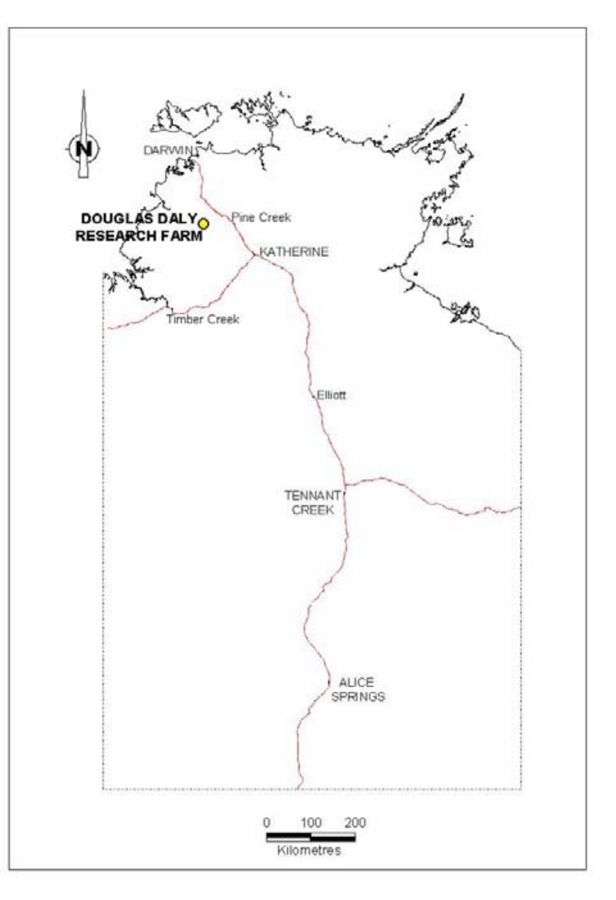
- growth rate,
- post weaning efficiency (kg gain/d/yr),
- turnoff pattern,
- turnoff weight,
- value-adding potential and end-use suitability,
- percentage of carryover cattle,
- P8 fat depth at turnoff,
- residual feed on offer.

2.1.1 Research Site Description.

Experiments in this part of the project were conducted at Douglas Daly Research Farm (DDRF) which is a NT DPIFM research station.

DDRF is located approximately 200 km south of Darwin NT (13^{o}50' S, 131^{o}11' W), immediately east of the junction of the Douglas and Daly Rivers (see Figure 5). DDRF is at the northern end of the Daly Basin and experiences a monsoonal climate with mean annual rainfall of about 1200 mm falling between October and April.

Figure 5: Location of Douglas Daly Research Farm.



Trial Area

The trial area used in these experiments consisted of 32 six hectare paddocks of improved pasture. The pasture was established in 1988 on recently cleared bush, and is principally buffel (*Cenchrus ciliaris* cv. Gayndah) with small amounts of sabi grass (*Urachloa mosambicensis*) invading in places and a trace of verano (*Stylosanthes hamata* cv Verano).

The pasture received an annual dressing of 70 kg/ha superphosphate and trace elements (Cu, Mo, Zn) every three years. The paddocks are spot sprayed for weeds in the early to mid Wet Season.

Soil

The Blain soil type on which these experiments were conducted was described by Lucas *et al.* (1987) as a sandy red earth. It is one of the two main soil types suitable for improved pasture establishment and cropping in the Daly Basin. Buffel seedlings do not set in this soil without appropriate cultivation due to crusting of the soil surface.

Husbandry

Soon after weaning, the experimental cattle were transported to DDRF and left to graze plentiful buffel pasture for about two weeks. This allowed them to recover from transport stress and establish a representative level of gut fill. They were then weighed (full and empty) and randomly allocated to paddocks. The weaners were then processed (castrated and dehorned as required, vaccinated [bivalent botulism, 5 in 1, Avomec for internal parasites, Lepto for heifers] and transported to their paddocks.). In the Wet Season commercial insecticidal eartags (Spike) were applied to each ear to minimise the effects of buffalo flies.

Seasons

Table 12 shows the rainfall received over the trial period. The 1998/99 and 1999/00 seasons were above average, 2000/01 and 2001/02 were average seasons while 2002/03 was a below average season (the average annual rainfall is 1208 mm).

Table 12: Rainfall (mm) Received During Trial Period at DDRF.

	Year				
MONTH	**1998-99**	**1999-00**	**2000-01**	**2001-02**	**2002-03**
Jul	0	0	0	0	0
Aug	6.8	0	0	0	0
Sep	9.2	0	2.8	0	11.1
Oct	47.8	46.9	67	81.5	5.2
Nov	196.7	106.6	47.4	123.3	85.2
Dec	201.6	119.4	242.2	222.6	41.4
Jan	116.2	176.9	160	178.4	213.4
Feb	480.2	256.4	442.3	460.4	365.8
Mar	445.6	507.8	212.5	91.6	187.8
Apr	71.9	229	18.6	0	20.8
May	0	6.4	0	0	0
Jun	0	0	0	0	0
Total	**1576**	**1449.4**	**1192.8**	**1157.8**	**930.7**

2.1.2 The effects of 25% Charolais genes and alternative supplementation regimes on growth, post weaning efficiency and value adding potential at turnoff in cull weaner heifers.

Objective

To measure, analyse and report on the effects of 25% Charolais genes and some alternative supplementation regimes involving Uramol and Phosrite in cull heifers grazing buffel pasture.

Summary

- An infusion of 25% Charolais genes in to a Brahman herd improved total ELW growth and post weaning efficiency of cull heifers by 9.5% = 13.1 kg/hd or 17.2 kg/ha respectively, (P< 0.001),
- Nil Uramol (U/P vs.. -/P) reduced growth in the Dry by 12.3 kg (P< 0.001) but the residual response in feeder heifers by the end of the Wet (–2.8% or 4.2 kg/hd, NS) was negligibly small. Uramol is unlikely to be cost-effective as a Dry Season supplement for cull heifer weaners in this location where deaths due to low feed availability are unlikely to occur.
- However other data collected at DDRF suggests that a +12.3 kg/hd response to Uramol in yearling heifer weaners to be mated in later December that year, could be associated with a 7-8% improvement in conception rate if this response persists until the start of mating. In such circumstances the Uramol would be highly cost-effective.
- Failure to provide Phosrite in the Wet resulted in a significant reduction in both total ELW gain and post weaning efficiency (-16.8% = -25.4 kg/hd and -33.2 kg/ha respectively, P< 0.001).
- The ELW gain and post weaning efficiency for the U/P and -/P groups during the period of supplementation were similar (151.3 vs. 147.1 kg/hd and 198.0 vs. 192.5 kg/ha respectively, NS).
- With 1/4 Charolais heifers, nil supplementation resulted in 154.0 -111.5 = 45.5 kg/hd less ELW gain or 59.5 kg/ha lower post weaning efficiency (-29.0%) over the year (P< 0.002). The effect of not providing Phosrite (203.5-154 = 49.5 kg/ha) was nearly five times as great as not providing Uramol (183.8 - 173.6 = 10.2 kg/ha).

Material & Methods:

See the site description section (2.1.1) for an outline of location, pastures, soil, fertiliser and husbandry including animal health treatments.

Animals

In 1997/98 and 1998/99 cull first weaning round heifers from the Kidman Springs Breeder Genotype Comparison were allocated at random to the treatment combinations. Heifers were considered to be culls if they weighed less than 160 kg at weaning.

Duration

Each year the heifers were weaned in the first week in May and transferred soon after to DDRF, where supplementation began 2 June in 1997 and 22 June in 1998.They were turned off at the end of their first post weaning Wet Season (21 May).

Stocking Rate

There were 7 heifers/ 6 ha = 1.2 hd/ha.

Treatments

- Data set 1 (genotype): the effect of the infusion of 25% Charolais genes in to a Brahman herd.
- Data sets 2 & 3 (supplementation): the three supplementation regimes were

U/P Uramol in the Dry and Phosrite in the Wet, *ad libitum* (control)

U/- Uramol in the Dry only

-/P Phosrite in the Wet only

- Data set 4 (supplementation): a fourth supplementation regime (-/-) with 1/4 Charolais enabled the comparison:

Uramol vs. Phosrite and Dry vs. Wet

Design

- Data sets 1,2 & 3 are based on a factorial design with two genotype treatments and the three supplementation treatments listed above, repeated in two successive years (see Table 13).The treatment combinations were re-randomised to plots between years.

There was a difference in the time periods over which the genotype and supplementation effects occurred. One or the other of these two main effects was used to provide within year replication (i.e. when for example genotype effects were being evaluated, the supplementation groups were used to provide three within year replicates).

Table 13 below provides the layout and heifer numbers used in data sets 1, 2 and 3

Table 13: Treatment Combinations and Numbers of Heifers

Supp	Year	Geno	
		Bra	1/4 Ch
U/P	1	7	7
	2	5	7
U/-	1	7	7
	2	4	6
-/P	1	7	7
	2	5	7

In the second year, dummy grazers (cull Droughtmaster heifers) were used to maintain the stocking rate. One 1/4 Charolais heifer had to be replaced with an equivalent animal and so one data point is also missing in this cell.

- Data set 4 was an non replicated factorial comprising two supplements and two periods. Only 1/4 Charolais heifers from 1997/98 were involved. Table 14 below shows the number of heifers in each treatment combination.

Table 14: Treatment Combinations Numbers of Heifers Data Set 4

Supp	P	-
U	14	7
-	7	15

Analyses

- Data set 1 (genotype): analysis of variance for ELW gain and post weaning efficiency over the whole year.
- Data set 2 (supplementation): analysis of variance for weight change in the Dry (full weight).
- Data set 3 (supplementation): analysis of variance of total ELW gain and post weaning efficiency over the whole period of supplementation.
- Data set 4 (supplementation): analysis of variance of total ELW gain and post weaning efficiency for the whole year in four supplementation treatments to 1/4 Charolais heifers in 1997/98.

Results

Data Set 1 (genotype)

Tables 15 and 16 below show the treatment combination means for the genotype effect on total ELW gain to the end of the first post weaning Wet and post weaning efficiency respectively. (n = 76)

Table 15: Genotype and Year Effects on Total ELW Gain (kg/hd)

Geno	Year	Rep			Av (Yr)	Av (Geno)	Sig
		1	2	3			
Bra	1	140.7	130.4	147.4	139.5	137.9	P< 0.001
	2	142.7	128.8	137.2	136.2		
1/4 Ch	1	165.7	121.9	154.9	147.5	151.0	
	2	172.7	132.0	158.7	154.5		

Table 16: Genotype and Year Effects on Post Weaning Efficiency (kg/ha)

Geno	Year	Rep			Av (Yr)	Av (Geno)	Sig
		1	2	3			
Bra	1	184.1	170.1	192.9	182.5	180.4	P< 0.001
	2	186.7	168.5	179.5	178.2		
1/4 Ch	1	216.8	159.5	202.7	193.0	197.6	
	2	226.0	172.7	207.6	202.1		

There was a 9.5% advantage in total ELW gain and post weaning efficiency in cull heifers (13.1 kg/hd or 17.2 kg/ha respectively, P< 0.001) due to the infusion of 25% Charolais genes in to a Brahman herd

Differences between years were not significant.

Data Set 2 (supplementation in the Dry)

Table 17 provides the effect of Uramol on weight change in the Dry (n = 76).

Table 17: The Effect of Uramol on Weight Change (Full) in the Dry

Supp	Year	Rep		Av	Av	Sig
		1	2	(Yr)	(Supp)	
U/P	1	-5.1	+4.7	-0.2	+6.0^{A}	P< 0.001
	2	+15.0	+9.1	+12.1		
U/-	1	-3.7	-2.7	-3.2	+3.3^{A}	
	2	+10.0	+9.7	+9.9		
-/P	1	-12.3	-6.0	-9.2	-6.3^{B}	
	2	-2.6	-3.9	-3.3		

Values in columns with different alphabetic superscripts are significantly different (P< 0.05).

Access to Uramol resulted in a significant advantage in FLW change by the end of the Dry (P< 0.001). There was no significant difference between the U/P and U/- groups. The response to Uramol was 11.0 kg/hd for these two groups combined and 12.3 kg/hd for the U/P group alone.

Data Set 3 (supplementation - whole year)

Tables 18 and 19 below provide the supplementation treatment means for total ELW gain and post weaning efficiency (n = 76).

Table 18: Supplementation Effects on Total ELW Gain

Supp	Year	Rep		Av	Av	Sig
		1	2	(Yr)	(Supp)	
U/P	1	138.7	163.7	151.2	151.3^{A}	P< 0.001
	2	138.2	164.7	151.5		
U/-	1	128.4	123.9	126.2	126.0^{B}	
	2	124.8	127.0	125.9		
-/P	1	142.4	153.9	148.2	147.1^{A}	
	2	138.2	153.7	146.0		

Values in columns with different alphabetic superscripts are significantly different (P< 0.05).

Table 19: Supplementation Effects on Post weaning Efficiency

Supp	Year	Rep		Av	Av	Sig
		1	2	(Yr)	(Yr)	
U/P	1	181.5	214.2	197.8	198.0	P< 0.001
	2	180.8	215.5	198.2		
U/-	1	168.0	162.1	165.1	165.0	
	2	163.3	166.2	164.7		
-/P	1	186.3	201.4	193.9	192.5	
	2	180.8	201.1	191.0		

Values in columns with different alphabetic superscripts are significantly different (P< 0.05).

Supplementation treatments had a significant effect on both total ELW and post weaning efficiency and this was due to the effect of not providing access to Phosrite (P< 0.001). There was no significant difference (2.8%) between the U/P and -/P groups (151.3 vs. 147.1 kg/hd = 4.2 kg/hd and 198.0 vs. 192.5 kg/ha = 5.5 kg/ha respectively)

Data Set 4 (supplementation 1997 1/4 Charolais weaners only)

Table 20 below gives the treatment means and responses for the 1997 1/4 Charolais weaners to all four potential supplementation treatments (n = 43).

Table 20: Effects of Supplementation of 1/4 Charolais Heifers on Total ELW Gain and Post Weaning Efficiency

Analysis	Variable	Supp	P	-	Av.	Response
1	Total ELW Gain (kg/hd)	U	157.0^A	123.9^B	140.5	
		-	153.9^A	111.5^B	132.7	-5.5%
		Av.	155.5	117.7		
				-24.3%		
	Response (kg/hd)	U		-33.1		
		-	-3.1	-45.5		
	Response (%)	U		-21.1		
		-	-2.0	-29.0		
2	Post weaning Efficiency (kg/ha)	U	205.4^A	162.1^B	183.8	-5.5%
		-	201.4^A	145.9^B	173.6	
			203.5	154.0		
				-24.3%		

Values within the same analysis with a different alphabetic superscript are significantly different (P< 0.05)

The responses are expressed relative to the nominated control (U/P).

Total ELW gain and post weaning efficiency were reduced by 5.5% (7.8 kg/hd or 10.2 kg/ha respectively) if Uramol was not provided and by 24.3% (37.8 kg/hd or 49.5 kg/ha respectively) if Phosrite was not provided.

Conclusions:

Data Set 1

An infusion of 25% Charolais genes in to a Brahman herd improved the post weaning efficiency (kg gain/ha/yr) of cull heifers by 9.5% or 17.2 kg/ha (P< 0.001).

Data Set 2

Nil Uramol in the Dry (U/P vs. -/P) reduced growth by 12.3 kg (P< 0.001) but the residual response in feeder heifers by the end of the Wet (–2.8% or 4.2 kg/hd, NS) was negligibly small. Uramol is unlikely to be cost-effective as a Dry Season supplement for cull heifer weaners in this location where deaths due to low feed availability are unlikely to occur.

However data collected at DDRF suggests that a +12.3 kg/hd response to Uramol in yearling heifer weaners to be mated in late December that year, may be associated with a 7-8% improvement in conception rate if this response persists until the start of mating. In such circumstances the Uramol would be highly cost-effective.

Data Set 3

Failure to provide Phosrite in the Wet resulted in a significant reduction in both total ELW gain and post weaning efficiency (-25.4 kg/hd and -33.2 kg/ha respectively or -16.8%, P< 0.001).

The ELW gain and post weaning efficiency for the U/P and -/P groups during the period of supplementation were similar (151.3 vs. 147.1 kg/hd and 198.0 vs. 192.5 respectively, NS).

Data Set 4

In these 1/4 Charolais heifers, nil supplementation resulted in 154.0 - 111.5 = 45.5 kg/hd less ELW gain or 59.5 kg/ha lower post weaning efficiency (-29.0%) over the year (P< 0.002). The effect of not providing Phosrite (203.5 - 154 = 49.5 kg/ha) was nearly five times as great as not providing Uramol (183.8 -173.6 = 10.2 kg/ha).

In this data set the effects of the nil Phosrite treatment (-21.1%) and the nil Uramol treatment (-2.0%) had a very similar effect on total ELW gain and post weaning efficiency to the same treatments in data set 3. This supports the general validity of the result for the nil treatment.

Supplement intake figures are not presented here for each year but the figures from 1999/00 were a good indication of all the years. In 1999/00 animals consumed on average 0.11 kg/head/day of Uramol over the Dry Season and 0.12 kg/head/day of Phosrite over the Wet Season. These intake figures are high and that is probably due to the small size of the paddocks (6.1 ha) which meant that the animals were often in close proximity to the lick blocks.

2.1.3 The effects of supplementation, castration and genotype on growth, post weaning efficiency and value adding potential in a feeder cattle production system.

Objective

An experiment to measure, analyse and report on the effects of some alternative supplementation regimes (3) involving Uramol and Phosrite, castration and some alternative genotypes (3), on growth and post weaning efficiency in a feeder cattle production system based on buffel pasture.

Materials and Methods

See the general Materials and Methods section (2.1.1) for an outline of location, pastures, soil, fertiliser and animal health treatments.

Animals

First weaning round entire male weaners from the VRRS breeder genotype comparison were transferred to DDRF after weaning in early May. They were allowed to settle down on unsupplemented buffel pasture for a couple of weeks. The Brahmans and 1/4 Charolais were then randomly assigned within genotype to be castrated or left entire. All Droughtmasters were castrated. All weaners were dehorned and treated with botulism vaccine, 5 in 1 vaccine and Ivomec at this time.

Duration

The experiment lasted from June 1997 to May 1999. The experimental year commenced in June immediately after castration and ended on 31 May.

Stocking Rate

There were 7 animals/ 6 ha = 1.16 hd/ha of buffel pasture. Where insufficient Brahman weaners were available from VRRS, Droughtmaster weaners of the same sex were used as dummy grazers to make up the stocking rates.

Where animals died during the experiment they were also replaced by a dummy grazer to maintain the nominated stocking rate.

About half (3 or 4) of the animals in each plot were selected at random and transferred to the KRS feedlot in January/February each year (early turnoff, see Table 21). The remaining animals continued to graze in their plots at the reduced stocking rate (4 hd/plot) until the end of the Wet (21 May) when they were also transferred to KRS for lotfeeding (late turnoff, see Table 21). This reduction in stocking rate was assumed to have had a negligibly small effect on their growth for the whole year.

Treatments

- the supplement control was U/P (Uramol in the Dry/Phosrite in the Wet) and the treatments were:

  U/- Uramol in the Dry only

  -/P Phosrite in the Wet only

- a castration treatment in which the steer was considered the control,

- two genotype treatments with the Brahman as the control (industry norm) and the Droughtmaster and 1/4 Charolais (3/4 Brahman) the two alternative genotypes. All three genotypes were derived from the Kidman Springs Breeder Genotype Comparison.

Design

The two original factorial designs in which replication was provided by re-randomisation of the treatments to plots at the end of the first year were:

- Genotype (3) x Supplementation (3) using steers only,
- Genotype (2) x Supplementation (3) x Sex (2).

The animal numbers in the late and early turnoff groups are shown in Table 21.

This report deals mainly with the animals that were turned off at the end of the Wet. The layout and animal numbers are provided in the results section. The analyses of the effect of nil Uramol in the Dry use both early and late turnoff animals as well as the U/- treatment animals.

Table 21: Original Layout and Animal Numbers

Turn Off	Geno	Year	Steer			Bull		
			U/P	U/-	-/P	U/P	U/-	-/P
Early	DM	1	3	3	3	0	0	0
		2	3	3	3	0	0	0
	Bra K	1	3	3	3	2	3	3
		2	2	2	2	2	2	2
	1/4 Ch	1	4	3	3	3	3	3
		2	3	3	3	3	3	3
Late	DM	1	4	3	4	0	0	0
		2	4	4	4	0	0	0
	Bra K	1	2	2	2	3	3	2
		2	3	3	4	3	4	3
	1/4 Ch	1	3	4	3	4	4	3
		2	4	4	4	4	4	4

In the first year, 1/4 Charolais steers and Brahman bulls in the U/- supplementation treatment were provided with Phosrite in the Wet in error. All plots receiving this treatment in the Wet in Year 1 have been excluded from many Tables and subsequent analyses presented here.

Growth Data

All animals were weighed full (FLW, immediately after being mustered from plots 2 km away from the yards, at about 8:30am) and empty (ELW, after 24 hours in yards without feed and 16 hours without water) at the start and the end of each year.

Full weights were taken at 4-6 weekly intervals. The first two records of weights each year after the start of the experiment provided a basis for evaluating the short term impact of castration on growth.

The year was divided in to the following periods:

Period 1	start to 6 October (start of the Dry Season)
Period 2	6 October to first turnoff
Period 3	first turnoff to 21 May

Post Weaning Efficiency

Plot ELW growth over the whole year (kg/hd) was divided by its area (6.1 ha) then multiplied by its stocking rate (7 kg/hd ÷ 6.1 hd/ha), resulting in a value for post weaning efficiency with the dimensions, kg gain/ha/yr.

Value-Adding Potential (VAP)

The cattle turned off in this experiment were used in the KRS feedlot to validate the theoretical maturity type growth (MTG) curves developed in Project 8.4.8. These validated MTG curves were then used to estimate the VAP of the cattle in this experiment at turnoff.

Age at weaning was estimated as:

$$\frac{\text{(Weaning wt kg) - (assumed birth wt kg)}}{\text{(assumed growth rate in the Wet kg/d)}} = \text{weaning age (days)}$$

Data from the Kidman Springs herd indicated that growth rate of calves turned back with their mothers at the second weaning round was about 0.825 kg/d in the subsequent Wet. Birth weight was assumed to be 30 kg.

Results

The results have been analysed as four data sets, each focussing on a different aspect of the data. The four measures of growth reported in each data set are FLW growth in the Dry and the Wet and for the whole year and ELW for the whole year. Tables 22 to 25 provide the subset means for these four measures of growth.

Table 22: Dry Season FLW Growth, kg/hd, (n = 186)

Turn Off	Geno	Year	Steers			Bulls		
			U/P	U/-	-/P	U/P	U/-	-/P
Early	DM	1	17.7	19.7	8.3	0	0	0
		2	16.3	18.3	-6.0	0	0	0
	Bra K	1	2.3	-2.3	-6.7	1.5	14.0*	-6.7
		2	6.5	-2.0	0.5	6.0	10.5	-21.5
	1/4 Ch	1	2.8	8.3*	-7.0	-2.3	6.3	-10.0
		2	-4.7	12.7	-18.7	12.3	8.3	-11.7
Late	DM	1	10.8	8.0	1.5	0	0	0
		2	16.5	19.8	-7.5	0	0	0
	Bra K	1	7.5	1.0	1.5	3.3	-7.7	1.5
		2	3.7	9.7	-0.5	11.0	6.8	-10.7
	1/4 Ch	1	4.7	5.0	-11.7	9.5	6.0	-19.3
		2	7.8	13.0	-8.0	14.3	12.3	-4.5

**These two figures are based on the second year's data only (1998/99) as these groups were given access to Phosrite in error during the first Wet Season.*

Table 23: Wet Season FLW Growth, kg/hd, (n = 186)

Geno	Year	Steers		Bulls	
		U/P	-/P	U/P	-/P
DM	1	177.3	190.3	0	0
	2	170.3	173.5	0	0
Bra K	1	181`.5	179.0	171.3	180.3
	2	185.3	178.3	209.3	203.0
1/4 Ch	1	181.0	188.3	215.3	195.7
	2	183.8	210.3	219.0	223.3

Table 24: Annual FLW Growth, kg/hd, (n = 186)

Geno	Year	Steers		Bulls	
		U/P	-/P	U/P	-/P
DM	1	188.0	191.8	0	0
	2	186.8	166.0	0	0
Bra K	1	189.0	190.5	174.7	180.5
	2	189.0	177.8	220.3	203.0
1/4 Ch	1	185.7	176.7	215.3	195.7
	2	191.5	202.3	219	223.3

Table 25: Annual ELW Growth, kg/hd, (n = 186)

Geno	Year	Steers		Bulls	
		U/P	-/P	U/P	-/P
DM	1	171.0	170.5	0	0
	2	168.0	155.0	0	0
Bra K	1	173.5	170.5	163.3	170.5
	2	167.0	166.3	200.3	193.3
1/4 Ch	1	164.7	153.0	205.3	172.7
	2	174.0	177.3	192.8	199.0

Tables 26 and 27 provide the results of two alternative ways of calculating the response to Uramol. Response 1 is calculated as:

$$\frac{(U/P + U/-)}{2} \text{ minus } -/P$$

Table 26: Response 1, Uramol in the Dry (kg/hd)

Geno	Year	Early		Late	
		Steer	Bull	Steer	Bull
DM	1	10.4	0	7.9	0
	2	23.3	0	25.7	0
Bra K	1	6.7	14.5	2.8	-5.9
	2	1.8	29.8	7.2	19.6
1/4 Ch	1	12.6	14.3	16.6	27.1
	2	22.7	22.0	18.4	17.8

The percentage residual values Response 2 (in Table 27) can only be calculated from the late turnoff data as:

(U/P minus -/P)

Table 27: Response 2, Uramol in the Dry (kg/hd)

Geno	Year	Early		Late	
		Steer	Bull	Steer	Bull
DM	1	9.4	0	9.3	0
	2	22.3	0	24.0	0
Bra K	1	9.0	8.2	6.0	1.8
	2	6.0	27.5	4.2	21.7
1/4 Ch	1	9.8	12.3	16.4	28.8
	2	14.0	24	15.8	18.8

Data Set 1: (supplementation, genotype, steers only)

Tables 28, 29, 30, 31 and 32 respectively provide the treatment combination means for the effects of supplementation, genotype and year.

In the tables of results, differences in the within row or within column alphabetic superscripts (that appear against some margin means in the tables of results) indicate where statistically significant differences exist within the respective row or column.

Table 28: FLW Growth (kg/hd), in the Dry (n = 113)

Turn Off	Geno	Year	Supp			Av 1 (Yr)	Av 1 (Geno)	Av 2 (Yr)	Av 2 (Geno)
			U/P	U/-	-/P				
Early	DM	1	17.7	19.7	8.3	15.2	12.4^{A}	18.7	18.0^{A}
		2	16.3	18.3	-6.0	9.5		17.3	
	Bra K	1	2.3	-2.3	-6.7	-2.2	-2.0^{B}	0	1.2^{B}
		2	6.5	-2.0	0.5	-1.7		2.3	
	1/4 Ch	1	2.8	8.3	-7.0	-1.4	-2.6^{B}	5.6	4.8^{B}
		2	-4.7	12.7	-18.7	-3.7		4.0	
	Av^{6}		6.8^{A}	9.1^{A}	-4.9^{B}	3.7			
Late	DM	1	10.8	8.0	1.5	6.8	8.2^{A}	9.4	13.8^{A}
		2	16.5	19.8	-7.5	9.6		18.2	
	Bra K	1	7.5	1.0	1.5	3.3	3.8^{B}	4.0	5.4^{B}
		2	3.7	9.7	-0.5	4.3		6.7	
	1/4 Ch	1	4.7	5.0	-11.7	-0.7	1.8^{B}	4.9	7.7^{B}
		2	7.8	13.0	-8.0	4.3		10.4	
	Av^{6}		8.5^{A}	9.4^{A}	-4.1^{B}	4.6			
	Av^{12}		7.7^{A}	9.2^{A}	-4.5^{B}	4.1			

Values in columns or rows with different alphabetic superscripts are significantly different (P< 0.05).

Av 1 = (U/P + U/- + -/P) ÷ 3

Av ^{X} *= average of X values*

Av 2 = (U/P + U/-) ÷ 2 i.e. Uramol only

In the Dry (Table 28):

- nil Uramol reduced growth by 4.5 + ((7.7 + 9.2) ÷ 2 = 13.0 kg (P< 0.001)),
- there was a significant genotype effect (P< 0.001), with Droughtmasters growing significantly (P< 0.05) more than the two other genotypes,
- there was no significant year effect (3.7 vs. 4.6 kg),
- there was no significant difference between the U/P and U/- groups or the early and late turnoff groups. These figures are derived from the average of the two treatments supplemented with Uramol (U/P and U/-) less the one treatment without access to Uramol (-/P).

In Table 29 the 1/4 Charolais and Droughtmasters consistently showed a greater response to nil Uramol than the Brahmans.

Table 29: Response to Nil Uramol in the Dry (n = 113)

Geno	Turn Off	Response 1 (kg/hd)	Response 2 (kg/hd)
DM	Early	-16.9	-15.9
	Late	-16.8	-16.7
Bra K	Early	-4.3	-7.5
	Late	-5.0	-5.1
1/4 Ch	Early	-17.7	-11.9
	Late	-17.5	-16.1
Av		-13.0	-12.2

For FLW growth in the Wet Table 30 shows:

- there were no significant differences within the supplementation or genotype treatments;
- the 1/4 Charolais and the Droughtmasters in the -/P treatment appeared to consistently exhibited compensatory growth whereas the Brahman -/P groups had lower growth (NS) than the Brahman U/P groups.

Table 30: FLW Growth (kg/hd), in the Wet (n = 41)

Geno	Year	Supp		Av		Av
		U/P	-/P	(U/P+ -/P) 2	-/P – U/P	(Geno)
DM	1	177.3	190.3	183.8	+13.0	177.9
	2	170.3	173.5	171.9	+3.2	
Bra K	1	181.5	179.0	180.3	-2.5	181.1
	2	185.3	178.3	181.8	-7.0	
1/4 Ch	1	181.0	188.3	184.7	+7.3	190.9
	2	183.8	210.3	197.1	+22.5	
Av (Yr)	1	179.9	185.9	182.7		
	2	179.8	187.4	183.6		
Av (Supp)		179.8	186.6			

Table 31 shows that for annual FLW growth:

- the carryover effect of nil Uramol from the Dry was 188.4 - 182.5 = 5.9 kg (3.1%, NS) less total FLW growth. The residual effect was (5.9 ÷12.6) x 100 = 46.8% of the effect observed at the end of the Dry;
- there was no significant genotype or year effect.

Table 31: Annual FLW Growth (kg/hd), (n = 41)

Geno	Year	Supp		Av	Av
		U/P	*-/P*	(Year)	(Geno)
DM	1	188.0	191.8	189.9	183.2
	2	186.8	166.0	176.4	
Bra K	1	189.0	180.5	184.8	184.1
	2	189.0	177.8	183.4	
1/4 Ch	1	185.7	176.7	181.2	189.1
	2	191.5	202.3	196.9	
Av (Yr)	1	187.6	183.0	185.3	
	2	189.1	182.0	185.8	
Av (Supp)		188.4	182.5		

In Table 32 there was no significant effect of supplementation, genotype or year on annual ELW growth.

Table 32: Annual ELW Growth (kg/hd), (n = 41)

Geno	Year	Supp		Av	Av
		U/P	-/P	(Yr)	(Geno)
DM	1	171.0	170.5	171.0	165.0
	2	168.0	155.0	161.5	
Bra K	1	173.5	170.5	172.0	169.3
	2	167.0	166.3	166.7	
1/4 Ch	1	164.7	153.0	158.9	167.3
	2	174.0	177.3	175.7	
Av (Yr)	1	169.7	164.7	167.2	
	2	169.7	166.2	168.0	
Av(Supp)		169.7	165.5		

Data Set 2: (supplementation, castration, genotype)

Tables 33, 34, 35, 36, 37 and 38 provide the treatment combination means for the effects of year, genotype and castration.

Table 33 shows that two months after castration, the short term effect of castration on FLW growth was negligibly small, not statistically significant and in the opposite direction to that expected. However:

- there was a significant effect of nil Uramol (-7.5 kg, P< 0.001)
- nil Uramol reduced growth in bulls by twice as much as in steers 8.6 + (0.2 + 1.9)÷ 2 = 9.7 kg/hd vs. 3.7 + (0.1 + 2.1) ÷ 2 = 4.8 kg/hd.

Table 33: FLW Growth (kg/hd), Two Months After Castration (n = 145)

Geno	Year	Steer			Bull			Av	Av
		U/P	U/-	-/P	U/P	U/-	-/P	(Yr)	(Geno)
Bra K	1	+4.2	+5.2	0	-5.2	+4.8	0	+1.5	-1.5
	2	-1.6	+1.6	-5.5	+0.4	-1.2	+20.0	-4.4	
1/4 Ch	1	+2.0	-0.7	+6.0	+2.9	-3.1	-0.5	+1.1	-1.3
	2	-4.4	+2.3	-15.1	+2.9	+7.1	-14.9	-3.7	
Av	1	+6.2	+2.3	+3.0	-1.2	+0.9	+0.3	+1.9	
	2	-6.0	+2.0	-10.3	+1.7	+3.0	-17.5	-4.0	
Av (Supp)		+0.1	+2.1	-3.7	+0.2	+1.9	-8.6		
Av (Sex)			-0.5			-2.2			

Table 34 shows that by the end of the Dry:

- nil Uramol reduced FLW growth by 14.4 kg ($P < 0.001$), there was a significant genotype x Uramol interaction ($P < 0.02$),
- there was no significant effect of castration, genotype or year on growth in the Dry. However, the response to nil Uramol in the late turned off steers was -11.3 kg/hd and in the bulls, -16.0 kg/hd.

Table 34: FLW Growth (kg/hd) in the Dry (n = 145)

Turn Off	Geno	Year	Steer			Bull			Av	Av
			U/P	U/-	-/P	U/P	U/-	-/P	(Year)	(Geno)
Early	Bra K	1	2.3	-2.3	-6.7	1.5	14.0	-6.7	0.35	0.2
		2	6.5	-2.0	0.5	6.0	10.5	-21.5	0	
	1/4 Ch	1	2.8	8.3	-7.0	2.3	6.3	-10.0	0.45	0.4
		2	-4.7	12.7	-18.7	12.3	8.3	-11.7	-0.3	
	Av^{2}	1	2.6	3.0	-6.9	1.9	10.2	-8.4	0.4	
		2	0.9	5.4	-9.1	9.2	9.9	-16.6	-0.05	
	Av^{4}		1.8	4.2	-8.0	5.5	10.1	-12.5		
Late	Bra K	1	7.5	1.0	1.5	3.3	-7.7	1.5	1.2	2.3
		2	3.7	9.7	-0.5	11.0	6.8	-10.7	3.3	
	1/4 Ch	1	4.7	5.0	-11.7	9.5	6.0	-19.3	-1.0	2.4
		2	7.8	13.0	-8.0	14.3	12.3	-4.5	5.8	
	Av^{2}	1	6.1	3.0	-5.1	6.4	-0.9	-10.4	-0.2	
		2	5.8	11.4	-4.3	12.7	9.6	-7.6	4.6	
	Av^{4}		6.0	7.2	-4.7	9.6	4.3	-9.0		
	Av^{8}		3.9^{A}	5.7^{A}	-6.4^{B}	7.6^{A}	7.2^{A}	-10.8^{B}		

Values in columns or rows with different alphabetic superscripts are significantly different ($P < 0.05$).
Av ^{x} = average of X values

Table 35 shows that later maturing animals (1/4 Charolais -18.3 kg and bulls -17.5 kg) were more affected by nil Uramol than earlier maturing animals (Brahmans -10.3 kg and steers -10.9 kg).

Table 35: The Response to Nil Uramol in the Dry (n = 145)

Geno	Sex	Response			
		Yr 1 kg	Yr 2 kg	Av Kg	Av Geno
Bra K	Steer	-6.8	-5.1	-6.0	
	Bull	-5.6	-23.5	-14.6	
	Av	-6.2	-14.6		- 10.3
1/4 Ch	Steer	-14.3	-17.3	-17.3	
	Bull	-21.0	-19.6	-20.3	
	Av	-17.7	-18.8		-18.3
	Av (Yr)	-12.0	-16.7	-14.4	
	Av (Steer)	-10.6	-11.2	-10.9	
	Av (Bull)	-13.3	-21.6	-17.5	

Table 36 shows for FLW growth during the Wet:

- the carry over effect due to nil Uramol in the Dry was 8.7 kg more growth (4.6%, NS), this compensatory growth being greater in the bulls (11.4 kg) than in the steers (5.9 kg),
- castration reduced growth by 17.7 kg (8.7%, P< 0.01),
- 1/4 Charolais grew 14.8 kg more than Brahmans (7.9%, P< 0.05),
- there was a significant year effect (P< 0.02).

Table 36: FLW Growth in the Wet (n = 51)

Genotype	Year	Steer		Bull		Av (Yr)	Av (Geno)
		U/P	-/P	U/P	-/P		
Bra K	1	181.5	179.0	171.3	179.0	177.7	187.2
	2	185.3	178.3	209.3	213.7	196.7	
1/4 Ch	1	181.0	188.3	205.8	215.0	197.5	202.1
	2	183.8	210.3	204.8	227.8	206.7	
Av (Yr)	1	181.3	183.5	188.6	197.0	187.7	
	2	184.6	194.3	207.1	221.8	201.7	
Av		183.0	188.9	197.9	209.4		
Av (Sex)		186.0		203.7			

Table 37 shows that annual FLW growth:

- the nil Uramol carryover effect was negligibly small (5.6 kg). The average response to nil Uramol at the end of the Dry in late turned off animals was 13.65 kg (Table 34). This means that by the end of the year only 5.6 / 13.65 = 41% of the original response to Uramol was retained,
- castration reduced growth by 17.4 kg (8.5%, P< 0.05),
- 1/4 Charolais grew 11.8 kg (6.2%, P< 0.05) more than Brahmans.

Table 37: Annual FLW Growth, (n = 51)

Genotype	Year	Steer		Bull		Av	Av
		U/P	-/P	U/P	-/P	(Year)	(Geno)
Bra K	1	189.0	180.5	174.7	180.5	181.2	189.4
	2	189.0	177.8	220.3	203.0	197.5	
1/4 Ch	1	185.7	176.7	215.3	195.7	193.4	201.2
	2	191.5	202.3	219.0	223.3	209.0	
Av (Year)	1	187.4	178.6	195.0	188.1	186.0	
	2	190.3	190.1	219.7	213.2	203.3	
Av		188.9	184.4	207.4	200.7		
Av (Sex)		186.7		204.1			

Table 38 shows that for annual ELW growth:

- nil Uramol in the Dry reduced growth by 4.8 kg (NS),
- castration reduced growth by 18.9 kg (10.1%, P< 0.01),
- 1/4 Charolais grew 4.3 kg more (NS) than Brahmans,
- there was a significant year effect (P< 0.001).

Table 38: Annual ELW Growth, (n = 51)

Geno	Year	Steer		Bull		Av	Av
		U/P	-/P	U/P	-/P	(Yr)	(Geno)
Bra K	1	173.3	170.5	163.3	170.5	166.6	175.6
	2	167.0	166.3	200.3	193.3	181.7	
1/4 Ch	1	164.7	153.0	205.3	172.7	173.9	179.9
	2	174.0	177.3	192.8	199.0	185.8	
Av (Yr)	1	169.0	161.8	184.3	171.6	171.7	
	2	170.5	171.8	196.6	196.2	183.0	
Av		169.8	166.8	190.5	183.9		
Av (Sex)		168.3		187.2			

Data Set 3: (supplementation, genotype, steers only)

Tables 39, 40, 41 and 42 provide the means for all nine steer supplement x genotype combinations. Table 39 shows that in the Dry:

- nil Uramol reduced growth by 16.7 kg ($P < 0.001$), with the Brahmans significantly ($P < 0.07$) less affected than the other two genotypes. The effect of nil Uramol in these two genotypes was more than four times as great as in the Brahmans,
- Droughtmasters grew 8.6 kg ($P < 0.03$) more than 1/4 Charolais and Brahmans were intermediate.

Table 39: FLW Growth (kg/hd) and Response 1 in the Dry, Both Years (n = 58)

Geno	Supp			Av	Response
	U/P	U/-	-/P	(Geno)	1
DM	+16.4	+19.1	-6.9	+9.5^{A}	-24.7^{A}
Bra K	+4.8	+5.0	-0.2	+3.2^{AB}	-5.1^{B}
1/4 Ch	+2.4	+12.9	-12.6	+0.9^{B}	-20.3^{A}
Av (Supp)	+7.9^{A}	+12.3^{A}	-6.6^{B}	+4.5	-16.7

Values in columns or rows with different alphabetic superscripts are significantly different ($P < 0.05$).

Table 40 shows that in the Wet:

- the carry over effect (compensatory growth) in the nil Uramol group was 7.5 kg (4.2%, NS) more FLW growth in the Wet,
- nil Phosrite in the Wet reduced FLW growth by 44.9 kg (25.0%, $P < 0.001$),
- 1/4 Charolais grew 12.8 kg (7.7%, NS) more than Brahmans and 23.0 kg more (14.7%, $P < 0.07$) than the Droughtmasters.

Table 40: FLW Growth (kg/hd) in the Wet, Year 2 only (n = 34)

Geno	Supp			Av
	U/P	U/-	-/P	(Geno)
DM	170.3	125.0	173.5	156.3^{B}
Bra K	185.3	136.0	178.3	166.5^{AB}
1/4 Ch	183.8	143.8	210.3	179.3^{A}
Av (Supp)	179.8^{A}	134.9^{B}	187.4^{A}	

Values in columns or rows with different alphabetic superscripts are significantly different ($P < 0.05$).

Table 41 shows that for annual FLW growth:

- the residual effect of nil Uramol in the Dry was 7.1 kg (3.8%, NS) less growth. This was (7.1 ÷ 14.5) x 100 = 49.0% of the effect at the end of the Dry,
- nil Phosrite in the Wet reduced growth by 40.0 kg (21.2%, $P < 0.001$),
- Droughtmasters grew 4.9 kg (2.9%, NS) less than Brahmans and 1/4 Charolais grew 12.7 kg (7.4%, NS) more.

Table 41: Annual FLW Growth (kg/hd), Year 2 only (n = 34)

Geno	Supp			Av
	U/P	U/-	-/P	(Geno)
DM	186.9	144.8	166.0	165.9
Bra K	189.0	145.7	177.8	170.8
1/4 Ch	191.5	156.8	202.3	183.5
Av (Supp)	189.1^{A}	149.1^{B}	182.0^{A}	

Values in columns or rows with different alphabetic superscripts are significantly different (P< 0.05).

Table 42 shows for annual ELW growth:

- the carry over effect of nil Uramol in the Dry (-3.5 kg, NS) was negligibly small,
- the effect of nil Phosrite in the Wet was 41.2 kg less total growth (24.3%, P< 0.001),
- 1/4 Charolais grew 15.6 kg (10.6%, NS) more than Droughtmasters and 7.2 kg (5.8% NS) more than Brahmans.

Table 42: Annual ELW Growth (kg/hd), Year 2 only (n = 34)

Genotype	Supp			Av
	U/P	U/-	-/P	(Geno)
DM	168.0	117.3	155.0	146.8
Bra K	167.0	132.3	166.3	155.2
1/4 Ch	174.0	135.8	177.3	162.4
Av (Supp)	169.7^{A}	128.5^{B}	166.2^{A}	

Values in columns or rows with different alphabetic superscripts are significantly different (P< 0.05).

Data Set 4: (supplementation, castration, genotype)

Tables 43, 44, 45 and 46 provide the means for all twelve treatment combinations.

Table 43 shows for FLW growth in the Dry:

- nil Uramol resulted in 17.2 kg (P< 0.001) less growth,
- there was no significant effect of castration on growth,
- 1/4 Charolais grew 3.0 kg more than Brahmans (NS).

Table 43: FLW Growth (kg/hd) in the Dry, (n = 74)

Genotype	Sex	Supp			Av	Av
		U/P	+U/-	-/P	(Sex)	(Geno)
Bra K	S	+4.8	+5.0	-0.2	+4.7	+3.3
	B	+9.0	+8.0	-15.0	+2.0	
1/4 Ch	S	+2.4	+12.9	-12.6	+4.3	+6.3
	B	+13.4	+10.6	-7.6	+8.3	
Av (Sex)	S	+3.6	+9.0	-6.4	+4.2	
	B	+11.2	+9.3	-11.3	+4.8	
Av (Supp)		$+7.4^A$	$+9.2^A$	-8.9^B		

Values in columns or rows with different alphabetic superscripts are significantly different (P< 0.05).

Table 44 shows that for FLW growth in the Wet:

- nil Uramol in the Dry increased growth (compensatory growth) in the Wet by 11.7 kg (6.0%, NS),
- nil Phosrite in the Wet reduced growth by 58.7 kg (30.0%, P< 0.001),
- castration reduced growth by 14.5 kg (7.7%, P< 0.05),
- 1/4 Charolais grew 10.5 kg (6.0%, NS) more than Brahmans,

Table 44: FLW Growth (kg/hd) in the Wet, Year 2 data only (n = 44)

Genotype	Sex	Supp			Av	Av
		U/P	U/-	-/P	(Sex)	(Geno)
Bra K	S	185.3	136.0	178.3	166.5	174.9
	B	209.3	126.8	213.7	183.3	
1/4 Ch	S	183.8	143.8	210.3	179.3	185.4
	B	204.3	141.8	227.8	191.5	
Av (Sex)	S	184.6	139.9	194.3	172.9	
	B	207.1	134.3	220.8	187.4	
Av(Supp)		195.9^A	137.2^B	207.6^A		

Values in columns or rows with different alphabetic superscripts are significantly different (P< 0.05).

Table 45 shows that for annual FLW growth:

- nil Uramol in the Dry reduced growth by 3.3 kg (NS). This represented (3.3/15.2) x 100 = 21.7% of the effect at the end of the Dry,
- nil Phosrite in the Wet reduced total growth by 57.4 kg (28.0%, P< 0.001),
- castration reduced growth by 15.0 kg (7.8%, P< 0.03),
- 1/4 Charolais grew 13.0 kg (7.3%, P< 0.05) more than Brahmans.

Table 45: Annual FLW Growth (kg/hd), Year 2 data only (n = 44)

Genotype	Sex	Supp			Av	Av
		U/P	U/-	-/P	(Sex)	(Geno)
Bra K	S	189.0	146.7	177.8	170.8	178.2
	B	220.3	133.5	203.0	185.6	
1/4 Ch	S	191.5	156.8	202.3	183.5	191.2
	B	219.0	154.0	223.3	198.8	
Av (Sex)	S	190.3	151.0.3	190.1	177.2	
	B	219.7	143..8	213.2	192.2	
Av(Supp)		205.0^A	147.6^B	201.7^A		

Values in columns or rows with different alphabetic superscripts are significantly different (P< 0.05).

Table 46 shows that for annual ELW growth:

- nil Uramol in the Dry had no effect,
- nil Phosrite in the Wet decreased growth by 52.3 kg (28.5%, P< 0.001),
- castration reduced growth by 14.6 kg (8.4%, P< 0.02), and the interaction between castration and supplementation was significant (P< 0.05). Nil Phosrite in the bulls reduced growth by 69.3 kg or nearly twice as much as the steers at 36.4 kg,
- 1/4 Charolais grew 7.5 kg (4.6%, NS) more than Brahmans.

Table 46: ELW Growth (kg/hd) Whole Year, Year 2 data only (n = 44)

Geno	Sex	Supp			Av	Av
		U/P	U/-	-/P	(Sex)	(Geno)
Bra K	S	167.0	132.3	166.3	155.2	162.8
	B	200.3	118.3	193.3	170.6	
1/4 Ch	S	174.0	135.8	177.3	162.3	170.3
	B	192.8	136.3	199.0	176.0	
Av (Sex)	S	170.5	134.1	171.8	158.8	
	B	196.6	127.3	196.2	173.4	
Av (Supp)		183.6^A	130.7^B	184.0^A		

2.1.4 The effect of castration and short scrotum treatments on pre- and post weaning growth in commercial Brahman cattle.

Background

A vertically integrated major NT cattle producing company with a feedlot and butcher shop in SE Asia reported a developing over-fatness problem in steers when slaughtered for use in its own butcher shops after a normal period of fattening.

The Department was asked to recommend a solution to this problem and the company agreed to participate in a field test of two bull treatments as a solution.

Methods

At Camfield Station in October 1997 (second weaning round) 100-150 kg calves were tagged and allocated to the three treatments and returned to their mothers.

The 3 sex treatments were:

- Steer - Male weaners that were castrated.
- Bull - Male weaners that were left entire.
- SS Bull - Male weaners that were given a short scrotum treatment (castrating rings are applied below the testes so that the testes are held up close to the body were the higher temperature renders them infertile).

They were then weaned at the first weaning round in 1998 (late June) and transported to Douglas Daly Research Farm where they grazed improved buffel pasture. A weaning weight was recorded in July once they had settled down from being transported. They were stocked at 1hd/ha in 6 ha paddocks with 3 replicates per sex treatment (n = 54) and weighed at approximately monthly intervals until late May 1999.

Table 47: Liveweights and mm Fat at the P8 Site in Short Scrotum Bull Demonstration

Sex	Oct 97	Jul 98	Gain 1	May 99	Gain 2	Gain 1 + 2
Steer	122 kg -	260 kg 4.6mm	138 kg -	402 kg 11.5mm	142 kg -	280 kg -
Bull	121 kg -	265 kg 1.5mm	144 kg -	422 kg 7.0mm	177 kg -	321 kg -
SS Bull	122 kg -	272 kg 2.0mm	150 kg -	453 kg 7.0mm	188 kg -	331 kg -
Age	5mo	15mo		25mo		

Gain 1 = pre-weaning native pasture VRD.

Gain 2 = post weaning buffel pasture DDRF.

mm = P8 fat depth in millimetres.

Results

- There was no effect of castration on gain during, or weight at the end of the Wet in suckling calves on native pasture, but the bulls and the SS bulls were significantly leaner than the steers (P< 0.001) at weaning,

- Bulls and SS bulls both grew significantly more than the steers from weaning to the end of their first post weaning Wet ($P< 0.001$) while grazing buffel at DDRF.

- Even though the bulls and SS bulls were significantly leaner than the steers ($P< 0.001$) at the end of their first post weaning Wet they were already too fat on average for the Indonesian wet market (optimum 3 mm).

- The SS treatment did not adversely affect growth and no viable sperm were detected when the SS bulls were electro-ejaculated.

Conclusions

- Leaving calves entire in October 1997 resulted at 25 months age, in:

    - a significant reduction in fatness (4.5mm, -40%, $P< .001$),

    - a significant increase in empty liveweight (35.5 kg, 9%, $P< .001$).

  The greater weight of the SS Bulls compared to the Bulls was unexpected, was not statistically significant and was probably a sampling effect.

  The reduction in fatness in entire animals was not enough to eliminate the over-fatness problem in the 25 month old feeder cattle and these bulls should have been shipped to SE Asia early in January when their P8 measurement was less than 2mm and their weights were closer to market requirements (361 kg full or 332 kg empty).

- When the weight of the steers was adjusted for the fatness difference between them and the bulls, using the prediction equation developed in Project 8.4.8 (4.6 x 4.5 = 21 kg) the bulls were 56.5 kg heavier than the steers:

$$\frac{(422 + 453)}{(2)} - (402 - 21) = 56.5 \text{ kg}$$

  This is very close to the bull/steer difference measured in Kidman Springs' Brahmans in Project 8.4.4 (60 kg) and infers little difference in mature size between the two samples of Brahmans.

  When the age and fatness of the Camfield Station steers were inserted in to the 8.4.4 prediction equation to estimate empty liveweight,

$$\begin{aligned} \text{ELW} &= 4.6\ (\text{P8, mm}) + 9.9\ (\text{Age, mo}) + 116.3 \\ &= (4.6 \times 11.5) + (9.9 \times 25) + 116.3 \\ &= 417 \text{ kg} \end{aligned}$$

  This calculated value was 4% greater than the measured value and in good agreement given the more fibrous nature of the diet of the pasture fed relative to the feedlot fed cattle, on which the prediction equation was based. This result also infers little difference in mature size between the two samples of Brahmans.

- Leaving 100-150 kg calves on their mothers at the second weaning round results in:

    - weaners that are well over 12 months old at weaning,

    - hidden adverse effects on either the survival of their dams, or their dams inter calving interval, or the survival of the next calf or a combination of these effects. The unmeasured effect will be lower weaning percentage and lower weaning weights in the future.

Summary

1. If steer calves are not weaned down to 100 kg at the second weaning round they will be:
   - moderately fat at weaning (P8 = 4.6mm), with very low value-adding potential as feeders,
   - too fat at the end of their first post weaning Wet (P8 = 11.5 mm) for use as feeder steers (on average these steers were already fat enough for the Australian or SE Asian supermarket trade).
2. When the bulls average final weight was adjusted to the same level of fatness as the steers using the conversion factor derived in the Katherine Research Station feedlot (4.5 mm x 3.5 kg/mm = 15.75 kg), their weight was nearly 60 kg greater, or nearly the same as the bull vs. steer difference at the same fatness at two years age, established at the Katherine feedlot.
3. This suggests that the mature size of these randomly selected commercial VRD Brahmans from Camfield Station were of very similar mature size to the Queensland derived Brahmans at Kidman Springs.
4. Leaving 100-150 kg calves on their mothers at the second weaning round also results in hidden adverse effects on the inter-calving interval or the survival of their dams, thus reducing future weaning percentage and/or weaning weight.

2.1.5 The effects of genotype, stocking rate and sex on post weaning efficiency and value adding potential at turnoff in first round weaners grazing buffel pasture in the Douglas Daly region.

Objective

To measure and report on the effects of genotype, stocking rate and sex on growth rates during the post weaning year and final P8 fat depth in the growing phase of live export feeder cattle production off buffel pasture.

Background

No information is available for the Daly Basin on the long term effects of stocking rate on animal and pasture performance of steer and heifer weaners grazing grass only (buffel) improved pastures.

This project provides part of the mosaic of data required to compare the financial effects of shifting to a two-stage beef industry in the northern half of the NT (breeding only on native pasture and growing and fattening on improved or sub-coastal flood plain pastures in higher rainfall areas).

It will also contribute to the economic evaluation of the use of later maturing cattle to meet market specifications in SE Asia and the evaluation of the effects of genotype, stocking rate and sex on post weaning growth and fatness.

Method

The experiment took place at Douglas Daly Research Farm (DDRF). A description of the site is presented in section 2.1.1.

First round weaners from four genotypes were compared. The genotypes were:

- Brahmans (from Kidman Springs)
- Brahmans (from Mt Sanford)
- Droughtmasters (from Kidman Springs)
- 1/4 Charolais x 3/4 Brahmans (from Kidman Springs)

The reason for using Brahmans from two origins is that those from Kidman Springs (Bra K) represented purebred Brahmans (which is the current breeding objective of most commercial herds in the NT), while those from Mt Sanford (Bra MS) represented the type of Brahmans that most commercial stations currently run (they are in the latter stages of grading up from NT Shorthorns and may still have up to 25% Shorthorn genes). Weaners from Mt Sanford were not available in the final year of the experiment.

The heifers were replacement heifers rather than culls and as a result were of a similar age and weight range to the steers at the start of each experimental year. This allowed an unbiased comparison of their relative post weaning performance.

The weaners were transported from their property of origin to DDRF in June and allowed to recover from transport stress (and regain normal gut fill) for about 2 weeks before they were weighed (full and empty [no access to feed or water over night]) and randomly allocated to treatments. The weaners were then processed (castrated and dehorned as required, vaccinated [botulism, 5 in 1, Avomec for internal parasites, Lepto for heifers] and transported to their paddock). In the Wet Season commercial insecticidal eartags (Spike) were applied to each ear to minimise the effects of buffalo flies. All animals had access to Uramol supplement blocks in the Dry Season and Phosrite blocks in the Wet.

All animals were weighed at monthly intervals. These were full weights taken immediately after mustering in the morning. A full and empty (no access to feed or water overnight) weight was taken at the end of the

Dry Season (October) and at the end of the post weaning year in the following July. This allowed the calculation of Dry Season and Wet Season growth. Fat depth at the P8 site was measured ultrasonically at the end of the post weaning year.

There were three stocking rates of each genotype for both steers and heifers. These were:

- Low: 7 head per 6.1 ha paddock or 1.15 head/ha.

- Medium: 9 head per 6 ha paddock or 1.48 head/ha.

- High: 11 head per 6 ha paddock or 1.80 head/ha.

Twenty-four paddocks (6.1 ha) were used for the experiment and the pasture was almost exclusively buffel grass. These were split into two blocks with steers grazing in one of the blocks (12 paddocks) and heifers in the other. Each year the steers and heifers swapped blocks. The paddocks were fertilised with superphosphate at the start of the Wet Season every year, at 70 kg/ha (and trace elements every 3 years), and spot sprayed for weeds in the early to mid Wet Season.

Each year the experimental paddocks were pasture sampled at the end of the Wet Season (May) and the end of the Dry (October). In each paddock, twelve 1m^2 quadrats were harvested using mechanical hedge trimmers. The pasture was put in paper bags, oven dried and then weighed.

Analysis

Each variable (Dry Season weight gain, Wet Season weight gain, total weight gain and P8 fat depth) was analysed with a factorial linear model (3 factor ANOVA) for the effect of stocking rate, genotype and sex at the 0.05 significance level. Cell mean variances were satisfactory so the data did not require any transformation.

All tables, other than Table 48, show the mean and standard error (in brackets) for each of the factor levels. The means were calculated from the empty weights. Means within each factor were tested using Tukey’s test for unequal numbers. Those with different superscripts are significantly different (the experiment-wise error rate was corrected to 0.05 using the Dunn-Sidak adjustment for multiple comparisons).

Results

(All the means for each treatment combination are presented in Table 1, Appendix 1).

Stocking Rate - Pasture

Table 48 shows that stocking rate had a significant effect on the amount of pasture available. Each time it was measured there was more pasture left in the paddocks with lower stocking rates than the medium and high stocking rates. On average, there was 15% less pasture in the paddocks with a medium stocking rate than the low stocking rate, and 26% less in the high than the medium stocking rate paddocks.

Table 48: The Effect of Stocking Rate on the Amount of Pasture on Offer

Stocking Rate	Average amount of pasture on offer (kg/ha).				
	May 01	Oct 01	May 02	Oct 02	Jul 03
High	1873 [a]	1709 [a]	2680 [a]	1647 [a]	2074 [a]
Med	2472 [b]	2356 [b]	3323 [b]	2410 [b]	2674 [b]
Low	2725 [c]	2824 [c]	3832 [c]	3103 [c]	3646 [c]

Means in the same columns with different letter superscripts are statistically different ($P < 0.001$).
In 2001 the means are for the steers only.
Each year was analysed separately.
Data from pre-May 01 was not analysed as the sampling procedure was not reliable.

The differences between the amounts of pasture left at the end of the Wet Season and the end of the Dry each year are not as great as would be expected but this is due to the nature of buffel grass, as much of the weight comes from the stalks and by October it is mostly the stalks of the plants that are left.

Stocking Rate - Animal Performance

Not only did stocking rate have a significant effect on the amount of pasture on offer but it also affected the animal performance. Table 49 shows that stocking rate had a significant effect on animal performance in all of the growth parameters measured. Generally the effect was that the lower the stocking rate, the higher the weight gain. P8 fat depth also increased as stocking rate decreased. But while the growth of individual animals was reduced at higher stocking rates, the weight gain per hectare increased, and sustainably optimising the production of beef per hectare is more important to the profitability of a beef enterprise than optimising individual animal weight gain. The increase in beef production per hectare was greater from the low to medium stocking rate (42.2 kg) than from the medium to high stocking rate (36 kg). The reduced benefit from increasing the stocking rate above the medium rate (1.48 head/ha), and visual observation of the paddocks at the end of the Dry Season indicated that the medium stocking rate would be the most profitable in the long term without running the risk of overgrazing. While there were no visible effects on pasture composition in the short period of time that this highest stocking rate was implemented, the amount of bare ground between clumps of Buffel grass was increasing and it is likely that if this level of grazing pressure was sustained that in the longer term weeds would start invading the pasture.

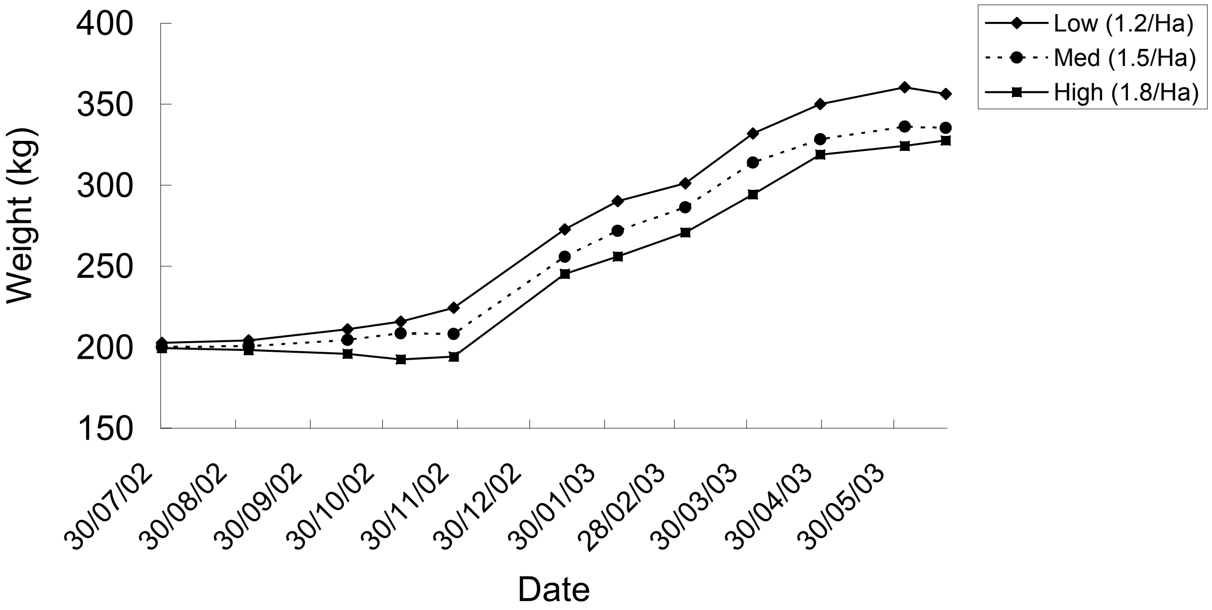
Table 49: The Effect of Stocking Rate on Growth Parameters (average of all years' data)

Stocking Rate	Dry Season growth (kg/head)	Wet Season growth (kg/head)	Total year growth (kg/head)	Total year growth (kg/ha)	P8 Fat depth (mm)
Low	10.0 (0.58) [a]	145.7 (1.40) [a]	155.7 (1.46) [a]	178.14 (2.85) [a]	8.3 (0.30) [b]
Medium	8.4 (0.52) [a]	140.1 (1.26) [a]	148.5 (1.31) [b]	220.33 (4.01) [b]	7.4 (0.27) [a,b]
High	6.0 (0.47) [b]	136.2 (1.13) [b]	142.0 (1.18) [c]	256.31 (5.04) [c]	6.9 (0.24) [a]

Means in the same column with different letter superscripts are significantly different ($P < 0.05$).
Standard errors are in brackets. Growth means are calculated from empty weights.

Figure 6 shows the effect of stocking rate on the weight gain pattern of heifers in 2002/03. This pattern was typical of all the years. While animals from the different stocking rates started at the same average weights, those at the lower stocking rates put on more weight than those stocked at the medium stocking rate and they put on more weight than those at high stocking rates.

Figure 6: DDRF Heifer growth 2002/3. Effect of stocking rate on growth.



This effect of stocking rate on growth and fatness is to be expected as when more pasture is available, cattle will grow more. The implications for meeting market specifications are that low stocking rates can be used to get increased growth in feeder cattle that start at lighter (weaning) weights and otherwise may not achieve a target weight for live export. But if a time comes when cattle are sold by specifications and incentives are paid for leaner cattle (which would have more value adding potential in a feedlot), then higher stocking rates can be used to reduce growth and fatness and hence increase value adding potential.

Genotype

There were no significant differences in annual growth between the different breeds (see Table 50). The 1/4 Charolais did grow significantly less than the Droughtmasters in the Dry Season but they grew more in the Wet, which even though it was not significant ($P< 0.05$) meant that they grew more over the whole year (again the difference was not significant).

While there were no significant differences in growth, the 1/4 Charolais and the Droughtmasters were significantly leaner than the Brahmans at the end of the post weaning year. While it is to be expected that the 25% Charolais genes would make the 1/4 Charolais leaner due to their larger mature size, the fact that the Droughtmasters were also significantly leaner than the Brahmans is somewhat surprising.

Table 50: The Effect of Genotype on Growth Parameters (Average Of All Years Data)

Breed	Dry Season growth	Wet Season growth	Total growth	P8 Fat depth
1/4 Charolais	6.8 (0.57) ^{a}	143.3 (1.40) ^{a}	149.9 (1.46) ^{a}	6.5 (0.29) ^{a}
Droughtmaster	9.7 (0.68) ^{b}	138.1 (1.40) ^{a}	146.8 (1.46) ^{a}	6.5 (0.30) ^{a}
Brahman (K)	7.3 (0.57) ^{a,b}	140.1 (1.39) ^{a}	147.4 (1.45) ^{a}	7.9 (0.29) ^{b}
Brahman (MS)	8.8 (0.58) ^{a,b}	141.1 (1.64) ^{a}	150.9 (1.71) ^{a}	9.2 (0.35) ^{b}

Means in the same column with different letter superscripts are significantly different (P< 0.05).

There was a significant (P = 0.0001) sex x breed interaction for P8 fat depth. The interaction plot in Figure 1 (in Appendix 1) shows that this was due to the Mt Sanford Brahman heifers being much fatter than all the other groups. This is the reason why the Mt Sanford Brahmans appear to be the fattest in Table 50. The Mt Sanford Brahman steers were actually leaner than the Kidman Springs Brahman steers but the much higher fatness of the heifers increases the overall figure for the Mt Sanford Brahmans.

There was also a significant (P< 0.05) sex x breed interaction for Wet Season and total growth (as nearly all of the growth occurs in the Wet Season, it is not surprising that the interaction effects both for Wet Season and total growth). The interaction plot in Figure 2 (in Appendix 1) shows that the effect was that the 1/4 Charolais heifers grew significantly more than all the other heifers in the Wet Season, while the Droughtmaster steers grew significantly less than the steers of the other breeds in the Wet Season.

Gender

Steers grew significantly more than heifers and were significantly leaner at the end of the post weaning year (see Table 51). On average over the post weaning year steers grew 12% more than heifers and were 2.9 mm leaner. As a result they are not only the more profitable animals to run in terms of growth but they have more value adding potential as well. Heifers have to be slaughtered at lighter weights if they were to be of the same target fatness as steers.

Table 51: The Effect Of Sex On Growth Parameters (Average Of All Years Data)

Sex	Dry Season growth	Wet Season growth	Total growth	P8 Fat depth
Heifers	6.7 (0.42) ^{a}	132.5 (1.02) ^{a}	139.1 (1.07) ^{a}	9.0 (0.22) ^{a}
Steers	9.6 (0.43) ^{b}	148.8 (10.5) ^{b}	158.4 (1.09) ^{b}	6.1 (0.22) ^{b}

Means in the same column with different letter superscripts are significantly different (P< 0.05).

Conclusions

This experiment has provided information that will be useful to NT cattle producers if or when the live export market starts to pay premiums for animals with more value adding potential. Now that the effect of factors such as stocking rate, breed and sex are known, they can be used to manipulate value adding potential.

2.2 Growing Feeder Cattle on Native Pasture

Purpose

To measure, analyse and report on the effects of genotype, weaning weight range, sex and management system on the growth and value-adding potential of first weaning round commercial Brahman weaners at the end of their first post weaning Wet Season.

This work was mainly aimed at quantifying for first weaning round weaners, *in the environment of production*, the effects of:

- weaner weight range (4),
- genotype (4),
- sex (2),
- grazing management system (2),

on:

- post weaning efficiency (kg gain/km^2/yr),
- turnoff weight,
- value-adding potential and end-use suitability at turnoff,
- the proportion of carryover cattle from the annual weaner crop,

up to the end of their first post weaning Wet.

Background

There is a paucity of information on the performance of young commercial Brahman cattle on native pasture in the Victoria River District (VRD), up to the end of their first post weaning Wet Season. This time period is important as most managers in the area try to get their turnoff cattle onto a boat for live export one year after weaning.

Mitchell grass constitutes a major pasture community in the VRD and provides a plane of nutrition that is well suited to the growing phase of beef production.

This experiment is the first occasion when a project has incorporated estimated safe carrying capacity, full supplementation, saved pasture and rotational use of fire as a management package in a post weaning feeder steer production system.

The experiment provides part of the mosaic of information required to compare the financial effects of shifting to a two-stage beef industry in the northern half of the NT (breeding only on native pasture and growing and fattening on improved or sub-coastal flood plain pastures in higher rainfall areas).

An experiment conducted in 1994 by Peter Ridley at DDRF (unpublished) demonstrated that the property of origin differences in the growth rate of first weaning round commercial Brahman steer weaners from the VRD, were negligibly small and were not statistically significant (15 property of origin sources were compared over a four year period on buffel pasture at DDRF). The experiments reported in this report at 2.1.5 and 2.2.2 were contemporary comparisons between the three weaner genotypes from Kidman Springs and Mt Sanford Station weaners. They therefore provided an industrially plausible link between the results obtained with the three weaner genotypes derived from Kidman Springs at the two sites and the relative performance of commercial Brahman steer weaners throughout the VRD.

By using weaners from a common source, experiment 2.1.5 at DDRF (improved pasture) and 2.2.2 at Mt Sanford (native pasture), provided industrially and scientifically credible data on the relative:

- annual weight gain potential at each site (native vs. improved pasture),
- value-adding potential and end-use suitability of feeder cattle at the end of their first post weaning Wet at each site,
- annual growth and residual value-adding potential of Droughtmaster, Brahman and 1/4 Charolais first weaning round steer weaners from Kidman Springs Breeder Genotype Comparison and commercial Brahmans from the Mt Sanford Station herd within and between both sites,
- proportion of a weaner herd at each site likely to reach specified export liveweight targets by the end of its first post weaning Wet and the residual value-adding potential of the feeders that made this liveweight target.

2.2.1 Research Site Description

Location

The trial area was located at Black Gin Bore (17° 12' S, 130° 38' W) on Mt Sanford Station in the southern Victoria River District (VRD) of the NT (see Figure 7). The whole project area (see Figure 8) was formed by fencing off 65 km^2 from the southern part of Mt Sanford's 200 km^2 Poison Creek paddock. It is about 35 km north of Kalkarindji and about 450 km west of Katherine. This experiment used the Quail, Finch, Galah and Turkey paddocks (see Figure 8).

Immediately prior to the start of the 1998/99 year the original 12 km^2 Quail paddock was divided in to two 6 km^2 paddocks named Quail and Finch as shown on the site map (see Figure 8). During 1998/99 Finch was subdivided in to three equal area plots, Finch 1,2 and 3. Grazing between these three plots was unrestricted during 1998/99. When it became apparent from the 1998/99 weaner growth data that there was a significant difference between the new Quail and Finch in their ability to support weaner growth the process of subdividing Galah was commenced to provide replication for the grazing management system comparison. This paddock was also split in to a 6 km^2 portion (renamed Galah) and three plots 2 km^2 named Turkey 1,2 and 3 as shown on the site map (see Figure 8). Since there is a slight north-south slope on the land form in those paddocks, the pattern of the Galah subdivision was the reverse of Quail, with the rotational treatment in the southern paddock rather than the northern one (Figure 8).

Soils and Pastures

Except for some minor sandstone ridges, the underlying geology of the site is basalt. There are three basic land types:

- Spinifex covered ridges and low hills,
- Red-brown soils low rises covered in arid short grasses (Antrim landsystem),
- Black soil plains dominated by tufted perennial grasses (Wavehill landsystem).

Appendix 2 shows the experimental area was almost entirely:

- 6a - Basalt plains; cracking clays (and structured earths on small rises); grassland of Golden Beard Grass, Mitchell Grasses, Flinders grasses and Native Couch with isolated trees and shrubs; surface gravel stone and rock.
- With very minor areas of 5a3 - Basalt rises; shallow soils, structured earths duplex soils and cracking clays.

Figure 7: Location of Mt Sanford Station.

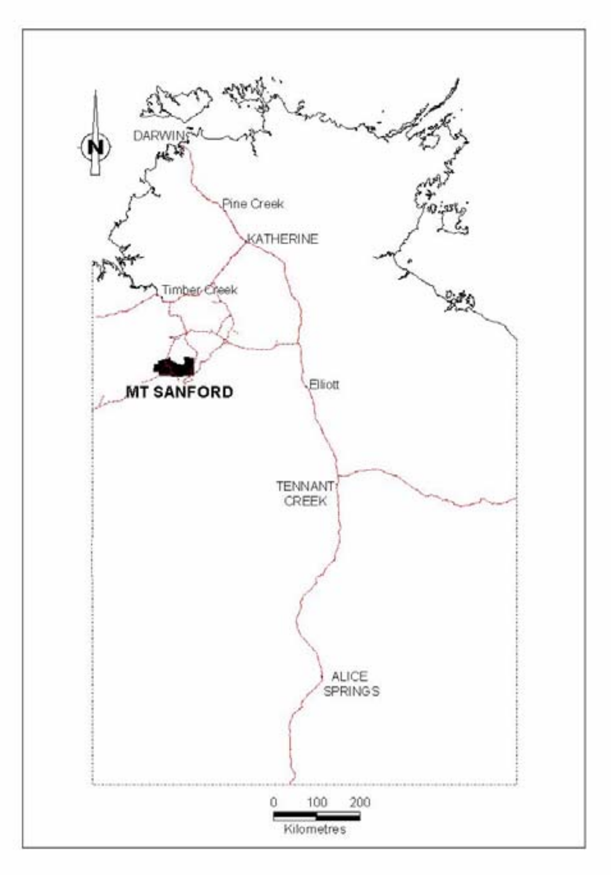
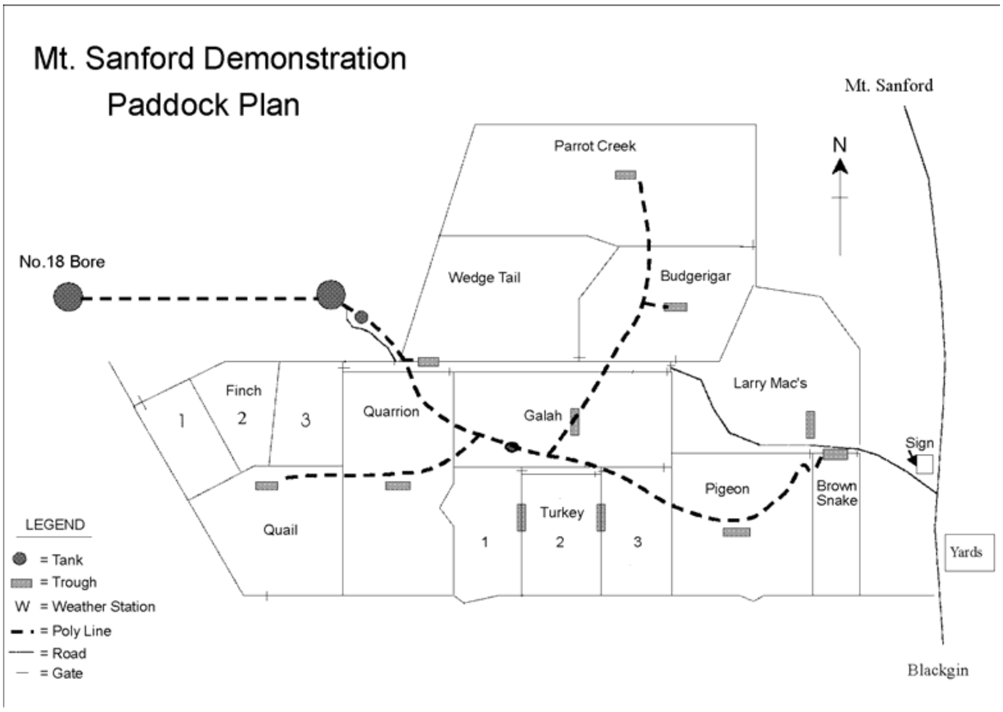


Figure 8: Mt Sanford trial area – Paddock Map.



General Materials And Methods

All weaners were vaccinated with bivalent botulinum vaccine according to the manufacturers' directions. They were all individually tagged, dehorned and castrated as required after their weaning ELW was recorded. They were then allowed to settle down for several weeks in a holding paddock adjacent to the yards before being mustered, reweighed, drafted in to their experimental mobs and walked to their experimental paddocks.

The cattle were weighed in the October after weaning to allow calculation of Dry Season growth and then again the following May to allow calculation of Wet Season and total year growth. The animals would then be removed from the trial and were replaced by the next year's weaners.

The weighing procedure was that cattle were mustered on one day and then held in the yards overnight with access to water but not to feed and then they were weighed the next morning. The wet curfew was in the interests of animal welfare. The experimental animals had to walk up to 12 km the day before weighing and the same distance again less than 24 hours after weighing. Fat depth was measured ultrasonically at the P8 site with a Meritronics ultrasound machine.

The stocking rate was 20 head per km^2 (see below for explanation), 120 head were put into each of the basic paddocks and 60 head were put into 2 of the 3 paddocks in each replicate of the pasture saving system areas.

The sustainable stock numbers (20 hd/km^2) were estimated by:

- assuming an initial empty liveweight (ELW) of 180 kg at weaning and 150 kg/hd gain by the end of the first post weaning Wet (MacDonald, *pers. comm.*),
- using the British metabolisable energy system (MAFF, 1984) with adjustments recommended by Corbett *et al.* (1994) to allow for the effects of energy expended while grazing and the lower maintenance energy requirements of *Bos indicus* cattle,
- assuming values for the ME/kg dry matter for pasture in the Wet and the Dry relevant to the assumed performance,
- assuming that the sustainable level of pasture intake/unit area was no more than 25% of what grew in 70% of years (Dyer, *pers. comm.*),
- estimating historical levels of annual pasture growth from historical rainfall records (Dyer *pers. comm.*).

A "basic" management system was compared to a "pasture saving" system (the grazing management systems are described briefly below and more fully in 2.2.2.3) and within that experiment, animals of different genotypes, sex and weaning weight ranges were allocated to paddocks so that the effects of these factors could be examined simultaneously. The genotype comparison comprised three weaner genotypes from Kidman Springs (Droughtmaster, Brahman and 1/4 Charolais-3/4 Brahman) and similar aged commercial Brahman weaners from Mt Sanford Station.

Brief Description of the Grazing Systems

In the "Basic" system, 120 weaners go into a 6 km^2 paddock at the first weaning round (May) and come out at round 1 in the following year (when the next year's weaners go in). The stocking rate was calculated so that the animals remove no more than 25% of the grass that grew in 70% of years.

In the "Pasture Saving" system the same thing happens except that the 6 km^2 paddock has been divided into three 2 km^2 paddocks and one of these paddocks is being saved at any one time. Therefore 60 weaners go into each of the two 2 km^2 paddocks that are being grazed. Each year half of the saved paddock is burnt. The paddock that is being saved rotates around the three paddocks every year so each paddock gets spelled once every three years and each half paddock is burnt once every 6 years. There are 2 “basic” paddocks (Quail and Galah) and 2 sets of the 3 “pasture saving” paddocks (Finch 1, 2, 3 and Turkey 1, 2, 3 - see Figure 3).

The grazing systems - the shaded areas are grazed each year.

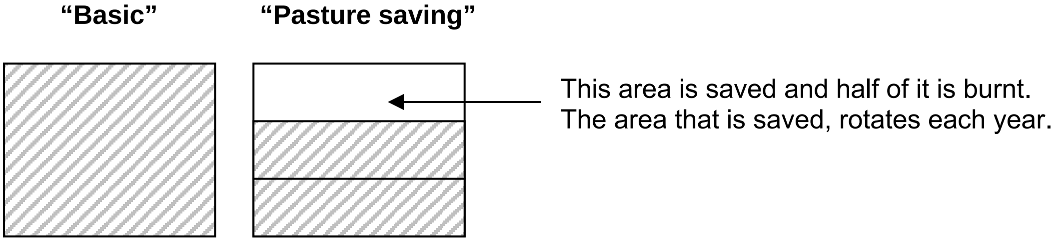


Table 52: Comparison of the two management systems (there are 2 replicates of each)

	“Basic”	“Pasture saving”
Total area	6 km^2	6 km^2 (3 x 2 km^2)
Area grazed each year	6 km^2	4 km^2
Number of weaners	120	120
Effective stocking rate	20 head/km2	30 head/km2

In 1999/00 there was a major disruption to grazing in the middle of the Wet when much of the water reticulation pipeline became clogged with limestone deposits and stock had to be removed from their plots for several weeks while the pipelines were renovated. In 2000/01 the experiment was again disrupted, this time by major flooding which again necessitated a period of destocking of the plots. As a result there is only limited reliable data from these years. There were no such problems in the last 2 years and that data is reliable enough for drawing conclusions.

2.2.2 The effects of weaning weight range, sex, genotype and grazing management system on growth, post weaning efficiency and value adding potential in weaners at the end of their first post weaning Wet Season.

There were three separate objectives within this project that were addressed in the years shown in brackets below:

Objective 1 To measure the effect of weaning weight and sex on post weaning growth and final value-adding potential of commercial Brahman weaners up to the end of their first post weaning Wet (1998/99).

Objective 2 To compare three weaner genotypes from the Kidman Springs Breeder Genotype Comparison with similar aged commercial Brahman weaners from Mt Sanford in terms of post weaning growth and final value-adding potential at the end of their first post weaning Wet (1999/00, 2000/01).

Objective 3 To compare the effects of weaning weight, sex and grazing management system on post weaning growth and final value-adding potential in weaners at the end of their first post weaning Wet (2001/02, 2002/03).

2.2.2.1 Summary

A summary of the findings associated with each objective is provided here. This is followed by the Background, Results and Conclusions for each objective separately.

Objective 1: (Weaning Weight and Sex)

- There were unexpected and highly significant negative relationships (P< 0.001) between weaning weight and weight change, in both the Dry and over the whole year. Average growth in the Wet was 7.0 kg/hd. The lightest weaning weight range group (100-140 kg) gained 3.2 kg/hd and recorded a 22.3 kg/hd advantage over the heaviest (220-240 kg) in the Dry retaining all of this advantage at the end of the first post weaning Wet. There was no evidence of compensatory growth in the Wet. For each extra kilogram of weaning weight, final ELW decreased by 0.21 kg.

  This result suggests that there is no justification for the view that calves ≤140 kg should not be weaned at WR1 because they will not thrive in the Dry.

  Furthermore, in the case of the 100-140 kg WW range steer weaners, data from Kidman Springs suggests that if they had not been weaned at WR1 they would have gained about 90-100 kg/hd suckling their mothers through the Dry. Assuming that they grew 100 kg/hd in the Wet after weaning then they would average 120 + 95 + 100 = 315 kg/hd. Most would be heavy enough for the boat trade to SE Asia. This is probably what motivates not weaning them as 100-140 kg weaners, at the end of WR1. But if the two alternative weights are plotted on the Brahman steer MTG curve with P8 fat depth at 10 mm, it can be seen that the early weaning option provides a lightweight feeder (254 kg) with 94 kg/hd relative value-adding potential whereas the delayed weaning results in an average weight of 315 kg with no value-adding potential. Another reason for not delaying weaning.

  The equation developed to predict ELW from P8 fat depth and age in Projects 2.3.1 and 2.3.2 can be used to estimate the P8 fat depth of the late weaning option as 12.5 mm. Ready for slaughter for the Darwin light weight chiller trade!

- There was a highly significant negative relationship between weaning weight and residual relative value-adding potential at the end of the first post weaning Wet. A difference of 94 - 27 = 67 kg/hd, (P< 0.001), between the lightest and heaviest weaning weight range sets was observed. All weaning weight range sets were significantly different to each other (P< 0.05) for relative value-adding potential.

  The high relative value-adding potential for the lightest weaning weight range group is probably the origin of the misguided interest shown by some SE Asian feedlotters and their importing agents, in seeking to purchase heavy weight weaners as feeders. Heavy weaners at WR1 will be the same weight as lightweight yearlings from the previous WR1.The equation for estimating ELW from age and P8 fat depth that was developed in Projects 2.3.1 and 2.3.2 predicts that a 240 kg steer weaner at 8 months age will have more than 10 mm of P8 fat and therefore negligible relative value-adding potential. Incisor dentition score would not detect the 7–8 month age difference between these two groups of the same average weight. Colour tagging weight-range (age range) sets as suggested in Part 1 of this report would.

- In the two lowest weight ranges, where equivalent data was available for both steers and heifers, the steers grew significantly more than the heifers (12.1 kg/hd or 10.7% or 242.2 kg/km^2, $P < 0.001$) and had significantly greater residual value-adding potential (85.5 kg/hd vs. 51.0 kg/hd or 68%, $P < 0.001$). The latter difference provides a valid basis for a lower price/kg for female feeder cattle in an environment where feedlot feed is cheap relative to the value of carcase weight gains (such as often occurs in SE Asia) and where weight gain is an important component of feedlot profitability.

- The average ELW gain for all WR1 steer weaners was 116 kg/hd for the year to give a post weaning efficiency of 2320 kg/km^2/yr.

Objective 2: (Genotype)

- The 1/4 Charolais genotype gave significantly more annual growth (+11% or +12.8 kg/hd, $P < 0.05$) and greater post weaning efficiency (20 x 12.8 = 256 kg gain/km^2) than the Bra MS, and 80% more (40 kg/hd, $P < 0.001$) feedlot value-adding potential.

- Relative to the 1/4 Ch, the DM provided a lower annual growth improvement (+7% or +7.9 kg/hd, $P < 0.05$) and post weaning efficiency (+158 kg gain/km^2), and no improvement in feedlot value-adding potential, at the end of the first post weaning Wet.

- There was no difference in annual growth, post weaning efficiency or value-adding potential between the two Brahman genotypes.

- The basis of the growth advantage of the 1/4 Ch was their greater response to improved nutrition relative to weaners from the two Brahman sources. This was seen as their 15% (+16.4 kg/hd, $P < 0.05$) growth advantage in the Wet relative to the Bra MS and their 24.4 kg/hd weight change difference in the Dry between the two years. This weight change difference was nearly four times the between-year difference in the Bra MS (6.5 kg) and nearly twice the difference that occurred in the other two genotypes (13 kg).

- The close similarity between actual and estimated empty liveweights (ELW) in Table 9 indicates that the two Brahman sources are probably herds of the same mature size. This result, together with the results of earlier work (Project 8.4.1) in which there were no significant property of origin differences in Wet Season growth rate in groups of 20 or more weaners from 15 properties in the Katherine Region, suggests that Bra K results can be safely extrapolated to commercial Brahman herds in the Region without need of adjustment for genetic differences.

- The relative post weaning efficiency for the four genotypes was

Droughtmaster	2452 kg/km^2/yr
Brahman K	2324 kg/km^2/yr
1/4 Charolais	2550 kg/km^2/yr
Brahman MS	2294 kg/km^2/yr

Objective 3: (weaning weight, sex, stocking rate and grazing management system)

- While the Pasture Saving (PS) system only improved Dry Season weaner performance (response = + 4.5 kg) in the year with the very late Wet Season (2002/03), the Dry Season disadvantage in the more normal year was not large (-4.4 kg/hd, $P < 0.001$). By the end of the year the PS system had reduced annual growth by 7.4 kg/hd or 5.7% ($P < 0.001$) in the normal year and by 10.6 kg/hd or 13.9% ($P < 0.001$) in the short Wet year (2002/03). This effect may be one of the inescapable costs of sustainability.

- Weaning weight range had most effect on post weaning performance in the Dry Season immediately after weaning. This effect was greatest in the short season year (2002/03) when there were significant differences between three of the four weight range means ($P < 0.05$) for Dry Season weight change. In this year, these effects were still evident at the end of the first post weaning Wet although some statistically significant compensatory growth occurred during the Wet. In the normal year (2001/02) compensatory growth in the Wet ($P < 0.05$) eliminated the smaller Dry Season weaning weight range effects by the end of the Wet.

  In both years, the lightest weaners (100-140 kg) performed best in the Dry and in the difficult year of 2002/03 nearly 67% (18 kg) of this advantage was still retained at the end of the Wet. Clearly there is no justification for not weaning 100-140 kg weaners for fear that they are too immature to thrive in the Dry Season. There is also a less easily quantified benefit to their mother from such early weaning, in terms of significantly improving her pre-calving body reserves and the consequential effects this has on her lactation (growth rate of the next calf) and her inter-calving interval (the time taken to conceive the next calf). The implications of early weaning on value-adding potential have already been discussed in conjunction with the data obtained at this site in 1998/99.

  This WW range effect was consistent with that observed in 1998/99 at this site. From both data sets and data collected in Project 2.1.5 it appears that as Dry Season nutrition declines (as evidenced by increasingly negative Dry Season growth), the likelihood of Wet Season compensatory growth exceeding the Dry Season relative disadvantage in heavier weaners, decreases. In particularly difficult Dry Seasons there will be a significant residual weight disadvantage at the end of the first post weaning Wet.

  Data from Project 2.1.5 which used weaners drawn at random from the same pool (not just the same properties) as Project 2.2.2 shows no evidence of a Dry Season advantage for lightweight Brahman weaners relative to heavyweight weaners. Average Dry Season growth in Brahman weaners in 2.1.5 was never negative for the whole group.

- The direct effect of saved pasture in the Dry Season was negligibly small in both years (1.1 kg/hd in 2001/02 and 2.0 kg/hd in 2002/03 the difficult year).

- The direct effect of a 50% increase in stocking rate was a relatively small decrease in growth per head over the whole year in 2001/02 (-1.6 kg/hd, NS) with a larger and significant effect in the low rainfall late season of 2002/03 (-8.6 kg/hd or –8.1%, $P < 0.01$).

- The average growth of WR1 steer weaners in the Basic grazing management system was 130.7 kg/hd in the “normal” year (2001/02) and 76.5 kg/hd in the low rainfall late Wet Season year (i.e. only 58.5% of the previous year). This gave a range of 1530–2614 $kg/km^2/yr$ for relative post weaning efficiency.

2.2.2.2 Objective 1

To measure the effect of weaning weight and sex on post weaning growth and final value adding potential of commercial Brahman weaners up to the end of their first post weaning Wet.

Background

The Basic management system used in this project compromised:

- a sustainable stocking rate (20 hd/km^2),
- *ad libitum* supplement in the Dry (N) and the Wet (P),

Two 6 km^2 replicate paddocks (Finch and Quail) were stocked with first and second weaning round (WR) weaners from Mt Sanford Station shortly after they were weaned (in June and September 1998 respectively). See the general materials and methods in 2.2.1 for a description of the methodology.

The population structure was set up to mimic the sex, weaning weight and weaning round distribution of an annual calf crop from a herd using the Best Bet breeder management package developed at Kidman Springs. There were four weaning weight ranges for steer weaners but only two (the two lightest) for heifers because the heavier heifers were required as replacement breeders and were not included in this population.

Table 53: Numbers of Weaners, and Initial Average Weaning Weights.

WR	Sex	Finch			Quail		
		n	kg	kg/hd	n	kg	kg/hd
1	*S*	71	13050	184	72	12949	180
	H	36	5155	143	36	4892	136
	total	105	18205	173	108	17841	165
2	S	21	3290	157	23	3905	170
	H	12	1727	144	12	1648	137
	total	33	5017	152	35	5553	159

WR = weaning round, S = steer, n = number of weaners, H = heifer

Table 53 shows:

- the population structure,
- the number of weaners initially allocated to each treatment combination in each paddock,
- the initial stocking rates in the Dry (17.8 hd/km^2) and the Wet (23.4 hd/km^2),
- the average weaning weights (169 kg at WR1 and 156 kg at WR2).

The overall grazing pressure in the two replicates was close to identical at the time of adding the WR1 weaners (Finch = 3034 kg/km^2, Quail = 2974 kg/km^2).

The two paddocks were to be replicates for a genotype comparison between three weaner genotypes from Kidman Springs and typical VRD commercial Brahman weaners up to the end of their first post weaning Wet, when the Kidman Springs weaners became available in 1999/00. It was also planned to confound grazing management system with replicate block and acquire some preliminary information on this aspect of the feeder-cattle production system if there was no significant difference in the growth of weaners between the two paddocks in 1998/99.

Results

The first element of Table 54 shows the numbers of first weaning round steer weaners for which full data was available. For a variety of reasons (escapes, fail to muster, lost tags, unconfirmed deaths etc) not all of the weaners initially allocated to the two replicates provided data for analysis

In the second element, weaning weight (WW) was used to estimate the weaning age (WA) of each subset using the formula described earlier in this report. The estimated WA in months is given in brackets. WW and estimated WA were identical for the two replicates. There was also good agreement in the mean values for these two variables between the two replicates for each weaning weight range.

Table 54: Results for WR1 Steers (1998/99)

Variable	WW Range (kg)	Finch	Quail	n	Sig
N	100-140	16	11	27	NR
	141-180	18	14	32	
	181-220	15	17	32	
	221-260	14	16	30	
	Total	63	58	121	NR
WW (kg) (Age) mo	100-140	127 (3.6)	123 (3.6)	125 (3.7)	NR
	141-180	163 (5.1)	163 (5.2)	161 (5.1)	
	181-220	202 (6.7)	205 (6.9)	204 (6.8)	
	221-260	239 (8.2)	237 (8.1)	238 (8.2)	
	Total	182 (6.0)	182 (6.0)		NS
Dry Growth (kg)	100-140	+2.3	+4.1	+3.2 ^{A}	P< 0.05
	141-180	+1.8	-6.7	-2.5 ^{B}	
	181-220	-0.8	-10.9	-9.5 ^{C}	
	221-260	-16.0	-22.2	-19.1 ^{D}	
	Av	-5.0	-8.9		P< 0.05
Wet Growth (kg)	100-140	130.8	119.8	125.3	NS
	141-180	122.9	121.8	122.4	
	181-220	122.4	118.0	120.2	
	221-260	128.6	120.3	124.2	
	Av	126.2	120.0		P< 0.01
Total Growth (kg)	100-140	133.1	123.9	128.5 ^{A}	P< 0.05
	141-180	124.7	115.1	119.9 ^{B}	
	181-220	114.4	107.1	110.8 ^{C}	
	221-260	112.6	98.1	105.4 ^{C}	
	Av	121.2	111.1		P< 0.001
Final W (kg) (Age) mo	100-140	260 (14.8)	247 (14.6)	254 (14.7)	NR
	141-180	284 (16.1)	278 (16.2)	281 (16.1)	
	181-220	316 (17.7)	313 (17.8)	314 (17.7)	
	221-260	352 (19.2)	355 (19.1)	343 (19.1)	
	Av	303 (17.0)	293 (17.0)		NR

Values with a different alphabetic superscript within a cell are significantly different (P< 0.05).
NR = not relevant NS = not significant

In the third element, weight changes in the Dry in all four weight range subsets were significantly different ($P < 0.05$). There was a consistent trend, with the lightest WW range weaners unexpectedly performing best (+ 3.2 kg/hd) and the heaviest weaners worst (-19.1 kg/hd). There was a significant negative correlation between WW (x) and weight loss in the Dry (Y):

$$Y = -0.19x + 27.9 \qquad r^2 = 0.41 \qquad P < 0.001$$

The fourth element shows that during the Wet there was no significant effect of WW range on growth (i.e. compensation did not appear to occur), and this was consistent with the higher regression coefficient in the regression of total gain (y) on WW (x).

$$Y = -0.21x + 154.2 \qquad r^2 = 0.23 \qquad P < 0.001$$

Over the whole year there was a significant effect of WW range on growth ($P < 0.05$) with the two lower WW range groups different from both each other ($P < 0.05$) and the two heavier groups ($P < 0.05$). The two heaviest weight range groups did not differ significantly in total growth over the 11 month period. Relative to weaners in Quail, weaners in Finch:

- lost less weight in the Dry (3.9 kg, $P < 0.05$),
- gained more weight in the Wet (6.2 kg, $P < 0.01$),
- gained more weight over the whole year (10.1 kg, $P < 0.001$).

This result clearly indicated that replication would be needed if a valid comparison between the two grazing management systems was to occur in the future.

The final element in Table 54 provides the turnoff weight and age (in months) for the cattle in this data set. The final weighing occurred 11 months after weaning and final age was obtained by adding 11 to the weaning age estimates obtained from the weaning weights.

Figure 9 provides the MTG curve derived for Brahman steers in Part 1 of this report. An estimate of the value-adding potential of the 100-140 kg WW range set at the end of its first post weaning Wet has been obtained in this Figure by assuming:

- a 20 day delay between final muster on the property of origin and commencement of feeding at the destination feedlot in SE Asia,
- zero carcase weight loss during transportation (property of origin to SE Asian feedlot),
- an ELW growth rate of 1 kg/d in the SE Asian feedlot.

The weight/age at feedlot turnoff for this weaning weight range set is the point of intersection of the hypotenuse of the weight x age triangle (1.0 kg/d) with the P8 = 10 mm MTG line (i.e. at 348 kg/18.3 months).

This provides the following slaughter estimates for this WW range set:

Value adding potential = 348-254 kg = 94 kg

End-use specifications

P8 = 10 ± 5 mm

ELW = 350 ± 30 kg

HSCW = 190 ± 15 kg (ELW x .54) Hot standard carcase weight

Figure 9: Brahman steer MTG curve (P8 = 10 mm)

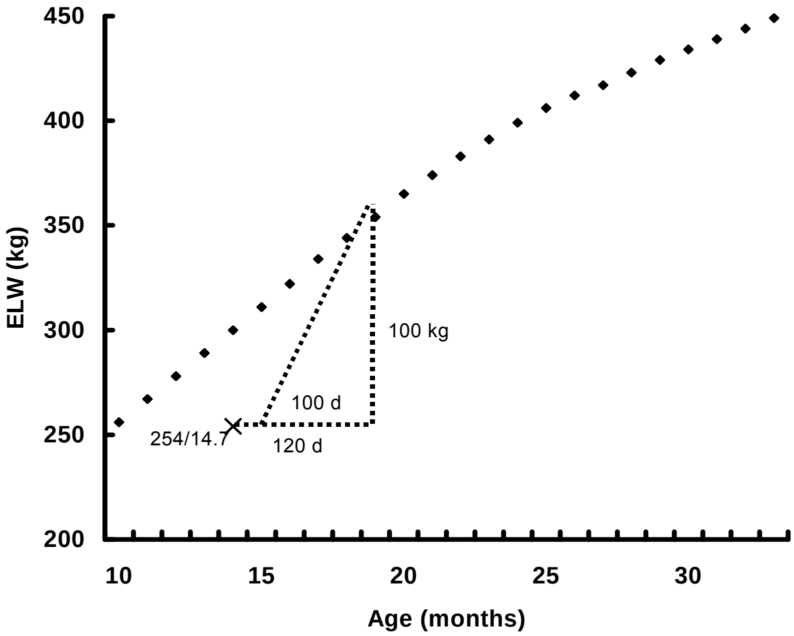


Figure 10 shows the ELW/age co-ordinates at turnoff from property of origin (X) and ELW/age at feedlot turnoff (▲) for all four weaning weight range sets, using this approach.

Figure 10: Brahman steer MTG curve (P8 = 10 mm)

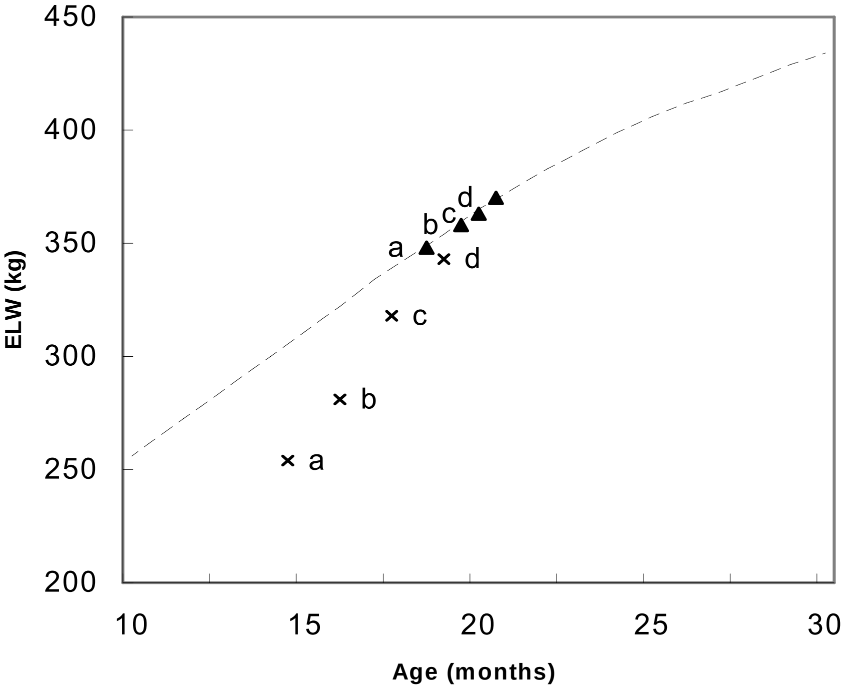


Table 55 provides the numerical values for these co-ordinates and the estimated value-adding potential for each weaning weight range set.

Table 55: Estimates of Value-Adding Potential

WW Range (kg)	Point on Graph	Turnoff ELW (kg)	Turnoff Age (mo)	Feedlot ELW (kg)	Feedlot Age (mo)	Value-Adding (kg)
100-140	a	254	14.7	348	18.3	94
141-180	b	281	16.1	358	19.4	77
181-220	c	318	17.7	363	19.8	45
221-260	d	343	19.1	370	20.5	27

Value adding potential = ELW at feedlot turnoff minus ELW at property of origin turnoff. In this case value adding potential in kg is equal to the period in the feedlot in days because the least cost ration has been assumed to grow the feeder cattle at 1.0 kg/day.

Table 56 shows the number of WR1 steer and heifer weaners in the two lightest WW range sets, their total growth for the year and their value-adding potential as determined using the method outlined above. Steers grew 12.1 kg or 9.7% (P< 0.001) more than heifers and had 34.5 kg more value-adding potential at the end of their first post weaning Wet.

Table 56: The Effect of Sex and WW Range on Annual Growth and Value- Adding Potential in Young Commercial Brahman Steers and Heifers at the End of their First Post weaning Wet.

WW Range kg	Steer				Heifer				Sign
	n	Wean Age mo	Total Gain kg	Value-Adding kg	n	Wean Age mo	Total Gain kg	Value-Adding kg	
100-140	27	3.7	129.4	94	29	3.8	117.1	60	
141-180	34	5.2	120.4	77	35	5.4	108.5	42	
Av			124.9	85.5			112.8	51.0	P< 0.001

Conclusions

- By end of their first post weaning Wet, the WR1 steer weaners in this calf crop gained 116.2 kg/hd, grew 12.1 kg/hd (10.7%, P< 0.001) more than heifers and had an estimated residual 61 kg/hd value-adding potential for the next (feedlot) phase of production.

- There was an unexpected and highly significant (P< 0.001) negative relationship between weaning weight and weight change in the Dry (eg. the lightest WW range weaners gained a 22.3 kg/hd advantage over the heaviest WW range set in this period). There was no apparent compensatory growth in the Wet. This suggests that there is no justification for the view that calves ≤140 kg should not be weaned at WR1 because they will not thrive in the Dry.

- Furthermore, in the case of the 100-140 kg WW range steer weaners, data from Kidman Springs suggests that if they had not been weaned at WR1 they would have gained about 90-100 kg/hd suckling their mothers through the Dry. Assuming that they grew 100 kg/hd in the Wet after weaning then they would average 120 + 95 + 100 = 315 kg/hd. Most would be heavy enough for the boat trade to SE Asia and this is what motivates not weaning them as 100-140 kg weaners, at the end of WR1. If the two alternative weights are plotted on the Brahman steer MTG curve with P8 fat depth at 10mm, it can be seen that the early weaning option provides a lightweight feeder (254 kg) with 94 kg/hd value-adding potential whereas the delayed weaning results in an average weight of 315 kg with negligible value-adding potential! Another reason for not delaying weaning. Unfortunately there are as yet no premiums for higher value-adding potential feeder cattle to act as an incentive, primarily because of the absence of a value-based description system.

- There was also an important negative relationship between WW range and estimated value-adding potential in both sexes, and heifers had significantly lower (34.5 kg/hd or 40%, P< 0.001) value-adding potential than steers of the same initial WW range.

2.2.2.3 Objective 2

To compare three weaner genotypes from the Kidman Springs Breeder Genotype Comparison with similar aged commercial Brahman weaners from Mt Sanford in terms of post weaning growth and final value-adding potential at the end of their first post weaning Wet.

Background

Two 6 km^2 replicate blocks (Finch and Quail) were again available for use in 1999/00 when the first weaners from Victoria River Research Station became available.

Each paddock contained weaners in a replicate of the Genotype comparison and a Weaning Weight (WW) Range comparison. See the general materials and methods in 2.2.1 for a description of the methodology.

The Genotype comparison comprised three weaner genotypes from Kidman Springs (Droughtmaster, Brahman and 1/4 Charolais) and similar aged commercial Brahman weaners from Mt Sanford Station. Earlier work at DDRF had demonstrated that it was unlikely that there were significant differences in the growth potential of commercial Brahman weaners between stations in the VRD and so the Mt Sanford Brahmans were both the control and a proxy for VRD commercial Brahmans in general.

The WW Range comparison contained only Mt Sanford weaners. Their ages and weights were similar to those of the Kidman Springs weaners

Tables 57 and 58 show the first weaning round (WR1) weaner numbers and weights in the two replicate blocks each year. The stocking rate through the Dry was 78 hd / 6 km^2 = 13 hd/km^2 with an initial grazing pressure of about 2600 kg/km^2.

Table 57: WR1 Weaner Numbers and Initial ELW in 1999/2000

Comp	Geno	Finch			Quail		
		n	kg	kg/hd	n	kg	kg/hd
Geno	DM	10	1950	195	10	1975	198
	Bra K	10	1865	187	9	1665	185
	1/4 Ch	10	2050	205	10	2075	208
	Bra MS	9	1740	193	10	1940	194
	Total	39	7605	195	39	7655	196
Weight Range	Lo	18	2176	121	19	2324	122
	Hi	21	4700	224	20	4628	231
	Total	39	6876	176	39	6952	178
Total		78	14481	186	78	14607	187

Table 58: WR1 Weaner Numbers and Initial ELW in 2000/01

Comp	Geno	Finch			Quail		
		n	kg	kg/hd	n	kg	kg/hd
Geno	DM	10	1864	186	10	1917	192
	Bra K	11	2226	202	10	2152	215
	1/4 Ch	8	1832	229	10	2020	202
	Bra MS	10	2124	212	10	2191	219
	Total	39	8046	206	40	8280	207
Weight Range	Lo	26	3365	129	25	3359	122
	Hi	20	4804	242	23	6100	231
	Total	46	8169	178	48	9459	197
Total		85	16515	194	88	17739	202

In 1999/00 there was a major disruption to grazing in the middle of the Wet when much of the water reticulation pipeline became clogged with limestone deposits. The experimental animals had to be removed from their plots and mixed with Mt Sanford cattle in an adjacent paddock for several weeks while the pipelines were renovated.

In 2000/01 the experiment was again disrupted, this time by major flooding which again necessitated a period of destocking and mixing with Mt Sanford cattle.

These disruptions did not significantly compromise the analysis of the Genotype comparison as they were returned to their correct paddocks. The main effect was the loss (disappearance) of some Mt Sanford animals. It was decided to use the WW Range comparison animals (which were all Bra MS in genotype) as the control and confine the analysis to WR1 animals only.

Results

Table 59 provides the number of animals available for analysis (n) and the values for mean ELW at weaning (WW) for all treatment combinations and the estimates of weaning age (WA) derived from these WW means using the formula described in Part 1 of this report. The Kidman Springs derived weaners were weaned a month earlier than the Bra MS weaners.

Table 59: ELW (kg) and Estimated Age (months) at Weaning.

Geno	Year						Average		
	1999/00			2000/01					
	n	WW	WA	n	WW	WA	n	WW	WA
DM	14	198	6.6	15	198	6.6	29	198	6.6
Bra K	19	186	6.1	18	209	7.0	37	197	6.6
1/4 Ch	16	207	6.9	15	201	6.7	31	204	6.8
Bra MS	61	176	5.7	77	186	6.1	138	181	5.9

Table 60 shows that both year ($P < 0.001$) and genotype ($P < 0.001$) had a significant effect on growth in the Dry. There were also significant differences between genotypes with DM weaners having the best performance in both years. A range of less than 5 kg covered the other three genotype means.

Growth in Finch was significantly lower than growth in Quail (0 vs. + 5.8 kg, $P < 0.001$). This was the reverse of the difference observed in 1998/99.

Table 60: The Effect of Year and Genotype on Dry Season Growth of Weaners.

Genotype	Year 1999/00 (kg)	Year 2000/01 (kg)	Average kg	Sig
DM	+2.0	+14.9	+8.5^{A}	P< 0.001
Bra K	-7.2	+ 5.8	-0.7^{C}	
1/4 Ch	-9.0	+15.4	+0.2^{BC}	
Bra MS	+0.5	+7.0	+3.8^{B}	
Average	-3.4	+13.1		P< 0.001

Values with different alphabetic superscripts are significantly different (P< 0.05).

Genotype had a significant effect (P< 0.001) on Wet Season growth (see Table 60) with all four genotypes being significantly different to each of the other three (P< 0.05). The 1/4 Ch performed best in both years and grew 14.8% or 16.4 kg more than the control (Bra MS). There was no significant year effect. Growth in Finch was again significantly lower than in Quail (114.0 kg vs. 120.6 kg, P< 0.01).

Table 61: The Effect of Year and Genotype on Wet Season Growth of Weaners.

Genotype	Year 1999/00 (kg)	Year 2000/01 (kg)	Average kg	Sig
DM	113.1	115.1	114.1^{C} (103)	P< 0.001
Bra K	118.6	115.2	116.9^{B} (105)	
1/4 Ch	134.7	119.9	127.3^{A} (115)	
Bra MS	110.3	111.5	110.9^{D} (100)	
Av	119.2	115.4		NS

Values with different alphabetic superscripts are significantly different (P< 0.05).

Values in brackets provide the difference in percentage terms between the control (Bra MS) and the alternative genotypes from Kidman Springs.

Table 62 shows that both year (P< 0.01) and genotype (P< 0.01) significantly affected total annual growth with DM and 1/4 Ch being similar and significantly better (P< 0.05) than the two Brahman samples (which were nearly identical).

Table 62: The Effect of Year and Genotype on Annual Growth of Weaners.

Genotype	Year 1999/00 (kg)	Year 2000/01 (kg)	Average kg	Sign
DM	115.1	130.0	122.6^{A} (107)	P< 0.01
Bra K	111.4	121.0	116.2^{B} (101)	
1/4 Ch	125.7	135.3	127.5^{A} (111)	
Bra MS	110.8	118.5	114.7^{C} (100)	
Av	115.8	128.5		P< 0.01

Values with different alphabetic superscripts are significantly different (P< 0.05).

The values in brackets provide the difference in percentage terms between the control (Bra MS = 100) and the alternative genotypes from Kidman Springs.

Again growth in Finch was significantly lower than growth over the year in Quail (114.0 kg vs. 126.4 kg, P< 0.01). This difference between paddocks probably reflects the higher effective stocking rate in Finch (as a consequent of a third of its area being saved, at any one time). This effect reversed the superior growth rates observed in Finch relative to Quail in 1998/99 before the Best Bet management regime was imposed.

Table 63 provides treatment combination means for final P8 fat depth. There was a small but significant (0.7mm P< 0.05) difference between years but no significant genotype effect (range 0.6 mm with 1/4 Ch leanest and the control Bra MS fattest).

There was no significant difference between Finch and Quail (3.2 mm vs. 3.0 mm respectively).

Table 63: Final P8 Fat Depth

Geno	Year		Average	
	1999/00 (mm)	2000/01 (mm)	mm	Sig
DM	3.7	2.6	3.2	NS
Bra K	3.1	3.0	3.1	
1/4 Ch	3.2	2.5	2.9	
Bra MS	3.8	3.1	3.5	
Average	3.5	2.8		P< 0.05

Figure 11 shows the final ELW and final age at for the Bra MS steers (297 kg/15.9 mo) and the estimation of relative value-adding potential (VAP) using the Brahman steer MTG curve (347 - 297 kg = 50 kg).

Figure 11: Brahman steer MTG curve (P8 = 10 mm)

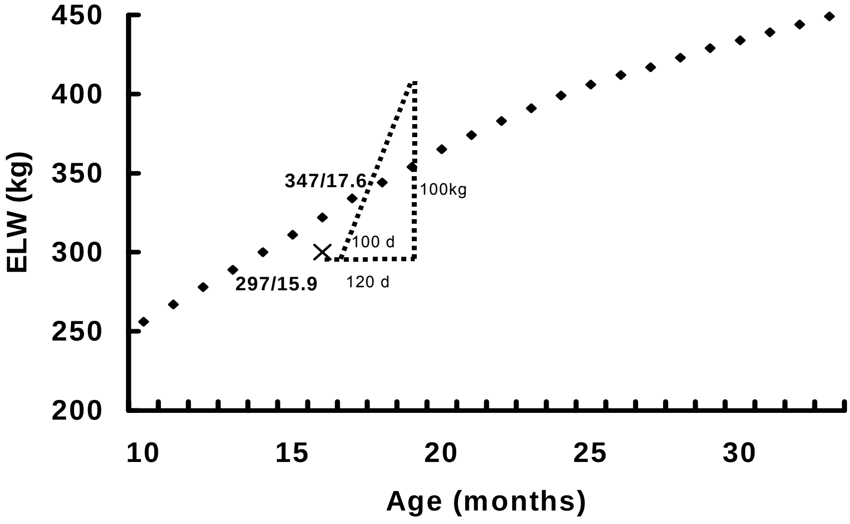


Table 64 provides the genotype means for final ELW, age and relative VAP at the end of the first post weaning Wet. The age estimate was obtained by adding the time that elapsed between the start of the experimental grazing and turnoff to the weaning age estimate in Table 59.

Table 64: Final ELW, Age and VAP

Geno	Year				Average		Relative
	1999/00		2000/01		Final		VAP
	kg	mo	kg	mo	kg	mo	kg
DM	313	17.6	328	17.6	320	17.6	50^A
Bra K	297	17.1	330	18.0	313	17.6	50^A
1/4 Ch	332	17.9	330	17.7	331	17.8	85^B
Bra MS	287	15.7	307	16.1	297	15.9	50^A
Sig							P< 0.001

Values with different alphabetic superscripts are significantly different (P< 0.05).

The relative VAP of the 1/4 Ch cattle in Table 64 was significantly greater than that of the other three genotypes (+35 kg or +70%, P< 0.001). As a consequence the 1/4 Ch had a significantly higher potential ELW at slaughter (331 + 85 = 416 kg) relative to the other three genotypes (347-363 kg). This favourably affected the end-use suitability of the 1/4 Ch for the SE Asian supermarket trade.

Figure 12: 1/4 Charolais steer MTG curve
(P8 = 10 mm)

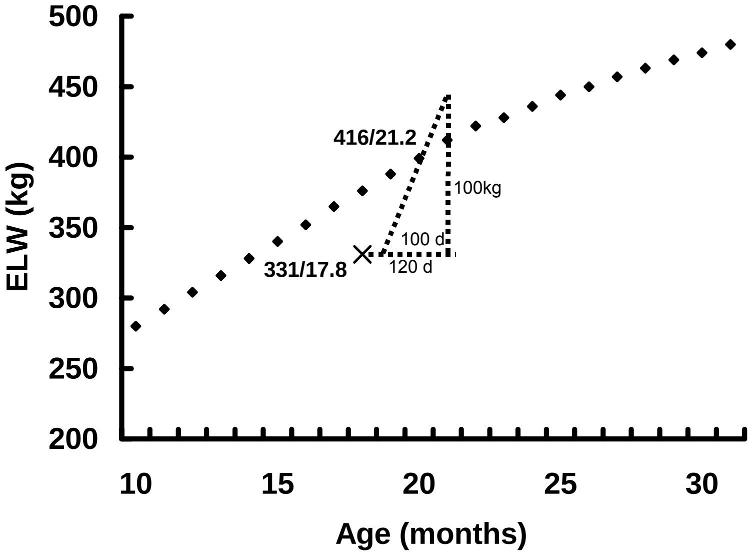


Figure 12 shows the estimation of relative VAP using the 1/4 Charolais steer MTG curve and the final ELW and final age for the 1/4 Charolais steers (331 kg/17.8 mo).

Finally in Table 65 the actual ELW of the cattle from the two Brahman sources at the end of their first post weaning Wet is compared to the estimates of ELW derived from a prediction equation (r^2 = 0.9) developed in Project 8.4.4. This equation predicts ELW from P8 fat depth and age. There is very good agreement between the actual and estimated values in Table 65 and this suggests that the two herds are very similar in mature size.

Table 65: Actual vs. Estimated ELW

Source	P8 (mm)	Age (mo)	Actual ELW (kg)	Est. ELW (kg)
Bra K	3.1	17.6	313	316
Bra MS	3.5	15.9	297	299

The importance of this finding, together with the absence of a significant difference in growth between the two Brahman sources (see Table 62), is that it implies that the genetic differences between the two herds is negligibly small. Production system results obtained with the Kidman Springs Brahmans can therefore be safely assumed to apply to the Mt Sanford Brahmans. Furthermore since Project 8.4.1 found no significant differences in post weaning growth rate between samples of 20 or more WR1 weaners from 15 commercial properties in the Katherine region it is also probably reasonable to assume that the Kidman Springs Brahman results are directly relevant to NT commercial Brahmans in general without any need for any adjustment (conscious or unconscious) for notional genetic differences.

Conclusions

- The 1/4 Ch genotype gave significantly more annual growth (+11% or +12.8 kg/hd, $P< 0.05$) and greater post weaning efficiency (20 x 12.8 = 256 kg gain/km^2) than the Bra MS, and 80% more (40 kg/hd, $P< 0.001$) feedlot value-adding potential.

- Relative to the 1/4 Ch, the DM provided a lower annual growth improvement (+7% or +7.9 kg/hd, $P< 0.05$) and post weaning efficiency (+158 kg/km^2), and no improvement in feedlot value-adding potential, at the end of the first post weaning Wet.

- There was no difference in annual growth, post weaning efficiency or value-adding potential between the two Brahman genotypes.

- The basis of the growth advantage of the 1/4 Ch was their greater response to improved nutrition relative to weaners from the two Brahman sources. This was seen as their 15% (+16.4 kg/hd, $P< 0.05$) growth advantage in the Wet relative to the Bra MS and their 24.4 kg/hd weight change difference in the Dry between the two years. This weight change difference between a relatively normal year and year with a very late and short Wet was nearly four times the between-year difference in the Bra MS (6.5 kg) and nearly twice the difference that occurred in the other two genotypes (13 kg).

- The close similarity between actual and estimated empty liveweights (ELW) in Table 65 indicates that the two Brahman sources are probably herds of the same mature size. This result together with the results of earlier work (Project 8.4.1) in which there were no significant property of origin differences in Wet Season growth rate in groups of 20 or more weaners from 15 properties in the Katherine region, suggests that Bra K results can be safely extrapolated to commercial Brahman herds in the Region without need of adjustment for genetic differences.

2.2.2.4 Objective 3

To compare the effects of weaning weight, sex and grazing management system on post weaning growth and final value-adding potential in weaners at the end of their first post weaning Wet (2001/02, 2002/03).

Background

In the mid 1990s there was a lot of interest in both saving pasture for weaners and periodic burning of pasture, but there was little data on the impact which these actions might have on weaner performance in a closed system (i.e. where the land/pasture resource and animal numbers were fixed and pasture saving and burning decreased the area per head available for grazing).

In order to address this lack of information, data set 3 was collected to provide some information on the short term effect of two alternative grazing management systems on the performance of weaners in the VRD up to the end of their first post weaning Wet.

The general design for the two grazing management options was developed at a stimulating meeting with the Katherine Regional Beef Research Committee, where it became apparent that the term saved pasture had nearly as many definitions as the number of individuals who attended the meeting.

The two grazing management treatments which this meeting endorsed were:

1. Basic (control):
    - sustainable grazing pressure (see definition below),
    - *ad libitum* N supplementation in the Dry and P supplementation in the Wet (in the form of commercially available lick blocks),
2. Pasture Saving (treatment):
    - stock numbers and supplementation as in the Basic treatment (animal numbers per unit area being grazed were 50% higher than in the Basic system because of the pasture saving),
    - pasture saving for WR1 weaners to begin at the start of the Wet prior to their weaning,
    - pasture saving for WR2 weaners to begin at the start of the Dry prior to their weaning and half of this area to be burned prior to this weaning muster (i.e. in August/September)

In each successive year the Wet Season saved and Dry Season saved areas in the Pasture Saving (PS) treatment were changed so as to ensure that:

- the area chosen for Wet Season pasture saving was not biased in relative agronomic potential,
- the whole of the 6 km^2 was routinely burned once over the six year period.

The then current rationale for sustainable pasture utilisation (utilise no more than 25% of annual pasture growth in 70% of years = 312 kg dry matter/ha at the Mt Sanford site, Dyer *pers. comm.*) provided an estimate of the amount of herbage dry matter that could safely (sustainably) be utilised each year in the long term.

The stocking rate for the Basic system was calculated by assuming that 180 kg weaners would gain 150 kg/hd by the end of their first post weaning Wet (MacDonald *pers. comm.*). The British metabolisable energy (ME) system (Anon, 1984) with allowances recommended by Corbett *et al.* (1994) for the ME cost of grazing and the *Bos indicus* content of the cattle was used to calculate the ME/hd required by these cattle. Pasture ME/kg dry matter content relevant to the level of performance of the cattle was assumed to facilitate the conversion of these estimates of ME/hd in the Dry and in the Wet to kg of dry matter/hd in the Dry and the Wet. It was decided to use a fixed stocking rate (a variable rate in response to chance annual fluctuations in rainfall being perceived to be not feasible in this environment).

Both systems carried the same number of weaners on the same land area (6 km^2 in each replicate, total area 24 km^2)

Calculation of the ME required by the target weaner population to maintain their weight through the Dry indicated that about one third of the whole area should be saved in the Wet. The PS system was therefore subdivided into three equal sized plots (2 km^2/plot). At any one time only two thirds of the area in the Best Bet system was available for grazing.

Each annual group of new WR1 weaners were randomly allocated to either the area that had been grazed in the previous Wet or the area that had been saved in the previous Wet, to provide data for a valid assessment of the effect of saved pasture on the relative performance of WR1 weaners in the Dry. Successive years provided animal replication.

Half of the WR1 weaners in the PS system grazed unsaved pasture at the start of the Dry, as did all the weaners in the Basic treatment. But the PS weaners grazed at a 50% higher stocking rate than those in the Basic treatment as a consequence of pasture saving. This provided a valid assessment of the effect of a 50% difference in stocking rate in the Dry with successive years providing animal replication (see Table 8).

The 1998/99 data from Finch and Quail indicated that there was a significant difference in the growth of weaners between these two paddocks when both used the basic grazing management system (Finch 121.9 kg/hd vs. Quail 109.9 kg/hd = 12 kg/hd or 10.9% difference, $P < 0.001$).

There was therefore a need to replicate the two grazing management treatments if their impact on animal performance was to be evaluated without confounding. This replication enhanced the validity of the stocking rate and saved vs. unsaved pasture comparisons previously described above.

By WR1 2001, Turkey (PS) and Galah (Basic) had been fenced and Turkey 2 had been ungrazed during the 2000/01 Wet. Plots 1 and 2 in both Galah and Turkey were stocked with 110 WR2 weaners through the Wet to leave the appropriate level of pasture residue at the start of the Dry in 2001/02 year. The second replicate was then ready for use.

The sequential use of the three plots in the two replicate paddocks of the PS system, provided diagrammatically over page, shows how the area that is saved and burned was to rotate each year. All of the area was to be burned once at the end of six years.

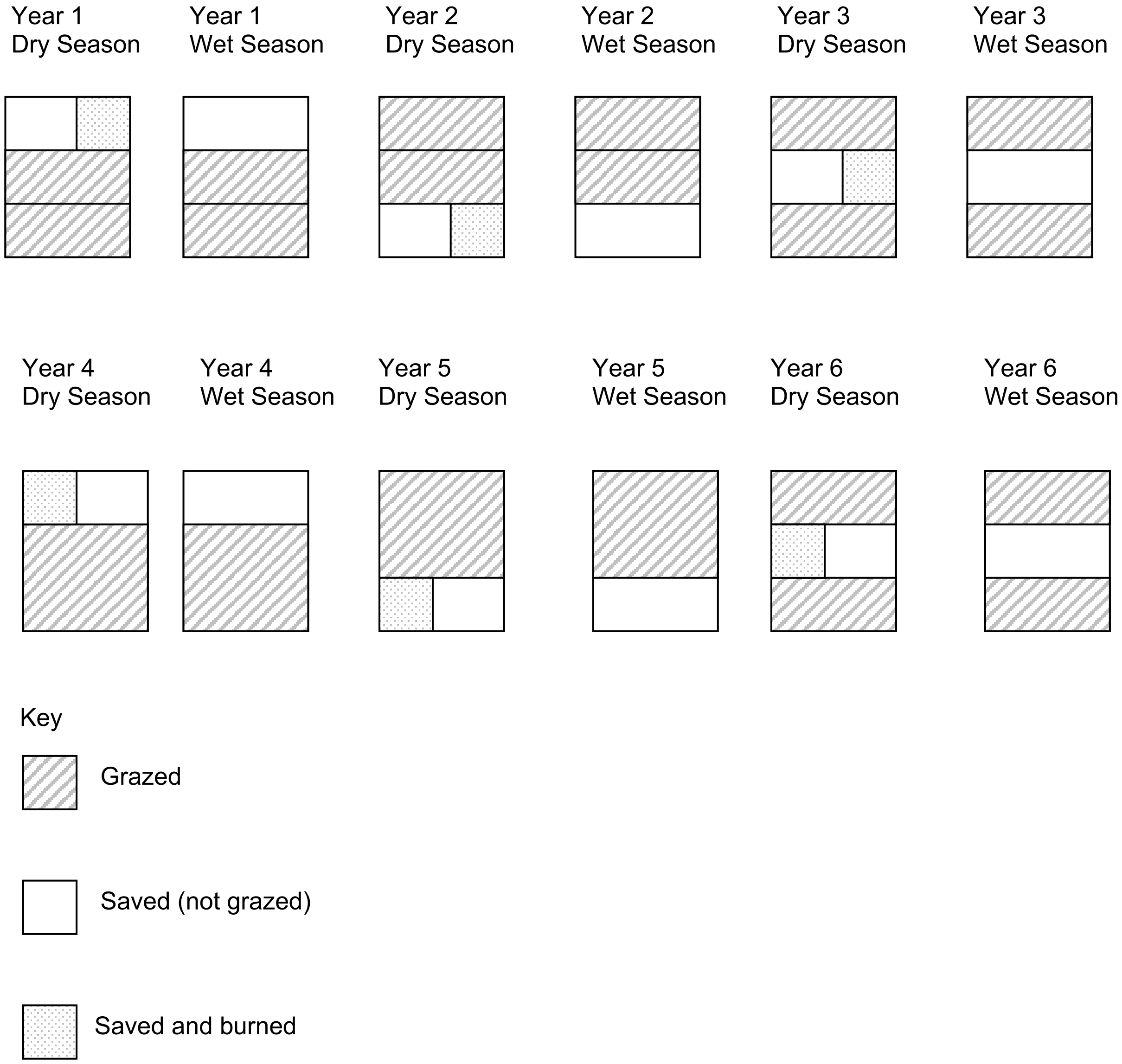


Table 66 shows the utilisation of the three plots in each PS replicate

Table 66: Utilisation of PS Plots

Year	2000/01		1/2		2002/03	
Season	D	W	D	W	D	W
Plot 1	-	G	G/G	G	G/G	G
Plot 2	-	S	G/S	G	S&B	S
Plot 3	-	G	S&B	S	G/S	G

G = grazing

G /G = grazing pasture then grazed in the Wet

S = saving pasture

G/S = grazing pasture then saved in the Wet

S&B = pasture saved in the Dry and 50% burned before WR2

Results

These results are for WR1 weaners only. Only animals for whom full data was available are included in the analyses here. Data losses included escapees, fail-to-muster, lost tags and an unknown number of unobserved deaths. Weaner growth in the first year reported here was within the range of normal expectation. In the second year, in which significant opening rains were delayed by several months, weaner growth over the whole year was only 55% of that recorded in the first year.

Table 67: Effect of Management System on Growth.

Year	Management System	Dry Season (kg)	Wet Season (kg)	Whole year (kg)	n
2001/02	Basic	8.8	121.9	130.7	196
	PS	4.4	118.9	123.3	205
	Sig	P< 0.001	P< 0.01	P< 0.001	
2002/03	Basic	-22.9	99.4	76.5	202
	PS	-17.4	83.3	65.9	189
	Sig	P< 0.001	P< 0.001	P< 0.001	

Table 68: Effect of Weaning Weight Range on Growth.

Year	Weaning weight range	Dry Season (kg)	Wet Season (kg)	Whole year (kg)	n
2001/02	100-140 kg	10.1	117.5	127.6	67
	141-180 kg	6.8	119.7	126.5	159
	181-220 kg	5.3	122.2	127.5	108
	221-260 kg	4.5	121.7	126.2	67
	Sig	P< 0.001	P< 0.05	NS	
2002/03	100-140 kg	-7.5^{A}	88.0^{AB}	80.6^{A}	34
	141-180 kg	-11.8^{B}	88.4^{A}	76.5^{A}	67
	181-220 kg	-21.3^{C}	91.0^{AB}	69.7^{B}	132
	221-260 kg	-25.6^{C}	94.2^{B}	68.6^{B}	158
	Sig	P< 0.001	P< 0.05	P< 0.001	

Values in columns with different alphabetic superscripts are significantly different (P< 0.05).

Table 69: Effect of Pasture Saving on Growth (saved vs. grazed)

Year	Management System	Dry Season (kg)	Wet Season (kg)	Whole year (kg)	n
2001/02	Saved	5.0	117.5	122.5	101
	Grazed	3.9	120.3	124.2	104
	Sig	NS	P< 0.05	NS	
2002/03	Saved	-16.3	74.8	58.5	89
	Grazed	-18.3	90.8	72.5	100
	Sig	NS	P< 0.001	P< 0.001	

Table 70: Effect of Stocking Rate on Growth

Year	Management System	hd/km^2	Dry Season (kg)	Wet Season (kg)	Whole year (kg)
2001/02	Basic	1X	8.8	121.9	130.7
	PS	1.5X	3.9	120.3	124.2
	Sig		P< 0.001	NS	P< 0.001
2002/03	Basic	1X	-22.9	99.4	76.5
	PS	1.5X	-18.3	90.8	72.5
	Sig		P< 0.001	P< 0.01	P< 0.01

Actual numbers/system varied between years and between seasons within years and the notation 1X and 1.5X is used here to indicate the 50% difference in stocking rate between the two grazing management systems.

In the Dry:

- Table 67 shows that in the year when weaner performance was worst, the PS system provided a small but statistically significant benefit (5.5 kg, P< 0.001), while in the "normal" year it resulted in a similarly small and also statistically significant disadvantage (-4.4 kg, P< 0.001);

- Table 68 shows that there was a consistent trend for the lighter (younger) weaners to perform significantly (P< 0.001) better than the heavier (older) weaners with this difference being greatest in the year of least growth (18.1 kg vs. 5.6 kg, P< 0.001). This trend was strongest in the year when nutrition was below maintenance and there were significant differences (P< 0.05) between three of the four weaning weight ranges;

- In Table 69 pasture saved during the previous Wet provided a negligibly small and non significant increase of 1.1 kg in the year of better nutrition and only 2.0 kg in the year of worst nutrition;

- Table 70 shows that there was a small but highly significant effect in both years (P< 0.001) from a 50% increase in stocking rate in weaners grazing pasture that had been grazed the previous year.

In the Wet:

- In Table 67 in both years, the PS system exhibited significantly (P< 0.01 and P< 0.001 respectively) lower growth than the Basic system with the effect being greater in the year with unusually low growth (3 kg vs. 16.1 kg);

- In Table 68 there was evidence of some compensatory growth with a significant effect of weaning weight range on growth (P< 0.05) in both years. Statistically significant differences (P< 0.05) occurred between some weaning weight ranges in the Wet in the year following the greatest weight losses during the preceding Dry. There appeared to be a negative relationship between Dry Season loss and Wet Season gain;

- In Table 69 the difference in growth between weaners grazing plots that had been grazed or saved during the previous Wet was the reverse of that which occurred in the intervening Dry. Again, there appeared to be a negative relationship between Dry Season loss and Wet Season gain;

- The effect of a 50% increase in stocking rate in Table 70 was a relatively small (1.6 kg) decrease in Wet Season growth in the year with the higher growth rate, with a larger (8.6 kg) decrease in the low rainfall year.

Over the whole year:

- Table 67 showed a relatively small (7.4 and 10.6 kg, $P < 0.001$) but significant disadvantage in total growth in the PS system,

- Table 68 showed no difference between weaning weight ranges in total growth in the good year and, surprisingly, consistent advantages in total growth as original weaning weight decreased in the low rainfall year!

- In Table 69 there is a highly significant ($P < 0.001$) difference in total growth between the weaners that grazed the plot that had been grazed the previous Wet (72.5 kg) and those that grazed the plot that had been saved the previous Wet (58.5 kg),

- The effect of a 50% increase in stocking rate in Table 70 resulted in relatively small decreases in total growth (6.5 kg and 4.0 kg in the favourable and dry years respectively, $P < 0.001$ and $P < 0.01$).

Conclusions

- The PS system (saved pasture) slightly improved Dry Season weaner performance (+4.5 kg) in the year with the very late Wet Season (2002/03), and in the more normal year it slightly reduced Dry Season weaner performance (-4.4 kg/hd, $P < 0.001$). By the end of the year the PS system had reduced annual growth by 7.4 kg/hd or 5.7% ($P < 0.001$) in the normal year and by 10.6 kg/hd or 13.9% ($P < 0.001$) in the short wet year (2002/03). The decrease in animal performance in a pasture saving system occurs because saving an area increases the stocking rate on the other areas that are grazed. This effect may be one of the inescapable costs of a pasture saving system, but this experiment did not run for long enough to assess the positive effects of pasture saving on pasture composition and woody weed control.

- Weaning weight range had most effect on post weaning performance in the Dry Season immediately after weaning. This effect was greatest in the short season year (2002/03) when there were significant differences between three of the four weight range means ($P < 0.05$) for Dry Season weight change. In this year, these effects were still evident at the end of the first post weaning Wet; although some statistically significant compensatory growth occurred during the Wet. In the normal year (2001/02), compensatory growth in the Wet ($P < 0.05$) eliminated the smaller Dry Season weaning weight range effects by the end of the Wet.

  In both years the lightest weaners (100-140 kg) performed best in the Dry and in the difficult year of 2002/03 nearly 67% (18 kg) of this advantage was still retained at the end of the Wet! Clearly there is no justification for not weaning 100-140 kg weaners for fear that they are too immature to thrive in the Dry Season. There is also a less easily quantified benefit to their mother from such early weaning, in terms of significantly improving her pre-calving body reserves and the consequential effects this has on her lactation (growth rate of the next calf) and her inter-calving interval (the time taken to conceive the next calf). The implications of early weaning on value-adding potential have already been discussed in conjunction with the data obtained at this site in 1998/99.

  These WW range effects are consistent with those obtained in 1998/99 at this site

- The direct effect of saved pasture in the Dry Season was negligibly small in both years (1.1 kg/hd in 2001/02 and 2.0 kg/hd in 2002/03).

- The direct effect of a 50% increase in stocking rate was a relatively small decrease in growth per head over the whole year in 2001/02 (-1.6 kg/hd, NS), with a larger and significant effect in the low rainfall of 2002/03 (-8.6 kg/hd or –8.1%, $P < 0.01$)

2.3 Measuring Mature Size (Feedlot Experiment)

2.3.1 The effects of genotype, sex and age on liveweight and carcase weight at target (P8) fat depth.

Objective

To construct maturity type growth curves from adolescence (10-20 months) to young adulthood (36+ months), for cattle of a range of maturity types.

Methods

Between July 1997 and June 1999, different groups of sex x genotype combinations were sourced from the Kidman Springs genotype herds and were grown out on buffel-based pastures at the Douglas Daly Research Farm. Groups of cattle were selected at random for placement in the KRS (Katherine Research Station) feedlot, either halfway through their first post weaning Wet (January/February) or in the following Dry Season. All animals upon entering the feedlot were in store condition and it was assumed that the between year differences in their average age at weaning and maturity type were negligibly small.

Setting

a) Location

The experimental cattle were fed in temporary feedlot pens at Katherine Research Station.

b) Animals

The seven sex x genotype combinations (maturity types) fed in the KRS feedlot and slaughtered at P8 = 10mm (group average) were:

- Droughtmaster steers only,
- Brahman bulls, steers and heifers,
- 1/4 Charolais bulls, steers and heifers.

Males entered the feedlot as two sub groups each year (approximately 16 months or 22 months average age) and the females at approximately 16 months age.

There was a wide range in time taken (2.5-5.5 months) by different sex x genotype sets, to reach P8 = 10mm group average. Ultrasonic equipment was used to determine when each group reached this target, and was ready to be slaughtered.

Project cattle were slaughtered at a local abattoir to provide hot carcase weight and cold P8 fat measurements and shin samples were taken for dissection to provide estimates of total carcase muscle, bone and fat content.

c) Feed

All cattle were fed *ad libitum* a ration based on 65% sorghum grain after a 3 week adaptation period (initially 20% grain), which incorporated weekly increments to the grain proportion of the ration.

Discussion of Results

Table 71. Actual vs. Predicted ELW at Feedlot Turnoff

Geno	Sex	N	Actual ELW (kg)	Actual P8 (mm)	Actual Age (mo)	Est ELW (kg)	Difference Est. - Actual	
							kg	%
DM	S	9	369	8.7	19.3	369	0	0
		12	417	10.6	26.1	419	+2	+0.5
		9	371	9.7	19.3	365	-6	-1.6
		11	382	9.0	22.6	392	+10	+2.6
Bra K	H	10	293	10.0	18.0	299	+6	+2.0
	S	9	369	9.6	19.8	365	-4	-1.1
		8	375	9.3	23.6	397	+22	+5.5
		9	362	9.8	18.6	352	-10	-2.8
		12	382	8.9	23.5	391	+9	+2.3
	B	9	429	7.8	21.0	439	+10	+2.3
		7	472	8.1	25.9	466	-6	-1.3
		9	429	10.4	19.3	423	-6	-1.4
		14	479	8.6	25.9	478	-1	0.2
1/4 Ch	H	10	329	8.1	19.4	329	0	0
	S	9	404	8.9	21.5	409	+5	+1.2
		11	464	9.8	26.9	457	-7	-1.5
		9	405	9.0	20.2	405	0	0
		11	455	9.6	25.6	447	-8	-1.8
	B	9	519	9.3	23.0	503	-16	-3.2
		11	522	8.1	29.0	542	+20	+3.7
		9	478	9.1	22.4	492	+14	+2.8
		11	569	10.0	29.7	552	-17	-3.1

In Table 71, for each sex x genotype group, the actual mean ELW immediately before trucking for slaughter was compared to the estimated ELW for that combination at their actual age and P8 fat depth (i.e. compared to their provisional MTG curve value at P8 = 10 mm as shown in Table 8).

Because the actual average P8 depth at slaughter varied from the target of 10 mm (as a consequence slaughter date being affected by the availability of abattoir space), the group's actual ELW was adjusted using the relationship 1 mm of fat (P8) equals 3.5 kg established earlier in this report. Most adjustments were small, and all reduced the difference between the two ELW values.

The difference between the two ELW values is shown as estimated ELW minus actual ELW in the eight and ninth columns of Table 71.

Considering the small numbers of animals in each group (N) in column 3 (Table 71), Table 71 shows that there was very good agreement between the actual and estimated ELW values. Only one sex x genotype set (Brahman steers) had a difference of more than 5%.

Table 72 shows that within each of the five male sex x genotype categories in Table 71 the differences between the two ELW values within each sex x genotype set tended to cancel out.

Table 72: Sex x Genotype ELW Difference Means

Geno	Sex	N	Est. ELW – Actual ELW
DM	S	41	+1.5 kg
Bra K	S	38	+4.25 kg
	B	39	-0.75 kg
1/4 Ch	S	40	-2.0 kg
	B	40	+0.25 kg

This supports the view that these differences within each sex x genotype set are probably random sampling errors and the provisional MTG curves do not appear to be systematically biased (i.e. too high or too low).

Conclusions

Four maturity type growth curves have been constructed with the earliest (Brahman females) being based on a very complete data set from 10 months to 10 years age. These maturity type curves and the sex x genotype sets characterised are shown in Table 73, and graphically represented as Figure 13 (the values that these curves are derived from are shown in Table 8 in section 1.1).

Table 73: Maturity Type of Breed x Sex Combinations

Group	Maturity Type	Breed x Sex Combination
1	Early	Brahman heifer
2	Early/mid	Brahman steer Droughtmaster steer 1/4 Charolais heifer
3	Late/mid	Brahman bull 1/4 Charolais steer
4	Late	1/4 Charolais bull

They can be plotted by adding increments to the earliest:

No. 1 + 15% = No. 2

No. 2 + 15% = No. 3

No. 3 + 15% = No. 4

Figure 13: Maturity Type Growth Curves Derived From Feedlot Data

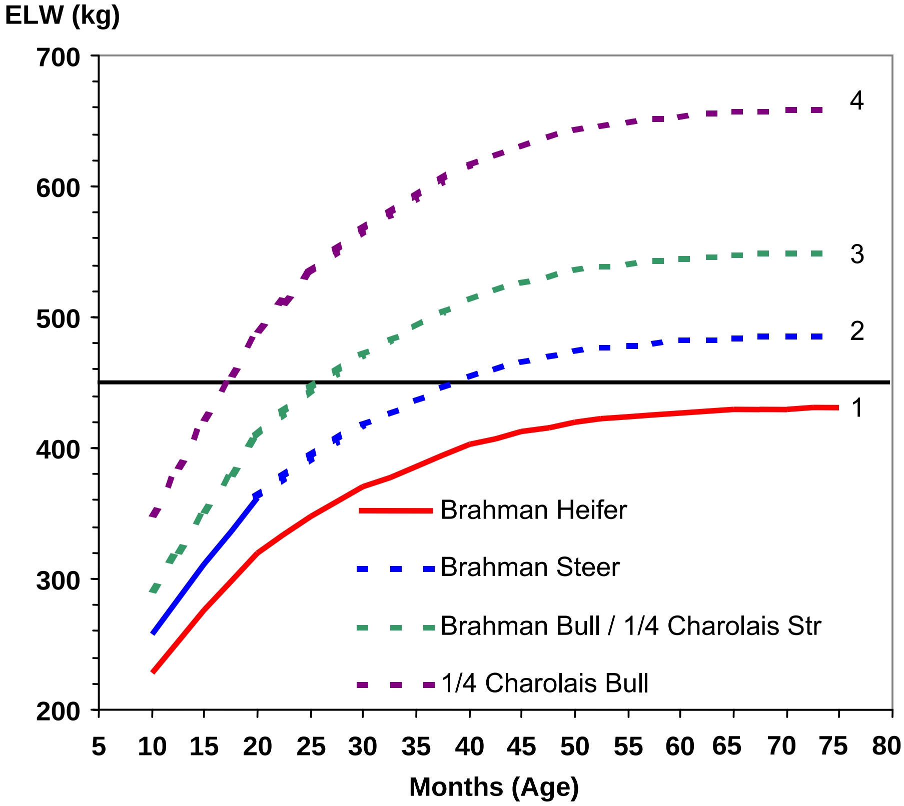
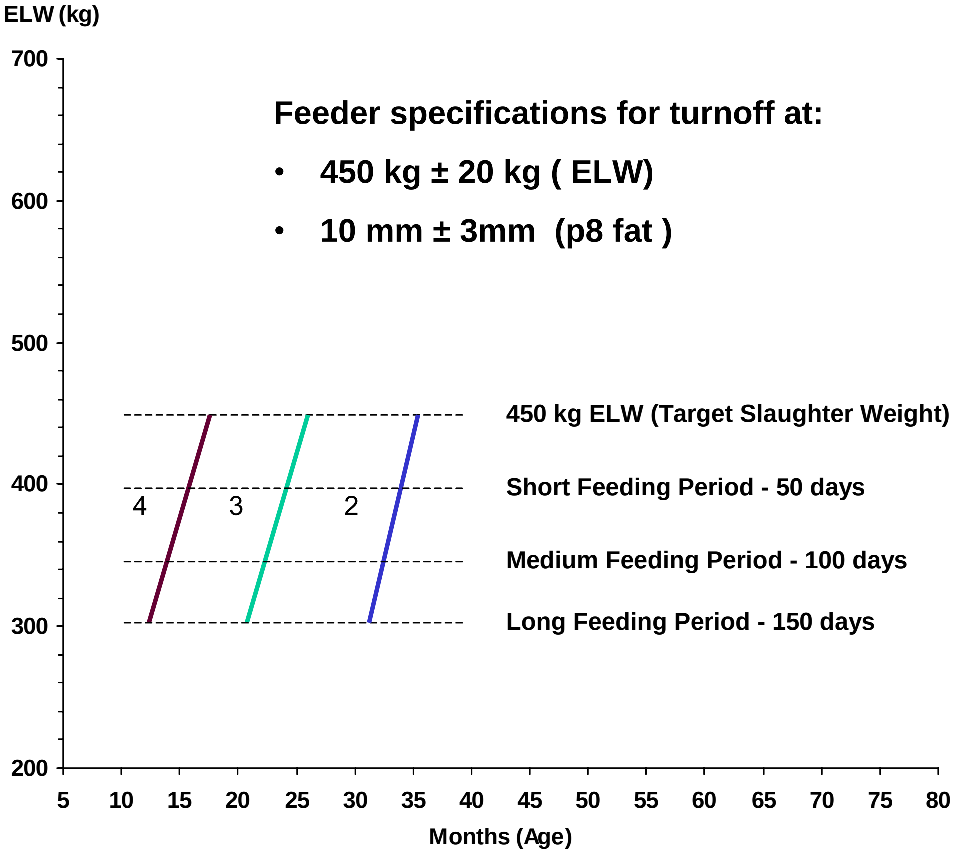


Figure 14: Example entry specification grid for SE Asian feedlotters



This information has the potential to improve the capacity of SE Asian feedlot operators to describe the specifications (age, weight, maturity type) they need in feeder cattle (i.e. the NT beef industry's market specifications) to meet their turnoff specifications (P8 fat range and live or carcase weight range), given the plane of nutrition (i.e. growth rate they expect to provide). See Appendix 3 for an explanation of how this would occur.

Utilisation of MT Curves by the Feedlotter – An Example

Take the case of a feedlotter wishing to slaughter at an empty liveweight of 450 kg and a P8 backfat depth of 10mm and plans to feed a ration that will support 1 kg/day gain for 50, 100 or 150 days.

Figure 13 shows MTG curves for four different maturity types (1, 2, 3 and 4). The horizontal line through 450 kg cuts three of these curves at the age (horizontal axis) at which these maturity types provide the desired slaughter specifications. One (maturity type 1) is clearly unsuitable for this end-use as it never reaches 450 kg at target fatness (i.e. it would have to be fatter to reach that weight).

Lines with a slope of 1 kg per day can be drawn downwards from the points at which curves 2,3 and 4 (refer to Figure 14) bisect the desired slaughter specification line until they in turn bisect any of the horizontal lines, which represent alternative feeding periods. The points at which the alternative feeding period lines are bisected indicate the entry specification for weight and age of feeder cattle of the three candidate maturity types.

Given that adequate live animal fatness appraisal skills are available at the feedlot, then feeder cattle that meet the given age, weight and maturity type and *Bos indicus* content specifications will ensure that a high proportion of carcasses meet the feedlotter's target fat and weight specifications on time.

2.3.2 The effect of 12 months age difference at slaughter on liveweight and carcase weight of Brahman steers and heifers at target fatness.

Objective

To analyse the interrelationship between weight, age and fatness during the adolescent growth phase in Brahman steers and heifers.

Background

There is widespread anecdotal evidence that in young cattle of less than 3.5 years age, increasing age leads to a commercially significant increase in the weight at which they achieve a specific level of fatness. Evidence in the scientific literature supports this notion of an inter-relationship between weight age and fatness. For example analysis of data published by Moulton *et al.* (1922) and Hiner and Bond (1973) by Ridley (unpublished, 1979) has shown that age made a statistically significant contribution to the prediction of carcase weight, when fatness was used as the other independent variable. These authors used early to medium maturity type British beef breed cattle in their work.

Ridley (1979) has discussed the implications of some data from 109 young Hereford cattle (bulls, steers and cull heifers). In this work carcase weight (y) in kg could be predicted from back fat depth (x_1) in mm, slaughter age (x_2) in days and sex (x_3) using the equation:

$$y = 5.05\, x_1 + 0.22\, x_2 + 37.0\, x_3 + 68.5$$

$$r^2 = 0.81$$

Where for x_3 bull = +

steer = 0

heifer = -

In this work, the Hereford heifers and bulls were respectively earlier and later maturing versions of the medium maturity Hereford steers. The equation above implies that at any given age (6-24 months) and fatness (0-16 mm back fat), their carcases were either 37 kg lighter (heifers) or 37 kg heavier (bulls) respectively.

The high degree of correlation between carcase weight (y) and liveweight (x) in this work is given by the equation:

$$y = 0.60\, x - 12.7$$

$$r^2 = 0.97$$

Inclusion of fatness in a multiple regression equation with liveweight did not improve the r^2 value of this linear regression equation. The equation provides a good basis for estimating liveweight from carcase weight in this data.

From the first equation above, a year's increase in age is equivalent to an (0.22 x 365) = 80.3 kg increase in carcase weight in 12-24 month old steers. From second equation this change in carcase weight is equivalent to:

$$y = 0.60x - 12.7 \qquad y = 80.3\text{ kg}$$

$$x = \frac{80.3 + 12.7}{0.60}$$

$$= 155\text{ kg liveweight}$$

As previously mentioned, this data covered cattle 6-24 months in age. In recent years, it is believed that feeder steers exported from the NT to SE Asia have moved from an estimated average age of 30 ±3 months in the late 1980s towards 18 ±3 months in the mid 1990s.

A major element in the cost/kg liveweight of feeder steers landed in SE Asia comes from the cost of sea transport. Animal welfare regulations and the interests of the NT beef industry favour maximising the average weight of export cattle. But the interests of feedlot operators in SE Asia favour lower weights because they lead to:

- lower age and therefore increased potential tenderness at slaughter
- higher feedlot gains/hd to target fatness;
- higher weight gain per feedlot space per year;
- higher feed conversion efficiencies;
- reduced frequency of buying; and
- reduced capital outlay.

Finally, in the Philippines individual animals over 330 kg and boatloads averaging more than 300 kg attract an import duty of 30% (Paradice & Linnegar, 1994). This reflects political interest in maximising value adding to imported cattle. These factors are also reflected in Malaysian feeder cattle contract specifications, which focus on cattle around 225-250 kg liveweight.

Given these factors, 300 ±20 kg feeders are considered likely to constitute the long term bulk of the SE Asia feeder cattle trade for the NT beef industry.

Ridley's equations imply that for 300 kg feeder cattle a 12 month shift in age will lead to a 155 kg shift in liveweight and an 80.3 kg shift in carcase weight at a given target fatness within the normal market range for table beef (say 3-9 mm).

This project was undertaken to measure the interrelationship between weight, age and fatness and thus demonstrate and quantify the extent to which the Brahman is too early maturing (i.e. its mature size was too low) to meet market specifications in this context.

The Brahman used in this project were bred from purebred (not stud) cows purchased in Queensland for the Kidman Springs Genotype Comparison. They are therefore representative of the genotype towards which the NT Brahman herd is heading.

Materials and Methods

In June 1997 two sets of 20 cull Brahman steers and heifers (10 + 10) from the first weaning rounds in 1996 and 1997 at Kidman Springs, were available for use in this project. All were in store condition (CS 1-2 Lowman *et al.* 1976) at this time. It was assumed that the between year differences in their average age at weaning and maturity type were negligibly small.

Setting

a) Location

The experimental cattle were fed in temporary feedlot pens at Katherine Research Station.

b) Animals

The weaners and yearlings were from the first weaning rounds of the Kidman Springs Genotype Comparison in 1997 and 1996 respectively (i.e. 12 months difference in age between the two sets), with weaning weights in the 100-160 kg range. Table 74 provides the estimated initial age and weight of these cattle.

Table 74: Estimated Initial Age and Weight

Year Weaned	Estimated Age (mo)	Weight (kg)
1996	18	300
1997	6	130

Design

The experimental design used to generate cattle of a wide range of age, fatness and liveweight for slaughter is shown in Table 75 below:

Table 75: Experimental Design

Sex	Target Slaughter P8 (mm)	Weaner Numbers (hd)	Yearling Numbers (hd)
Steer	5	5	5
	10	5	5
Heifer	5	5	5
	10	5	5

Feed

Young Brahman steers and heifers were placed in a feedlot in June 1997 and fed with ration based on 65% sorghum grain, after a three week adaptation period (initially 20% grain). All cattle were fed the same ration with the two age groups being fed separately.

Schedule of Activities

a) Weighing and Ultrasonic Back Fat Measurements

Table 76 shows the measurements that were recorded.

Table 76: Weighing and Ultrasonic Back Fat Measurements

Day	Action
0	Weigh full 8am. Measure back fats. Leave in yards with no feed and take off water at 4pm. in preparation for empty weighing
1	Weigh empty 8am then access to ration 1 in self feeders (each age group to be fed separately)
7	Weigh full and straight back to the self feeders (ration 2)
14	Weigh full 8am and straight back to the self feeders (ration 3)
21	Weigh full 8am and measure back fats then straight back on to their feed
35	Weigh full 8am and measure back fats then straight back on to their feed

This fortnightly cycle was repeated until specified groups approached 5mm or 10mm of fat depth (P8 site) when the weighing and fat measurements were repeated every 7 days.

b) Target Fatness

Subcutaneous fat depth was estimated ultrasonically over the P8 site (AUSMEAT, 1987) and the 11/12th rib (Butterfield 1965). The East of Scotland College of Agriculture condition scoring system (Lowman *et al.* 1976) was used to manually assess individual condition scores whenever back fats were measured ultrasonically.

As soon as the average ultrasonic fat measurement at the P8 site of the five fattest animals in any sex x age subset was 5mm or 10mm, arrangements were made to slaughter them within 7 days for carcase data. Their full and empty weights were taken in conjunction with the fat measurements. After their final empty weighing, animals for slaughter were given *ad libitum* access to Cavalcade chaff between this empty weighing and being carted for slaughter. If the interval between their final empty weighing and cartage for slaughter was greater than 7 days, the back fat measurement and full and empty weighing cycle was repeated immediately before cartage.

c) Carcase Measurements

The hot standard carcase weight (HSCW AUSMEAT, 1995) was recorded for each animal. Their left shins were removed for dissection and weighing of the shin muscle group and the radius and ulna. These were used together with carcase weight to calculate muscle and fat content of the carcase (Butterfield, 1965) and used together with carcase weight to calculate carcase fat content. Eye muscle area was measured and the location of the quartering ribs recorded. Fat depth at the 11/12th rib and P8 site was measured in the hot carcase at slaughter and on the hindquarter in the cold carcase after quartering. Cold carcase weights were recorded.

Method of Analysis

Multiple regression equations were developed to predict empty liveweight from P8 fat depth and age; and hot carcase weight from P8 fat depth and age.

Results

The ranges for the animals at slaughter were as shown in Table 77 below:

Table 77: Parameter Ranges for Animals at Time of Slaughter

Parameter	Range
Liveweight	189-410 kg
Carcase weight	103-233 kg
P8 fat depth	1.0-16.0 mm
Age	9.8-21.6 mo

Statistically highly significant ($P < .001$) regression equations to predict the empty liveweight (ELW) of steers (ELW_s) and heifers (ELW_H) were derived from this data:

$$ELW_s = 4.6\ (P8,\ mm) + 9.9\ (Age,\ mo) + 116.3 \quad r^2 = 0.89$$

$$ELW_H = 5.2\ (P8,\ mm) + 6.1\ (Age,\ mo) + 141.8 \quad r^2 = 0.63$$

For hot carcase weights (HCW), the prediction equations were:

$$HCW_s = 2.7\ (P8,\ mm) + 6.1\ (Age,\ mo) + 55.6 \quad r^2 = 0.92$$

$$HCW_H = 3.0\ (P8,\ mm) + 3.3\ (Age,\ mo) + 78.13 \quad r^2 = 0.64$$

If age was deleted from these prediction equations, there was a large drop in r^2 values although the relationship was still statistically significant ($P < .01$). For example:

$$HCWs = 8.1\ (P8,\ mm) + 118.4 \quad r^2 = 0.46$$

Conclusions

The difference in the r^2 values between the steers and heifers was due to one “outlier” in the heifers.The steer equations imply that adolescent Brahman steers:

- can only gain about 9.9 kg per month (30 days @ 0.33 kg/d) without increasing their P8 measurement; and
- each mm change in P8 measurement results in approximately 4.6 kg difference in empty liveweight.

As more Brahman cattle reach live feeder export weight specifications by the end of their first post weaning Wet, an increasing proportion will be unsuitable for slaughter for wet markets in SE Asia if current feeding periods and growth rates are maintained. Reduced growth rates will increase cost per kilogram gain and Indonesian import licenses require standard feeding periods. Value adding to cover shipping costs tends to encourage the maximisation of weight gain when feed costs are favourable.

Meeting Post Weaning Market Specifications

12 Months difference in age equals 120 kgs live weight at target fatness

The picture above demonstrates that animals that are the same fatness but 12 months different in age will be 120 kg different in liveweight. For the difference in liveweight to be less, the older animal would have to be leaner and the younger animal fatter.

2.4 Effect of late maturity on breeding herd efficiency in an extensively managed breeder herd in the semi-arid tropics – The Kidman Springs Genotype Experiment.

Objective

Evaluate the breeding herd efficiency of alternative cow genotypes (Brahman, Droughtmaster and F1 (1/2 Brahman, 1/2 Charolais)) under extensive conditions.

Background

Feedback from SE Asian feedlots during the early 1990s indicated an increasing problem with young Brahman cattle sourced from northern Australian herds being over-fat when they completed their feeding phase. Traditional wet markets are the major outlet for SE Asian feedlot beef and in these markets fat is a low value and less-desirable component of the carcase than lean meat.

The use of later maturing breed types is a means of producing the leaner animals desired by feedlotters, but this strategy has potential negative implications for the productive efficiency of breeder herds in a tropical environment. Late maturity is associated with large frame size, which leads to difficulty maintaining condition on breeders in harsh seasons, and consequently reduced fertility and increased mortality.

The hypothesis of this project was that a crossbred herd, based on small proportion of late maturing genes and a larger proportion of tropically adapted genes, should be able to lead to significant post weaning and feedlot advantages, while it was still possible for their mothers to demonstrate good survival and productivity on a station in the Victoria River District.

A trial to demonstrate this was therefore established at Kidman Springs, using a Charolais-Brahman criss-cross herd. Eventually this breeding strategy will result in two herds averaging 1/3 and 1/6 Charolais, but in this project period only the first generation was considered. Under commercial conditions, such a herd would be established by mating Brahman cows to 1/2 Charolais 1/2 Brahman bulls. In this trial, in addition, 1/2 Charolais 1/2 Brahman cows were mated to Brahman bulls. The 1/2 Charolais cows were included to provide wider sampling of the Charolais gene pool and to test cows that were slightly later maturing than any subsequent generation.

In this trial, breeding herd efficiency was measured on four adult breeder herds.

1. First cross (F1) cows - 1/2 Brahman, 1/2 Charolais - were purchased from an NT station. Although 50% European *Bos taurus* genes is considered extreme for the tropical environment, when these cows are mated back to Brahman sires their progeny (3/4 Brahman, 1/4 Charolais) contain both a high degree of tropical adaptation and some later maturing characteristics.

2. A straight Brahman herd, representing the current breeding objective of many of the districts commercial herds, was established by purchasing high grade breeders from a number of Qld properties.

3. A second Brahman herd was established in a similar manner and joined to F_1 (1/2 Brahman, 1/2 Charolais) bulls to generate later maturing progeny as described above.

4. A Droughtmaster herd that represents a stabilised two-breed composite of medium maturity and providing a link to past research at Kidman Springs was established through the reduction of the resident herd to accommodate the other herds introduced in 1995.

All herds were run under the Best Bet management system from late 1995 to early 2001. This system has been shown from 1990-95 to lead to excellent reproductive rates and low mortality.

- Stocking rates of 7 cows per sq km.

- Year round supplementation at an average cost of $17 per breeder per year (urea-based loose mixes in the Dry Season, P-based in the Wet).
- Annual vaccination for botulism.
- Vibriosis vaccination for bulls.
- Continuous mating with five bulls per 100 cows.
- Cows culled for age at 10 years, bulls at 8 years.
- Weaning twice a year (May and October) to 100 kg.

Herds remained in the same paddocks for the duration of the trial, for practical reasons and after taking advice from a leading biometrician (Peter O'Rourke p.c.). In order to assess similarity of available pasture nutrition in each of the paddocks, indicator steers were run with each of the breeder herds. Weight changes of the steers over successive 12 month periods were recorded and taken into account when interpreting breeder herd results.

At the trial's inception, herds consisted of 130 cows each. In 1998, average mature weight for each herd was determined using ultrasound back fat measurements, and total herd numbers adjusted to result in similar total weight of cows grazing each paddock.

Results and Discussion

A summary of results from the breeder trial is shown in Table 78.

Table 78: Productivity Results From the Kidman Springs Breeding Herds 1997-2001

Herd	Bra x Bra	DM x DM	F_1 x Bra	Br x F_1
Cow Genotype	Brahman	Droughtmaster	Brahman	F_1 (1/2 Bra, 1/2 Ch)
Calf Genotype	Brahman	Droughtmaster	3/4 Bra, 1/4 Ch	3/4 Bra, 1/4 Ch
Average mature weight	400 kg	410 kg	400 kg	460 kg
No. of cows in herd	130	127	130	113
Total mature weight in paddock	52,000 kg	52,070 kg	52,000 kg	51,980 kg
Indicator steer gain per year	125 kg	133 kg	122 kg	123 kg
Breeder mortality rate	1.2%	3.0%	1.8%	2.5%
Average weaning weight	174 kg	175 kg	176 kg	182 kg
Average weaning rate	75.1%	83.8%	78.3%	82.1%
Breeding herd efficiency (kg weaner per 100 kg breeder mated)	31.2 kg	35.5 kg	33.7 kg	31.7 kg

Indicator steers performance varied in each paddock during the trial but were reasonably similar overall.

The paddock supporting the Droughtmaster herd appears to have had a small advantage (5-8%) over the other paddocks in terms of nutritional supply but it is difficult to quantify the impact this may have had on the productivity of the Droughtmaster breeding herd.

Mortality rates of the herds were very low (1-3%) throughout the trial, a consequence of the management system. Sufficient nutrition (including mineral supplementation), regular weaning down to 100 kg, culling for age, and vaccination against botulism are major components of the management system that contribute to the low death rate amongst the adult cow herds.

No significant difference between the mortality rates of the four individual herds was discernible. However, the mortality rate all the Brahman breeders (0.68%) was significantly lower than that of the two crossbred herds (Droughtmaster and 1/2 Charolais) considered together (1.24%). Mortality rates were found to be significantly higher during the Wet Season (1.24%) than the Dry Season (0.62%).

Mature weights of the two Brahman and the Droughtmaster cow herds were similar (400 kg and 410 kg respectively). The F_1 cows are larger at 460 kg, and therefore required a greater area to support them, so less could be run in the same area as the other herds. Consequently, for these larger cows to be as productive as the medium sized cows, they would need to produce more and/or heavier weaners to compensate for the lower herd numbers.

Weaning weights for the Droughtmaster and two Brahman cow herds were similar despite the progeny being of differing genotypes. The 1/2 Charolais cow herd produced heavier weaners, most likely due to a superior milk supply for calves up to weaning. On their own, weaning weight can be a misleading parameter as it is heavily influenced by the calving pattern of the herds which may vary considerably from year to year and from herd to herd.

The average weaning rate of the Brahman cows mated to Brahman bulls was 75% per year over the period of the trial, while the second Brahman cow herd (those producing 1/4 Charolais weaners) produced 78% (3% more) per year. This could be a function of a greater survival rate of from conception to weaning of cross-bred calves. It is not possible to prove in this case, but similar conclusions have been reported from elsewhere and no evidence of consistent paddock differences between Box and Nutwood paddock was shown by the indicator steer performance. The crossbred 1/2 Charolais cow herd weaned 82% per year, 5% above the Brahman herd producing the same genotype of progeny, the advantage being attributed to hybrid vigour. The Droughtmaster herd produced a weaning rate of nearly 84%. Possible causes for their higher performance are hybrid vigour, the influence of *Bos taurus* genes, and adaptation to Kidman Springs as the herd was established before 1995. It is interesting to note that, when examining the individual year data (not shown here), the superiority of the Droughtmaster herd fertility was mainly in the first two years of the trial and it subsequently declined to levels similar to the other herds as the trial progressed.

Breeding herd efficiency (BHE) was adopted as the best overall parameter, accounting for differing cow sizes, weaning rates and weaner growth rates. BHE is defined as the weight of weaners produced per year from the weight of cows mated the year prior, expressed as kilograms of weaner per 100 kg of breeder. The straight Brahman herd recorded the lowest BHE (31.3 kg per 100 kg), mainly because it had the lowest weaning rate. The higher weaning rate and heavier weaning weight of the 1/2 Charolais cows was negated by their heavier liveweight, and on a kilogram for kilogram basis were of similar efficiency (31.7 kg) to the straight Brahmans. Interestingly, the Brahman herd producing 1/4 Charolais weaners were more efficient (33.7 kg) than their Brahman sisters and also more efficient than the 1/2 Charolais cows producing the 1/4 Charolais weaners. The Droughtmaster herd recorded the greatest productivity (35.5 kg) of all the herds mainly due to its very high weaning rate in the early years of this trial.

Figure 15 shows the average breeder liveweight of each herd, adjusted for the stage of pregnancy by the method of O'Rourke *et al.* (1991) so that comparisons are from the same base each time. The similarity between the two Brahman cow herds and the Droughtmasters throughout the trial is obvious. The 1/2 Charolais cows were considerably heavier during the early years, but this difference decreased over time as the long Dry Seasons took their toll on the large framed cows.

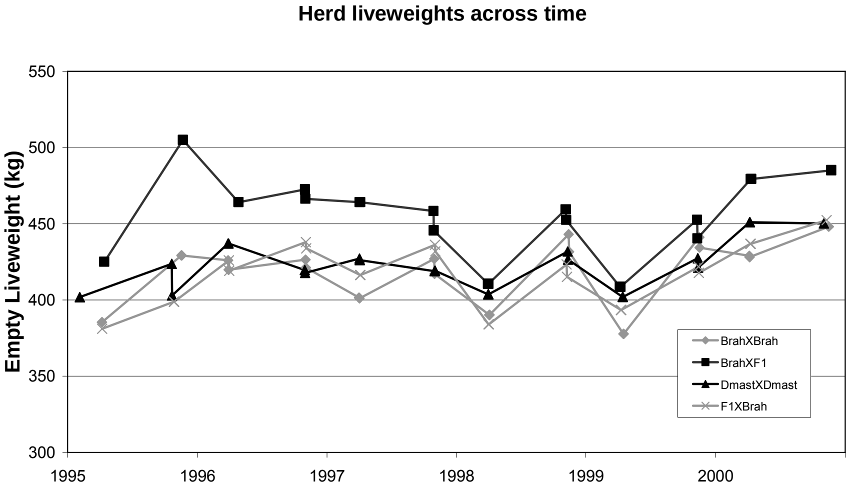


Figure 15: Average cow liveweight for different herds 1995-2001.

The condition score of the four cow herds was visually assessed on a 9 point scale adapted from Nicholson & Butterworth (1986). The analysis for each of the six years is reported separately in Appendix 5. In four of those years the 1/2 Charolais cows had significantly lower condition scores than the other genotypes.

Conclusions

- The Best Bet management system resulted in very good levels of productivity regardless of breed.
- The greater production efficiency of simple crossbreeding or stabilised composite breeds over a straight Brahman herd, was demonstrated.
- Crossbreeding with later maturing European breeds can result in larger cows and this has flow-on effects relating to breeder numbers.
- The loss in body condition of the 1/2 Charolais cows caused concern and. since this trial was run over a period of above average rainfall, it was concluded that 50% was too high a proportion of large European genes for a central VRD property. However, under the proposed criss-cross breeding strategy the normal maximum would be about 33% Charolais. It was felt that a lower proportion of Charolais and thus a lower mature weight would mean that future crosses would be hardier than this one.
- It was decided to continue the criss-cross herd after the end of the project to study the mature weight of genotypes comprising the second and third generations.

3.0 ACKNOWLEDGEMENTS

For support over the course of the project, Peter Ridley would like to thank the following in strictly alphabetic order, to avoid the need to determine an order of merit:

Peter Bagley, Farm Manager at DDRF for providing very important support when vested interests from the past attempted to avoid the irresistible pressure of the future.

Don Cherry, Manager at VRRS and his staff for their help in data collection for this project.

DDRF staff, who have mustered cattle on innumerable occasions from the 32 experimental plots over the past decade and have reliably maintained water supplies, supplement supplies and records and have generally ensured that the cattle have experienced the prescribed management regime.

Katherine Pastoral Industry Advisory Committee members for their capacity to see and support the important future implications of this work, despite its superficially abstract intentions (the establishment of maturity-type growth curves).

David Lafontaine, who personally undertook most of the infrastructure development (eg. fences and water supplies at DDRF, feedlot shelters at KRS) and mastered the use of biometrics software to facilitate the analysis of the data in addition to completing a degree in Commerce at New England over a five year period.

Neil MacDonald and other Katherine Pastoral Production staff, who built fencing and water supplies and mustered experimental cattle on the 24 km^2 area at Mt Sanford.

Meat and Livestock Australia for providing about 25% of the operational funding.

Britt Ramage, who worked as a technical officer on the project as well as being the research site manager at Mt Sanford towards the end of the project.

Tim Schatz, who worked as a technical officer on the project.

Tom Stockwell, who saw the value-adding potential (have we heard that term before?) which this many faceted series of experiments had to offer and provided encouragement and support like no one else before or since, to enable it to proceed.

Paul Stone, the manager at Mt Sanford, who showed great tolerance in agreeing to a number of requests to use his cattle outside his normal husbandry regime and allowed the department to buy weaners for the DDRF genotype x stocking rate experiment. As well as the staff over the years whelped with mustering and yard work.

Jack Wheeler, Farm Manager at KRS, with whom I enjoyed a great deal of positive interaction not to mention numerous scandalously defamatory conversations during the three years of feedlot work at KRS. Jack and his staff grew the feed, processed the feed and delivered the cattle for slaughter without fail despite the inevitable breakdowns with the worn-out 25 year old milling and mixing equipment.

In the writing of the report, the authors would like to acknowledge the contribution of **Neil MacDonald**, **Mark Hearnden, David Lafontaine** and **Melanie Usher**.

4.0 PUBLICATIONS/EXTENSION

Publications

DBIRD Technical Annual Reports. Much of this work was reported in DBIRD Technical Annual Reports from 1997 to 2002.

“A new description system for feeder cattle?” Proceedings of the North Australia Beef Industry Conference. Kununurra 2001. p.83-89.

Meeting market specifications. **-** A New Description System for Feeder Cattle?” A presentation to an industry group in the Philippines (a copy is attached in the appendix).

Meeting market specifications. A Progress Report to Katherine Region Producers. *“What happened to those Kidman Springs weaners?”*

Katherine Rural Review. The following articles were written and published in the Katherine Rural Review:

- DDRF steer comparison
- Not Weaning 100-120 kg Calves?? - The Effect on Cow Body Reserves.
- Does Castration Cause Short Term Weight Loss?
- The Longer Term Effect of Castration on Growth.
- Will Purebred Brahmans be as Productive as Current Cattle in the VRD/Gulf?
- Old Brahmans vs. New Brahmans.
- Do Supplements on Buffel Pay?
- What Does Weaning Weight Mean?

Scientific papers. Tim Schatz is writing two scientific papers on this work, they will be published in a refereed journal in 2007. One paper will be on the Mt Sanford work and the other on the Douglas Daly work. Proposed titles:

> *The effects of weaning weight, grazing system and sex on the post weaning growth of feeder cattle in the southern VRD region.*
>
> *The effects of genotype, stocking rate and sex on the post weaning growth of feeder cattle in the Douglas Daly region.*

Field Days

This project was reported on at the following field days:

1997	DDRF Field Day Mt Sanford Field Day
1998	DDRF Field Day Kidman Springs Field Day
1999	DDRF Field Day Mt Sanford Field Day
2000	DDRF Field Day Kidman Springs Field Day
2001	DDRF Field Day Mt Sanford Field Day
2002	DDRF Field Day Kidman Springs Field Day
2003	DDRF Field Day Mt Sanford Field Day

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Ridley, P.E.R., (1994 c) Meeting Post Weaning Market Specifications: The Breeding Herd

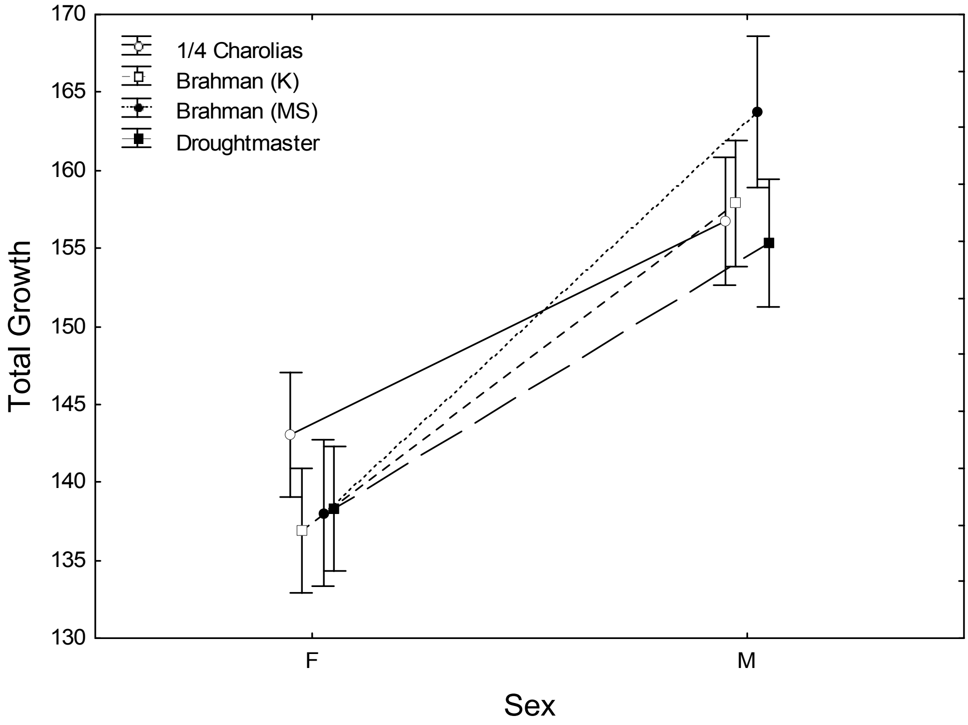
Ridley, P.E.R., (1999) Meeting post weaning market specifications in the live cattle export trade with SE Asia. 1999 Review of live export projects. North Australia Program Occasional Publication No.9 MLA p.20-26.

Schatz T.J. (2001) Estimating age from weaning weights of cattle in Northern Australia. Proceedings of the Northern Australia Beef Industry Conference. 8&9 November 2001. Kununurra. P. 71-78.

6.0 APPENDIX

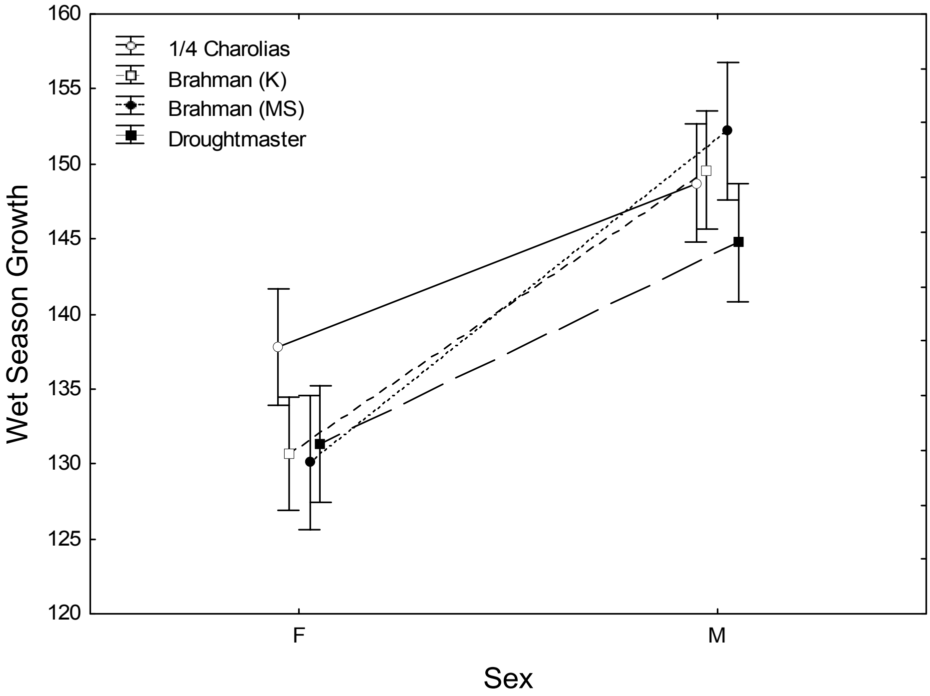
Appendix 1 – Interaction Plots and Raw Data for Section 2.1.5

Figure 1: Interaction Plot For Total Growth: Sex x Breed ($F_{(3, 750)}$ =2.6966, P = 0.0449)



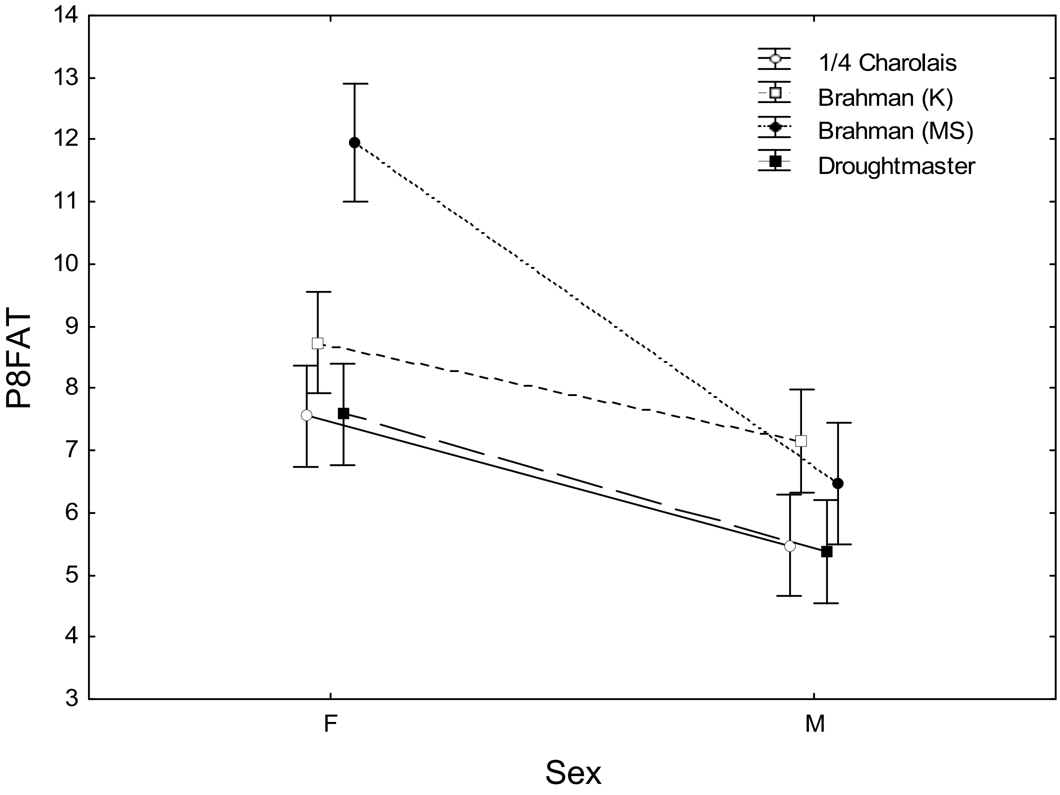
**Vertical bars denote 0.95 confidence intervals*

Figure 2: Interaction Plot For Wet Season Growth: Sex x Breed ($F_{(3, 751)}$ = 2.8901, P = 0.0347)



**Vertical bars denote 0.95 confidence intervals*

Figure 3: Interaction Plot For P8 Fat Depth: Sex x Breed ($F_{(3, 752)}$ = 7.0847, P = 0.0001)

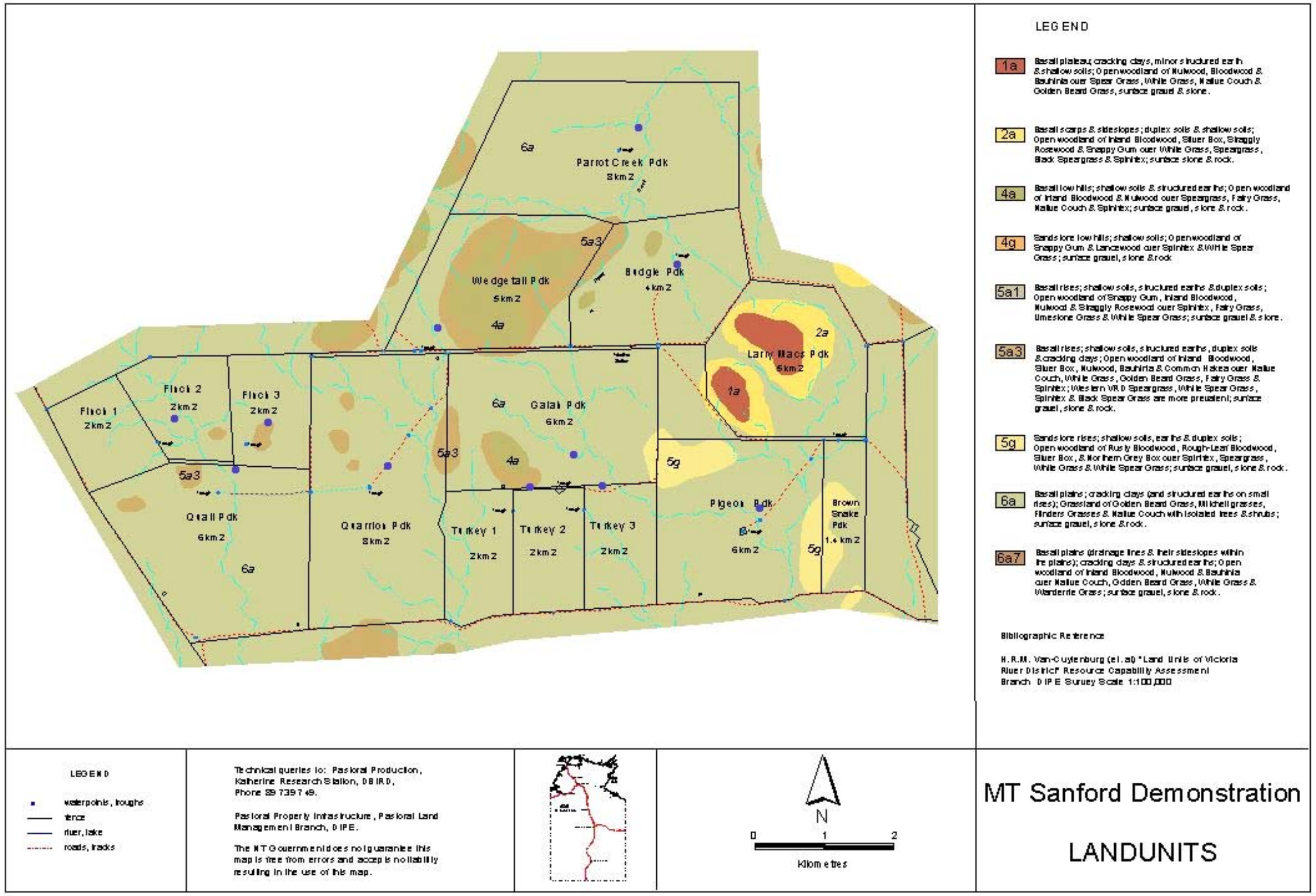


**Vertical bars denote 0.95 confidence intervals*

Table 1: Raw Means of All Treatment Combinations for Experiment 2.1.5

			1/4 Charolais				Brahman (Kidman Springs)				Brahman (Mt Sanford)				Droughtmaster			
Year	S R	Sex	Dry	Wet	Total	Fat mm	Dry	Wet	Total	Fat mm	Dry	Wet	Total	Fat mm	Dry	Wet	Total	Fat mm
99_00	High	f	6.3	148.7	155.0	7.3	1.2	134.1	135.3	9.3	10.6	117.6	128.1	10.1	3.4	131.7	135.1	8.3
		m	2.8	162.8	165.6	4.7	7.1	152.4	159.5	6.4	11.7	148.4	160.1	8.4	5.6	153.2	158.8	4.5
	Med	f	12.3	139.6	151.9	7.1	4.0	126.0	130.0	6.9	8.3	115.9	124.1	10.2	12.9	131.8	144.6	5.8
		m	12.3	160.6	173.6	5.4	10.4	160.6	171.0	7.0	10.6	149.8	160.4	5.8	12.4	143.9	156.3	5.5
	Low	f	4.3	134.9	139.1	7.9	13.1	146.7	159.9	8.8	14.7	129.9	144.6	10.0	10.4	130.0	140.4	7.6
		m	9.6	141.4	151.0	6.6	8.6	160.0	168.6	6.8	7.7	163.7	171.3	6.7	7.0	154.3	161.3	4.5
00_01	High	f	-4.2	150.1	142.5	8.2	5.0	136.9	141.9	8.5	8.8	130.3	139.1	11.9	-2.1	152.0	149.9	7.5
		m	4.6	147.6	152.2	4.8	9.2	155.1	164.3	5.8	12.0	150.5	162.5	6.1	12.4	149.5	161.9	6.0
	Med	f	5.4	143.9	149.3	7.8	-0.5	141.2	140.7	10.0	0.8	142.1	142.9	11.9	2.5	144.1	146.7	7.9
		m	14.3	158.4	172.8	5.5	3.9	144.5	148.4	7.0	13.9	162.3	176.1	7.1	15.0	156.5	171.5	6.7
	Low	f	6.3	156.0	162.3	9.2	4.2	126.6	130.9	10.2	5.7	146.9	152.6	10.4	-5.7	153.2	147.5	7.4
		m	6.3	148.7	155.0	6.8	9.4	145.9	155.3	8.1	16.7	167.4	184.1	5.7	14.1	168.3	182.4	7.9
01_02	High	f	6.6	119.9	126.5	5.0	13.4	117.6	131.0	9.3	3.4	127.5	130.9	9.8	7.6	117.0	124.6	6.7
		m	11.3	140.7	152.0	4.9	10.5	143.5	153.9	6.3	7.5	134.6	142.1	6.5	17.2	122.9	140.1	3.9
	Med	f	9.2	130.0	139.1	7.7	7.9	133.7	141.6	10.2	12.9	113.0	125.9	9.6	9.7	142.7	152.4	8.2
		m	8.8	148.4	157.1	6.8	11.9	139.9	151.8	7.1	10.3	144.2	154.6	6.6	12.8	128.9	141.6	4.4
	Low	f	8.0	146.1	154.1	7.5	10.9	129.4	140.3	9.6	7.6	144.1	151.7	10.3	19.8	123.9	143.7	8.5
		m	12.4	150.3	162.7	5.5	18.4	152.7	171.1	8.4	13.8	150.7	164.5	5.8	17.3	156.9	174.1	5.4
02_03	High	f	1.0	121.7	122.7	7.0	0.0	126.0	126.0	6.1					4.9	103.1	108.0	5.5
		m	2.1	132.2	134.3	4.2	0.5	139.7	140.2	6.4					-4.7	124.6	119.9	4.9
	Med	f	5.9	120.4	126.3	6.0	7.7	118.2	125.9	8.9					12.2	119.6	131.8	7.0
		m	1.5	143.3	144.8	5.4	0.4	152.6	153.0	8.4					6.4	142.8	149.1	5.8
	Low	f	7.7	140.7	148.4	9.9	8.6	129.7	138.3	6.7					8.3	127.2	135.5	10.7
		m	9.3	152.3	161.6	5.4	9.6	149.4	159.0	8.1					11.3	134.4	145.7	5.0

Appendix 2 – Land units on Mt Sanford demonstration site



Appendix 3 – A presentation to an Industry group in Philippines 2001

MEETING MARKET SPECIFICATIONS

A New Description System for Feeder Cattle ?

Peter Ridley, Manager Meat and Livestock Program

Introduction

I am an Agricultural Scientist working in the field of developing beef production-systems to enable Northern Territory beef producers to cost-effectively meet market specifications in our live export trade with SE Asia.

If you are experiencing difficulty in sourcing feeder cattle that will meet your market specifications for carcase fatness and carcase weight at slaughter, chances are that I can tell you the probable cause of the problem and offer a cost-effective solution.

A biologically sound value-based description system is the only way to go !!

Supply-Chain Alliances

Pressures on operational efficiency, financial survival and equitable mutual benefit between trading partners in this dynamic business, are moving the trade towards supply-chain alliances.

By supply-chain alliances I mean intimate business arrangements between trading partners that lead to the confidential exchange of performance, demand pattern, and other information as a basis for reliable, mutually beneficial forward-trading arrangements. Their focus is optimisation of both business efficiency and customer satisfaction and thus the achievement of more equitable, stable and higher profitability for trading partners.

However, business is not my field of expertise.

What I do have to offer to this gathering, is a perspective of the biological framework within which such arrangements will have to operate.

Working with the biology of meeting market specifications, will inevitably prove more financially rewarding than ignoring it or spending money to work against it.

The Biology of Meeting Market Specifications

First, two definitions:

- value-adding = the increase in weight that is possible before market specifications are exceeded,
- end-use suitability = market specifications for age, weight and fatness,.

then the feedlotters dilemma:

- If I cannot accurately describe what I want (in outcome driven terms) I am unlikely to be satisfied with what I get.
- If I am not prepared to pay (enough) for what I need, I am unlikely to get what I need.
- If I am uncertain about what I will get (in outcome terms) I will not enter the market prepared to pay as much as I could.

A biologically sound value-based description system has the capacity to resolve the first and third items above and lead to financially rational decisions in the second item.

A primary focus of my work over the past quarter of a century has been to develop such value- based description systems which then create a "market" among beef producers, for my beef production-system information. My early work in this field in Tasmania led to the grid-selling approach adopted by AUSMEAT and which is now widely used throughout Australia.

If you have clear market specifications, my role and interest is to provide a cost-effective biological production-system framework within which they can be achieved.

Maturity Type Growth Curves

The key production-system biological concept that I would now like to share with you is the maturity-type (MT) growth curve.

An MT growth curve is a weight by age graph showing the weight pattern which average cattle of a given genotype (breed combination) and sex (bull, steer or heifer) will follow if they are grown out at constant fatness **(see diagram 1).**

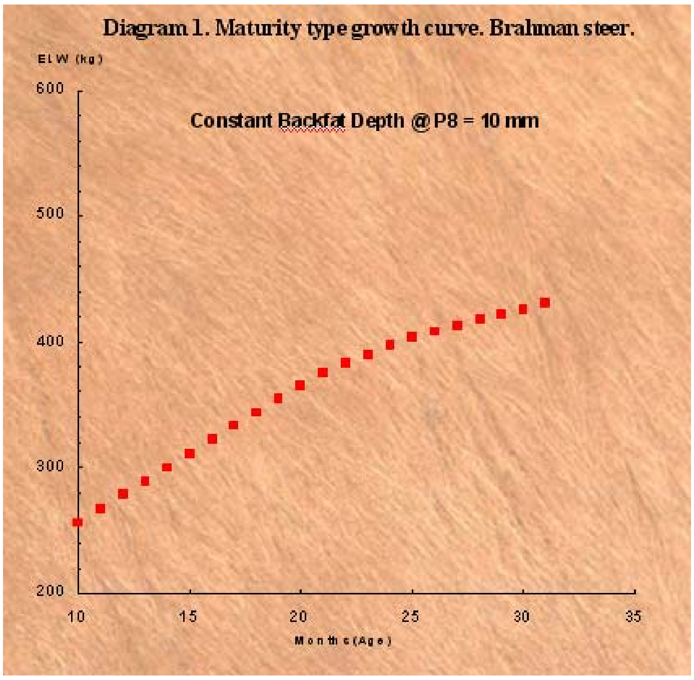


Diagram 1. Maturity type growth curve. Brahman steer.

In the meat business in Australia fatness is measured at the P8 site over the rump (see diagram 2). This measurement provides a useful estimate of the percentage of trimmed cuts in the carcase as well as a good indication of general fat cover and percentage waste fat trim.

So it is very important that the fat over the rump remains undamaged when the hide is removed at the abattoir.

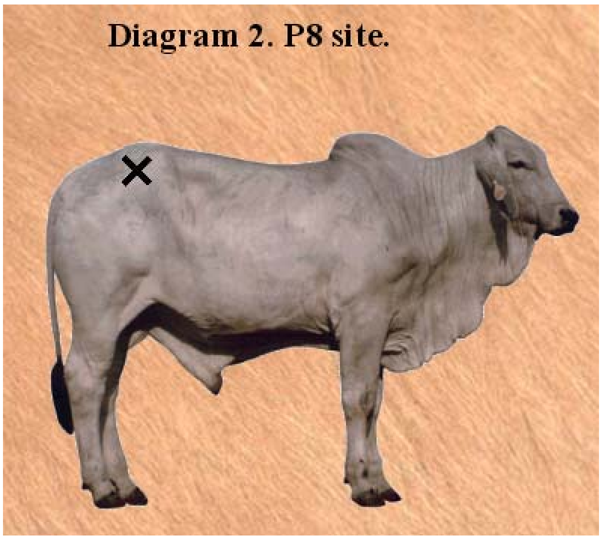
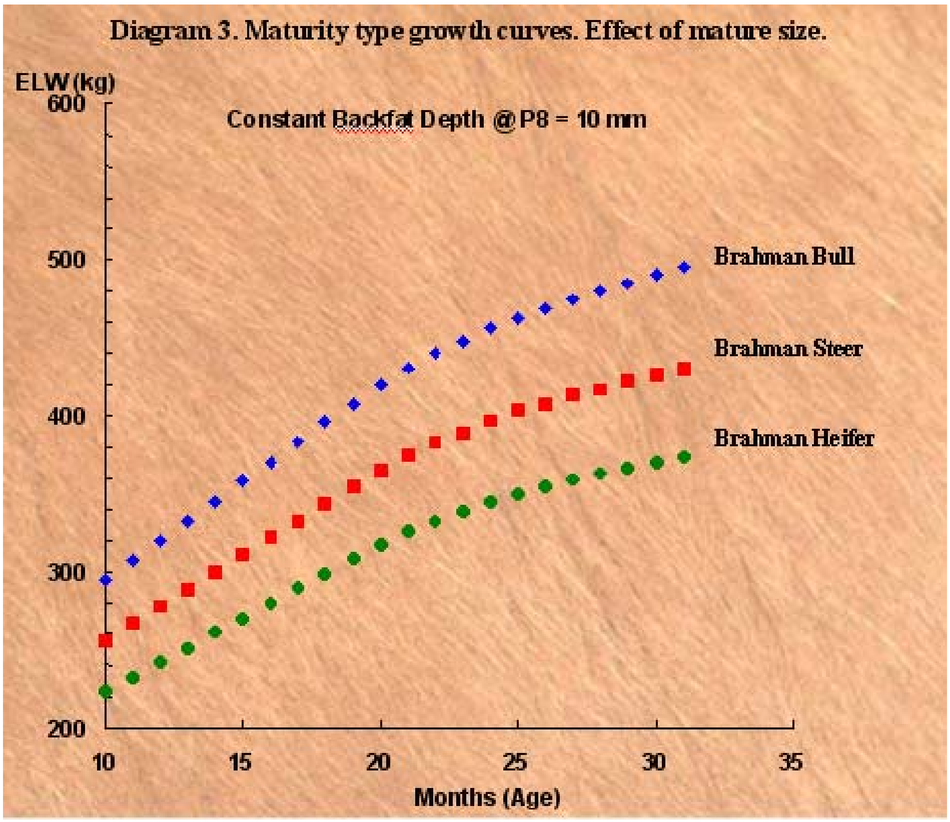


Diagram 2. P8 site.

My MT growth curves are derived from feedlot data from the research feedlot at Katherine Research Station in the NT. The target fatness at slaughter was P8 = 10 mm. This was measured ultrasonically in the live animal and confirmed by carcase measurement in the abattoir. MT curves can be drawn at a range of P8 fat depths between 0 mm and 15 mm depending on the mid-point of the market's target fat range.

Diagram 3 shows the MT growth curves for average Brahman bulls, steers and heifers. The difference between these three MT curves reflects the difference in maturity-type or mature size between the sexes.

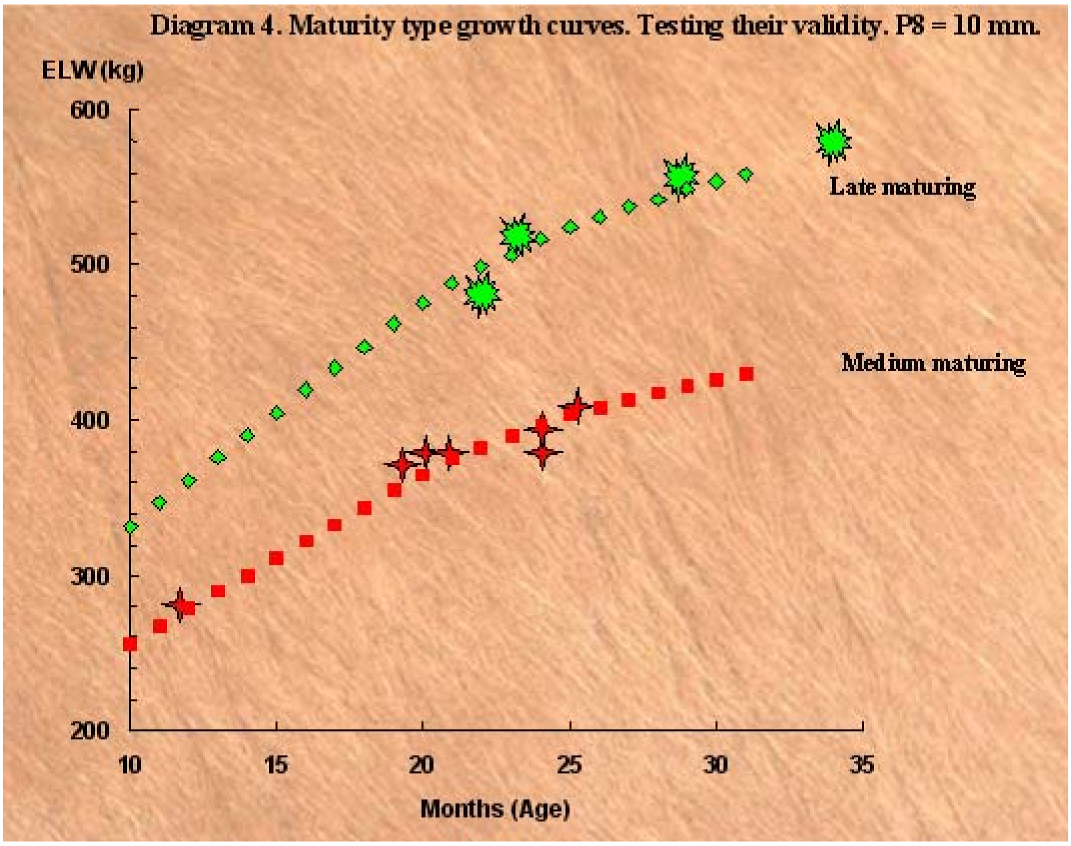


By definition, later maturing cattle are heavier than earlier maturing cattle at any given combination of age and fatness.

I also have MT curves for 1/4 Charolais x ¾ Brahman cattle.

I have tested the validity of these curves by feeding a number of randomly selected sets of young cattle of known age and maturity-type, to reach a range of weight by age combinations with each group's average fatness at slaughter also P8 = 10mm.

Diagram 4 shows where the averages from these test groups (each 8-12 head in number), has been placed in relation to my standard curves for late and medium maturity-type feeder cattle. Clearly there is good agreement.



The maturity-type (or mature size) of feeder cattle is determined by:

- their breed or breed composition (sires and dams),
- their sex,
- and to a smaller extent by the mature size of the particular herd of the breed from which they come.

Determining their sex is a matter of simple observation.

The mature size of their herd of origin can be accurately estimated from two simple once-up measurements of breeders on the property of origin. This measurement will enable the owner to account for both between-breed and within breed differences in mature size when classifying their maturity type for trading purposes.

Since at present there are no financial incentives in the form of different prices for different specifications (as they affect value-adding potential and end-use suitability), there is no reason for northern Australian beef breeders to incur the costs of recording approximate age at weaning or estimating mature size. Unfortunately if you ask at present you will not get !

The issue is in the hands (or perhaps more specifically, the chequebooks!!) of the feedlotters. How much is it worth to them to be sure of the value-adding potential and the end-use suitability of the feeder cattle that they buy ? (We are now back at the feedlotters dilemma, where we started).

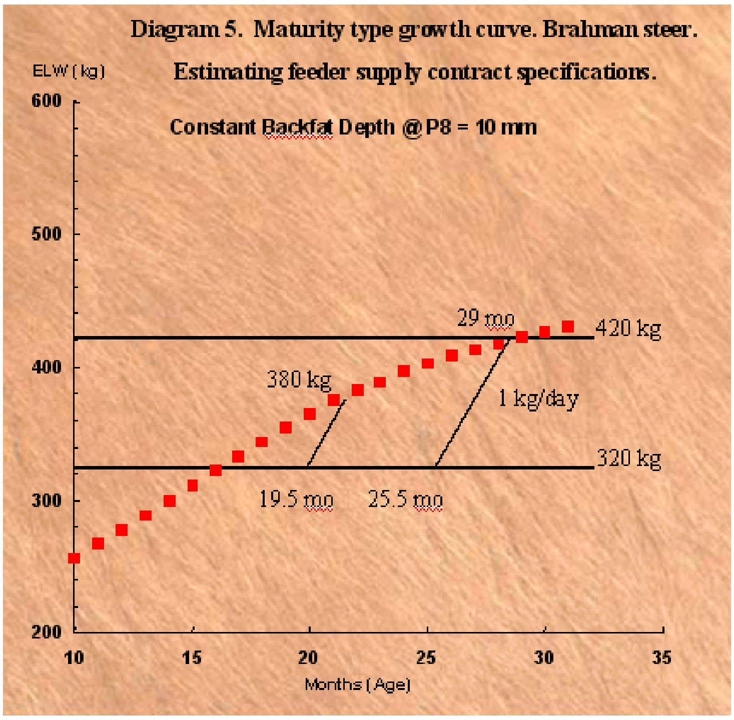
The key specifications for feedlotters are:

- maturity type,
- age (± 2 months),
- liveweight (± 30 kg).

MT Growth Curves and Supply Contract Specifications

MT growth curves may be very interesting for a scientist but what have they got to do with the feedlot business and the live export trade?

Diagram 5 provides an MT curve for a typical group of Brahman steer feeders. Let us now assume the feedlotter:



- requires slaughter specifications of 420 ±30 kg for empty liveweight, and P8 = 10 ±4mm for carcase fatness, and

- wishes to value-add 100 kg over a 100 day feeding period (i.e. a growth rate of 1.0 kg/day).

To determine the relevant age at slaughter, he enters the relevant MT curve in to his personal computer and drives a line across the MT graph at 420 kg, to intersect the MT curve. At the point of intersection, the average age at slaughter for this maturity type can be read off the horizontal axis (**29.0 months in diagram 5**).

Since he wishes to value-add 100 kg he then drives another line across the graph at 320 kg.

In this example the feeder cattle are to be grown at 1.0 kg day so he then drives a line of this slope through the first intersection to provide an intersection with the 320 kg line. The average age (±2 months) at which he should acquire feeders of this maturity type can now be read off the horizontal axis, immediately below this second intersection **(25.5 months in diagram 5).**

He has now worked backwards from his planned outcome to discover the feeder weight and age specifications with which he needs to start.

Diagram 5 provides the basis for writing supply-contract specifications of the type shown in diagram 6.

Diagram 6 shows three different maturity type classes (A,B,C). They correspond to average 1/2 Charolais, 1/4 Charolais and full Brahman steers respectively. The schedule also provides the age and weight specifications for feeders that have either 50 or 100 kg of value-adding at the planned plane of nutrition (growth rate).

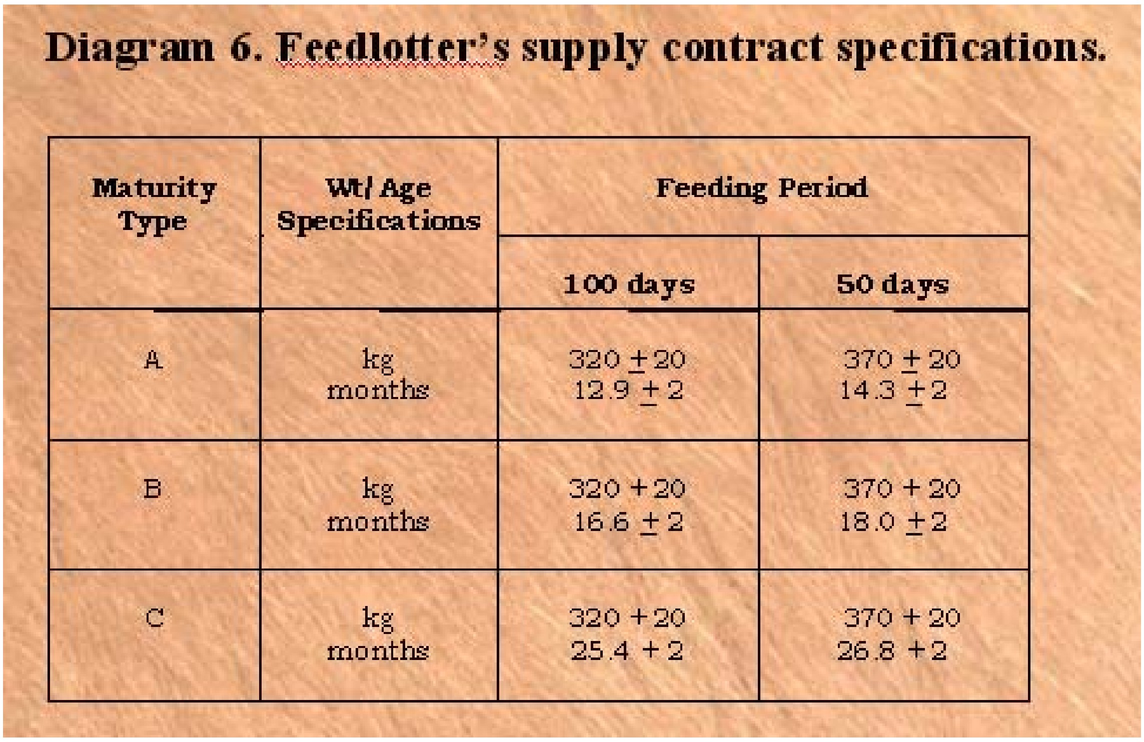


Diagram 6. Feedlotter's supply contract specifications.

Maturity Type	Wt/ Age Specifications	Feeding Period	
		100 days	50 days
A	kg months	320 ± 20 12.9 ± 2	370 ± 20 14.3 ± 2
B	kg months	320 + 20 16.6 ± 2	370 + 20 18.0 ± 2
C	kg months	320 + 20 25.4 + 2	370 + 20 26.8 + 2

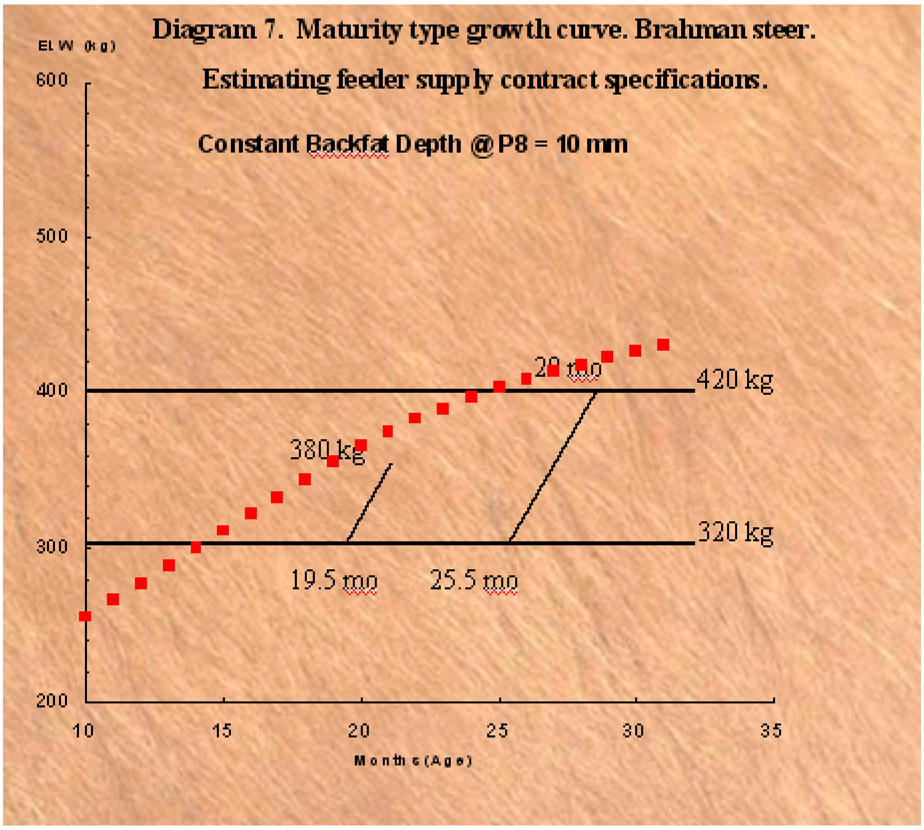
It should be a simple process for the feedlotter to calculate the relative value of the different cells in this table and arrive at the appropriate price ceilings for each.

Separate MT growth curves are available for average bulls, steers and heifers in two genotypes differing by about 15% in mature size (Brahman and 1/4 Charolais x ¾ Brahman).

As mentioned previously, I have also developed a technique to fine tuning these curves for progeny from individual breeding herds whose mature size (maturity type) deviates from the average within these two genotypes.

A Real- World Problem

Inspection of Diagram 7 exposes the biological origin of a common problem experienced by feedlot operators all over the world. There is no reliable way of visually distinguishing a group of Brahman steers that average 320 kg and 19.5 months age from a group of Brahman steers that average 320 kg and 25.5 months age. Both age-branding at weaning and dentition are too inaccurate



At a starting age of 19.5 months, average 320 kg Brahman steers grown at 1.0 kg/day will average about 380 kg at P8=10 mm whereas the 320 kg steers averaging 25.5 months age at the start will average about 420 kg at P8= 10 mm.

Clearly the two groups have very different value-adding potential and end-use suitability in terms of portion size!

Is this a problem that you are experiencing?

If this is a problem confronting your feedlot business then I have a cost-effective answer for you !!

Describe your feeder cattle needs in terms of maturity-type, age (±2months)and weight(empty live ±30 kg) and be prepared to pay for what you want. Given that you have a staff member with appropriate live animal fatness appraisal skills at your feedlot, you should be able to slaughter a high percentage (> 80%?) of carcases in your target carcase fat and weight ranges.

However northern Australian beef producers will not start to collect the necessary information until an appropriate value-based description system is in place with differential prices that justify their costs of collecting and providing the data.

They will not collect this information if it reduces the total value of their annual turnoff.

It is not a viable mechanism for pulling prices down.

It has the potential to be the glue which binds supply-chain alliances partners together in mutual self-interest.

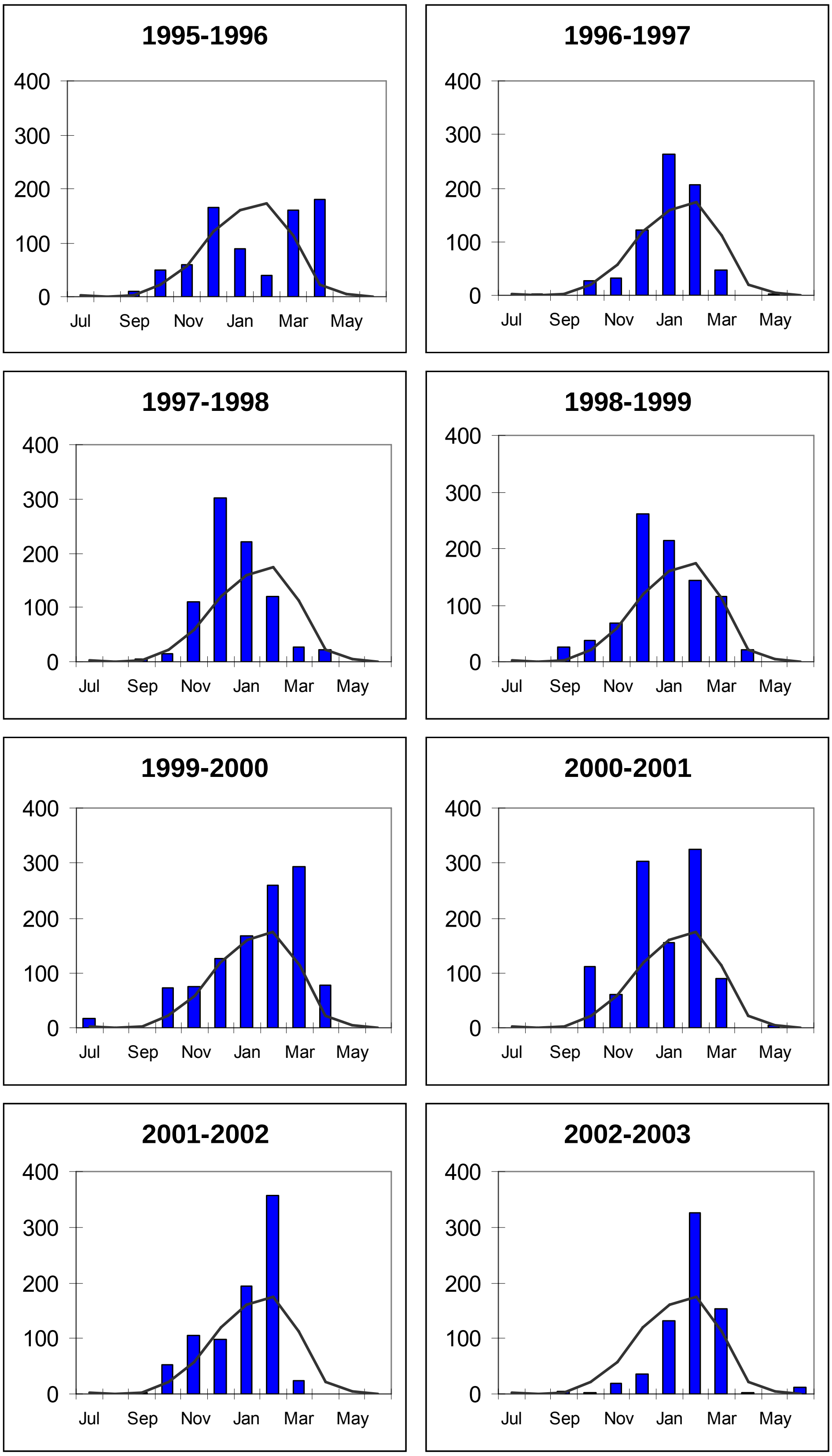
This new way of doing business cannot come about overnight. Accurate estimation of age needs to be done at weaning and requires additional staff time and other costs for the northern Australian cattle breeder. He will not incur these costs unless there is clearly some financial benefit.

This new approach to setting supply specifications needs a commercial scale demonstration. Such a demonstration would provide potential trading partners with a better feel for the implications of trading by specification. It would also provide them with a rational basis for deciding about change. It could significantly progress the maturity of the trade through the accelerated evolution of more successful supply-chain alliances.

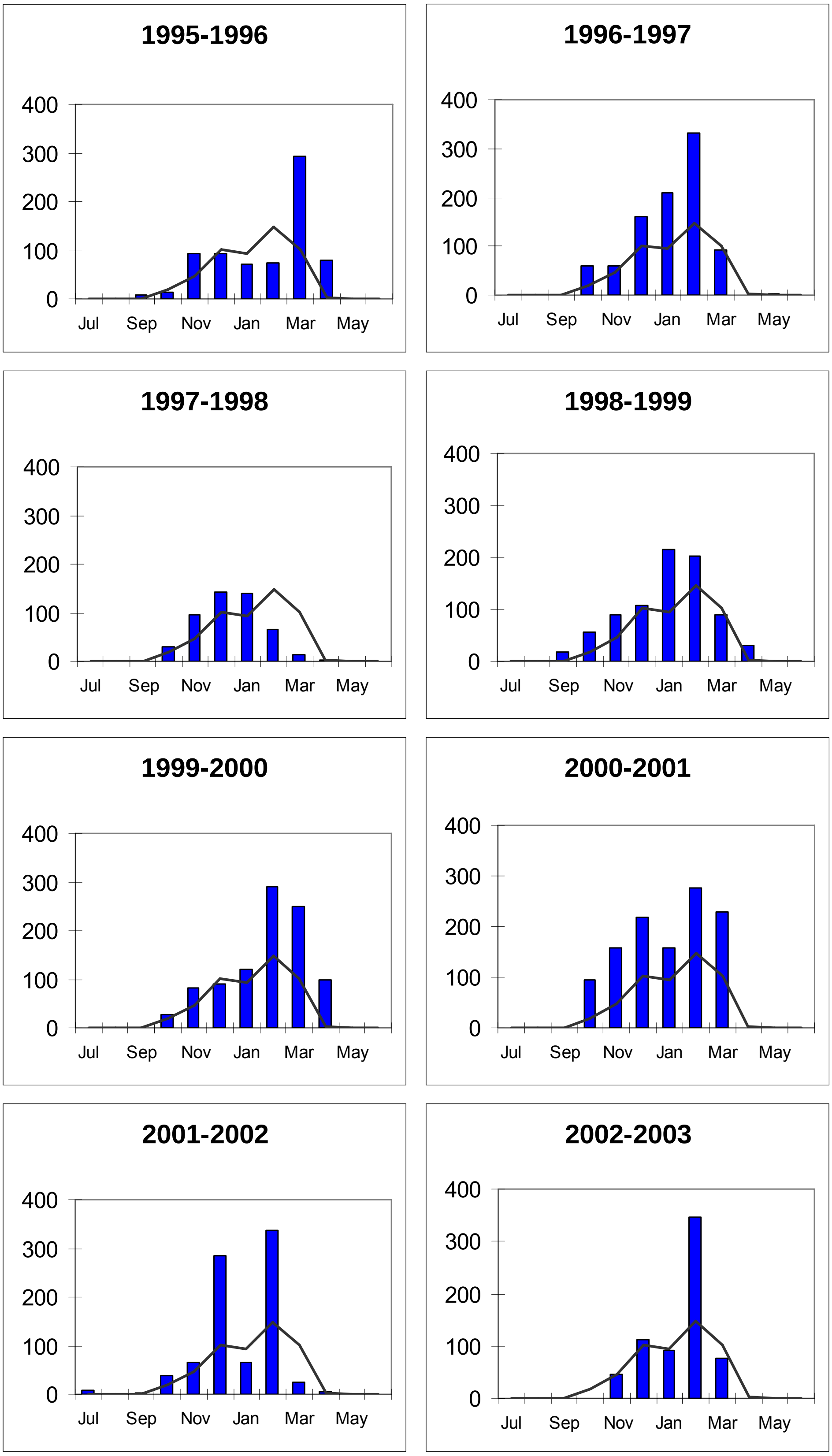
Diagram 8 shows two Brahman steers that are 10 months different in age after having been fed at different levels so as to be the same fatness (P8 = 10 mm). They differ by 120 kg in liveweight and this is typical for the breed up to about 24 months age.

Appendix 4 – Monthly Rainfall at Kidman Springs and Mt Sanford Homestead

Monthly Rainfall at Kidman Springs (mm)

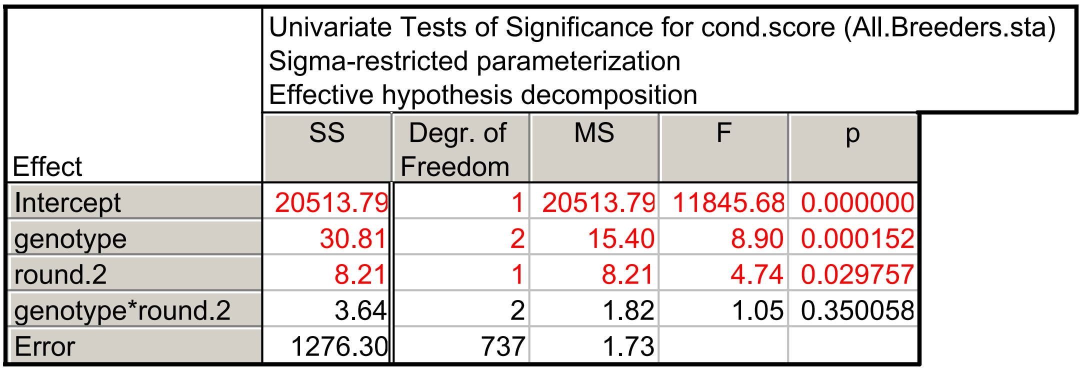


Monthly Rainfall Mt Sanford Homestead (mm)



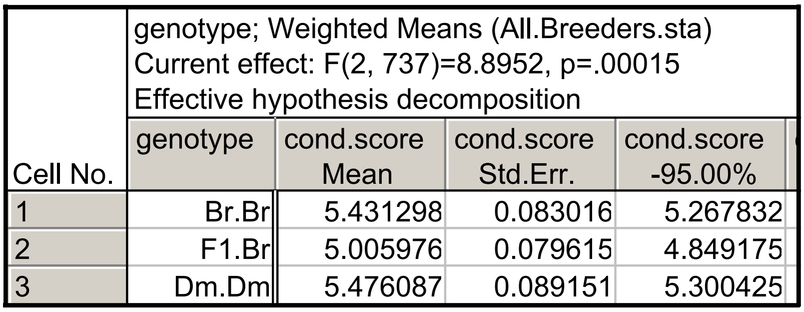
Appendix 5 – Condition scores for breeders at Kidman Springs 1996-2001

1996 - No condition scores for Brahman F1s



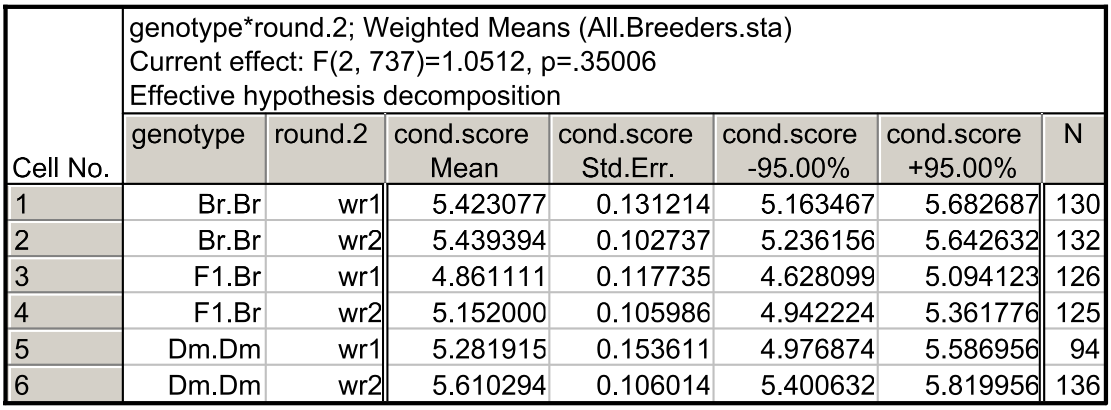
Univariate Tests of Significance for cond.score (All.Breeders.sta)
Sigma-restricted parameterization
Effective hypothesis decomposition

Effect	SS	Degr. of Freedom	MS	F	p
Intercept	20513.79	1	20513.79	11845.68	0.000000
genotype	30.81	2	15.40	8.90	0.000152
round.2	8.21	1	8.21	4.74	0.029757
genotype*round.2	3.64	2	1.82	1.05	0.350058
Error	1276.30	737	1.73		



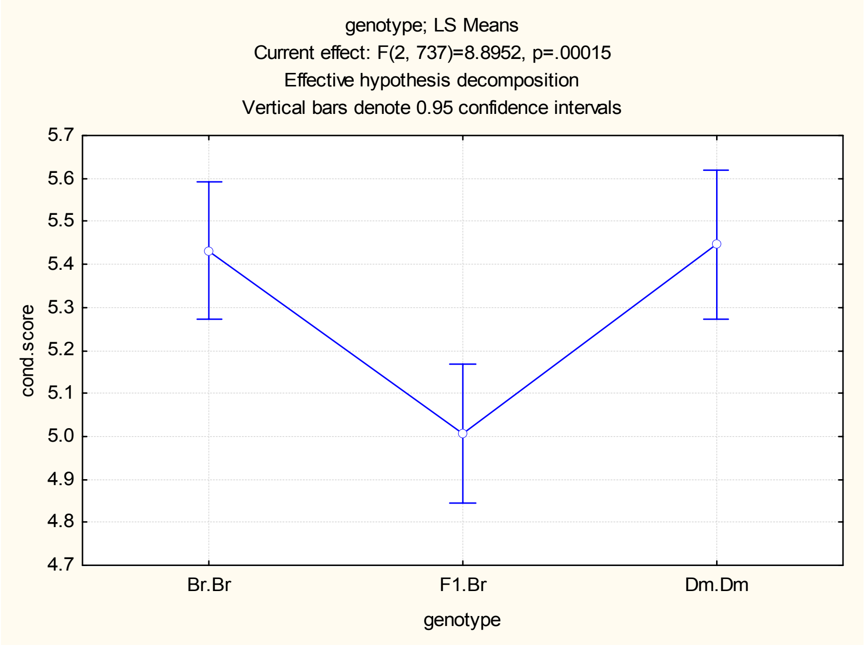
genotype; Weighted Means (All.Breeders.sta)
Current effect: F(2, 737)=8.8952, p=.00015
Effective hypothesis decomposition

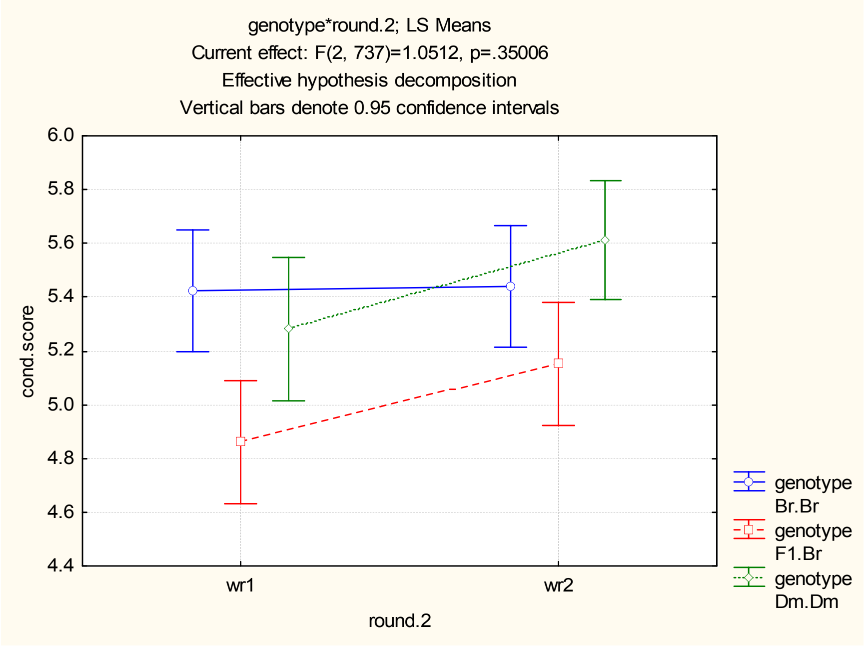
Cell No.	genotype	cond.score Mean	cond.score Std.Err.	cond.score -95.00%
1	Br.Br	5.431298	0.083016	5.267832
2	F1.Br	5.005976	0.079615	4.849175
3	Dm.Dm	5.476087	0.089151	5.300425



genotype*round.2; Weighted Means (All.Breeders.sta)
Current effect: F(2, 737)=1.0512, p=.35006
Effective hypothesis decomposition

Cell No.	genotype	round.2	cond.score Mean	cond.score Std.Err.	cond.score -95.00%	cond.score +95.00%	N
1	Br.Br	wr1	5.423077	0.131214	5.163467	5.682687	130
2	Br.Br	wr2	5.439394	0.102737	5.236156	5.642632	132
3	F1.Br	wr1	4.861111	0.117735	4.628099	5.094123	126
4	F1.Br	wr2	5.152000	0.105986	4.942224	5.361776	125
5	Dm.Dm	wr1	5.281915	0.153611	4.976874	5.586956	94
6	Dm.Dm	wr2	5.610294	0.106014	5.400632	5.819956	136


genotype; LS Means
Current effect: F(2, 737)=8.8952, p=.00015
Effective hypothesis decomposition
Vertical bars denote 0.95 confidence intervals
cond.score
5.7
5.6
5.5
5.4
5.3
5.2
5.1
5.0
4.9
4.8
4.7
Br.Br
F1.Br
Dm.Dm
genotype

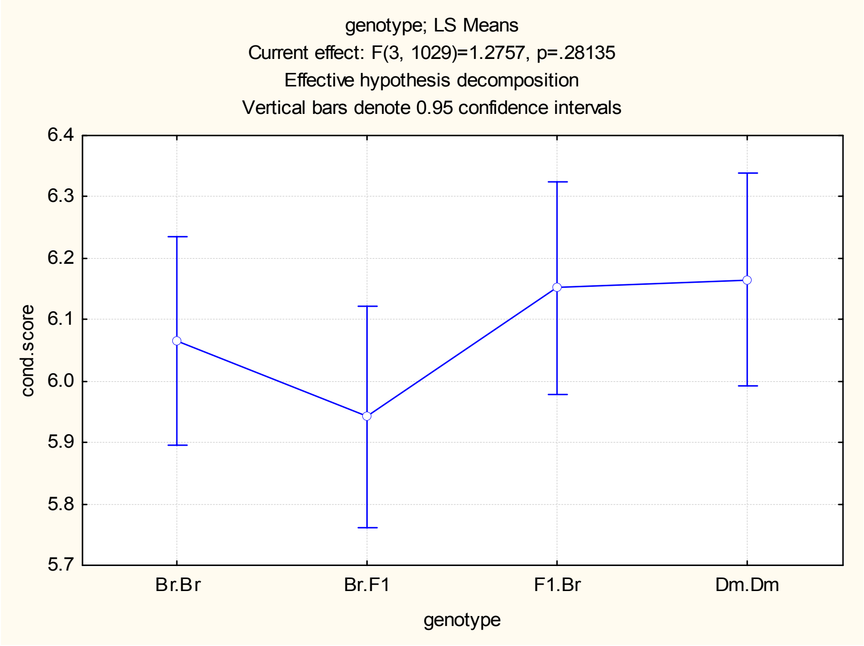

genotype*round.2; LS Means
Current effect: F(2, 737)=1.0512, p=.35006
Effective hypothesis decomposition
Vertical bars denote 0.95 confidence intervals
cond.score
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
wr1
wr2
round.2
genotype Br.Br
genotype F1.Br
genotype Dm.Dm

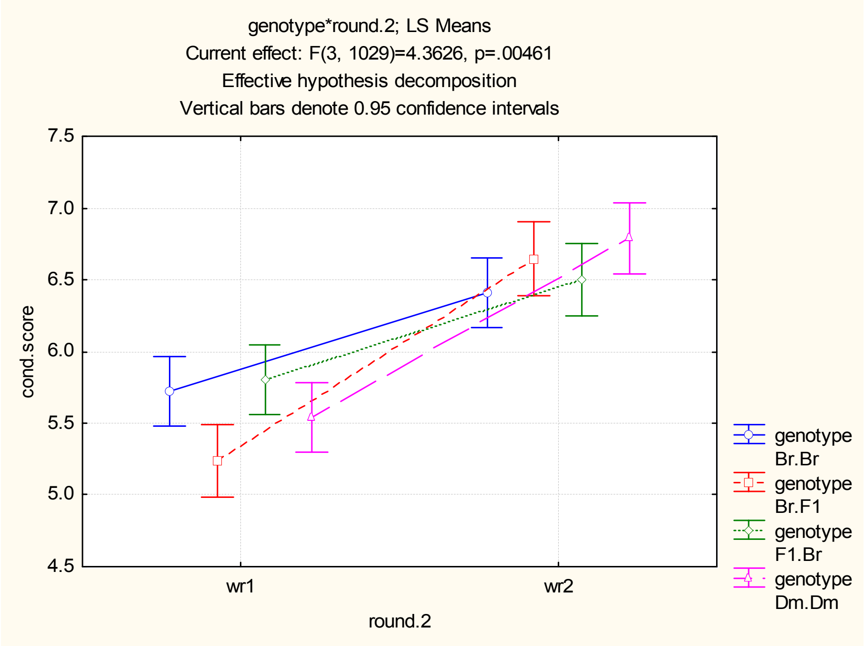
1997 - CS for all breeds

Effect	Univariate Tests of Significance for cond.score (All.Breeders.sta) Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	38249.60	1	38249.60	18643.51	0.000000
genotype	7.85	3	2.62	1.28	0.281349
round.2	263.60	1	263.60	128.49	0.000000
genotype*round.2	26.85	3	8.95	4.36	0.004611
Error	2111.13	1029	2.05		

Cell No.	genotype; Weighted Means (All.Breeders.sta) Current effect: F(3, 1029)=1.2757, p=.28135 Effective hypothesis decomposition genotype	cond.score Mean	cond.score Std.Err.	cond.score -95.00%	cond.score +95.00%	N
1	Br.Br	6.062500	0.095334	5.874810	6.250190	272
2	Br.F1	5.913223	0.091020	5.733927	6.092520	242
3	F1.Br	6.146154	0.091391	5.966190	6.326118	260
4	Dm.Dm	6.148289	0.099429	5.952507	6.344071	263

Cell No.	genotype*round.2; Weighted Means (All.Breeders.sta) Current effect: F(3, 1029)=4.3626, p=.00461 Effective hypothesis decomposition genotype	round.2	cond.score Mean	cond.score Std.Err.	cond.score -95.00%	cond.score +95.00%	N
1	Br.Br	wr1	5.722628	0.147518	5.430902	6.014353	137
2	Br.Br	wr2	6.407407	0.113391	6.183140	6.631675	135
3	Br.F1	wr1	5.238095	0.117880	5.004796	5.471394	126
4	Br.F1	wr2	6.646552	0.104080	6.440388	6.852715	116
5	F1.Br	wr1	5.803030	0.141225	5.523654	6.082406	132
6	F1.Br	wr2	6.500000	0.106967	6.288332	6.711668	128
7	Dm.Dm	wr1	5.540741	0.135375	5.272992	5.808490	135
8	Dm.Dm	wr2	6.789062	0.123342	6.544992	7.033133	128


genotype; LS Means
Current effect: F(3, 1029)=1.2757, p=.28135
Effective hypothesis decomposition
Vertical bars denote 0.95 confidence intervals
cond.score
6.4
6.3
6.2
6.1
6.0
5.9
5.8
5.7
Br.Br
Br.F1
F1.Br
Dm.Dm
genotype

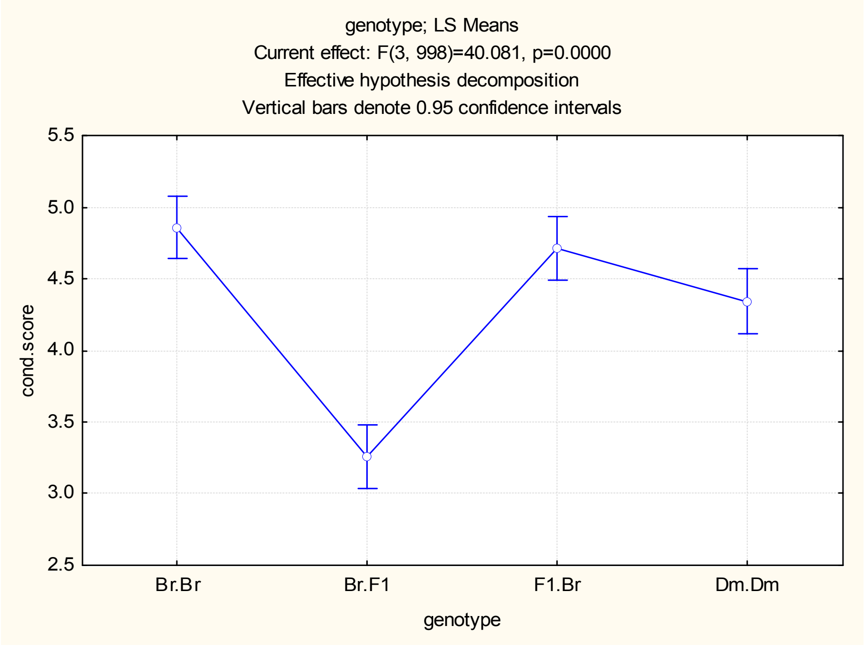

genotype*round.2; LS Means
Current effect: F(3, 1029)=4.3626, p=.00461
Effective hypothesis decomposition
Vertical bars denote 0.95 confidence intervals
cond.score
7.5
7.0
6.5
6.0
5.5
5.0
4.5
wr1
wr2
round.2
genotype Br.Br
genotype Br.F1
genotype F1.Br
genotype Dm.Dm

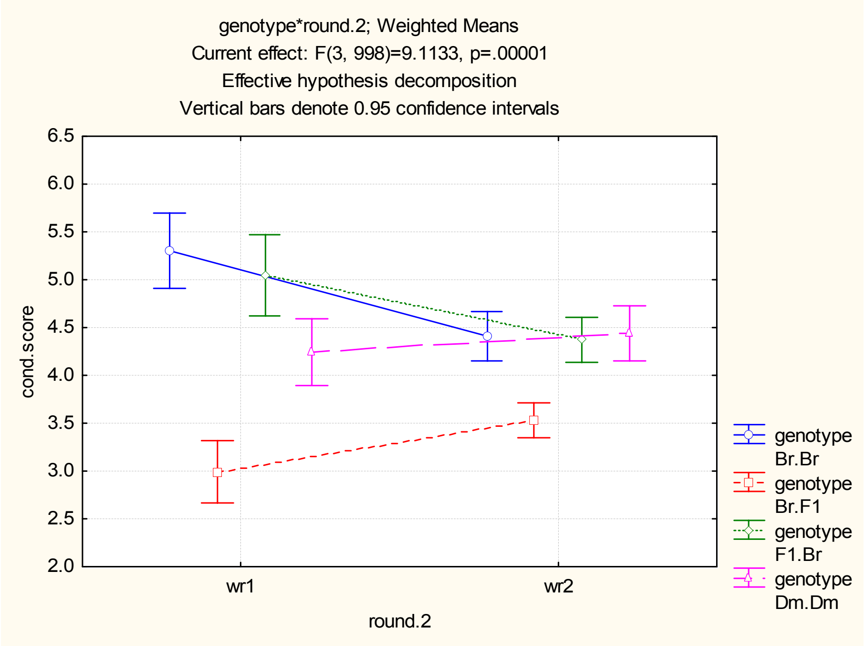
1998 - CS for all breeds

	Univariate Tests of Significance for cond.score (All.Breeders.sta) Sigma-restricted parameterization Effective hypothesis decomposition				
Effect	SS	Degr. of Freedom	MS	F	p
Intercept	18491.54	1	18491.54	5741.879	0.000000
genotype	387.24	3	129.08	40.081	0.000000
round.2	10.84	1	10.84	3.365	0.066877
genotype*round.2	88.05	3	29.35	9.113	0.000006
Error	3214.03	998	3.22		

	genotype; Weighted Means (All.Breeders.sta) Current effect: F(3, 998)=40.081, p=0.0000 Effective hypothesis decomposition					
Cell No.	genotype	cond.score Mean	cond.score Std.Err.	cond.score -95.00%	cond.score +95.00%	N
1	Br.Br	4.832700	0.120145	4.596128	5.069271	263
2	Br.F1	3.261411	0.095592	3.073105	3.449717	241
3	F1.Br	4.708171	0.122861	4.466225	4.950117	257
4	Dm.Dm	4.338776	0.115601	4.111071	4.566480	245

	genotype*round.2; Weighted Means (All.Breeders.sta) Current effect: F(3, 998)=9.1133, p=.00001 Effective hypothesis decomposition						
Cell No.	genotype	round.2	cond.score Mean	cond.score Std.Err.	cond.score -95.00%	cond.score +95.00%	N
1	Br.Br	wr1	5.306452	0.199388	4.911774	5.701129	124
2	Br.Br	wr2	4.410072	0.132276	4.148522	4.671622	139
3	Br.F1	wr1	2.991597	0.165581	2.663701	3.319493	119
4	Br.F1	wr2	3.524590	0.092544	3.341376	3.707804	122
5	F1.Br	wr1	5.047244	0.212666	4.626385	5.468103	127
6	F1.Br	wr2	4.376923	0.119762	4.139971	4.613875	130
7	Dm.Dm	wr1	4.242188	0.177730	3.890492	4.593883	128
8	Dm.Dm	wr2	4.444444	0.144373	4.158496	4.730393	117


genotype; LS Means
Current effect: F(3, 998)=40.081, p=0.0000
Effective hypothesis decomposition
Vertical bars denote 0.95 confidence intervals
cond.score
5.5
5.0
4.5
4.0
3.5
3.0
2.5
Br.Br
Br.F1
F1.Br
Dm.Dm
genotype

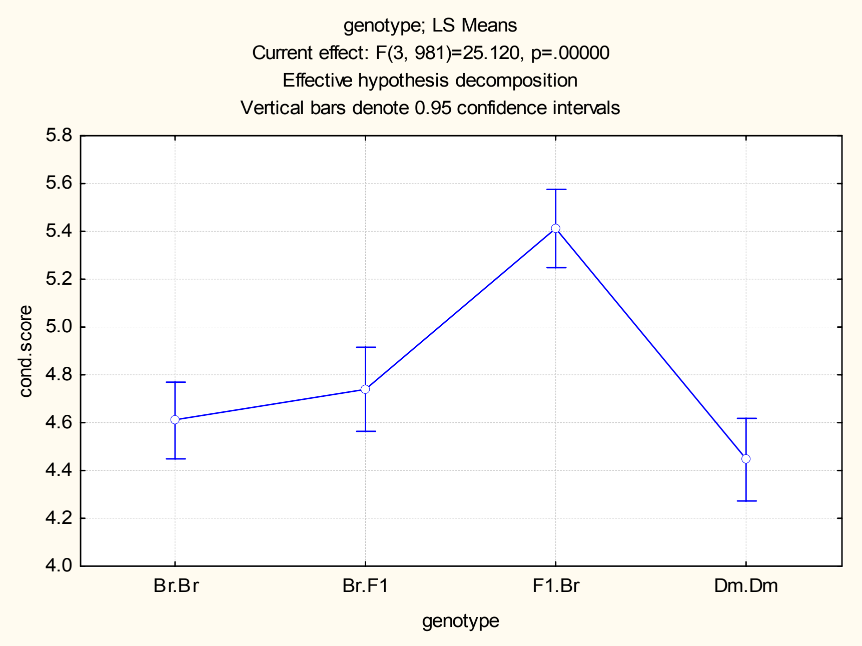

genotype*round.2; Weighted Means
Current effect: F(3, 998)=9.1133, p=.00001
Effective hypothesis decomposition
Vertical bars denote 0.95 confidence intervals
cond.score
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
wr1
wr2
round.2
genotype Br.Br
genotype Br.F1
genotype F1.Br
genotype Dm.Dm

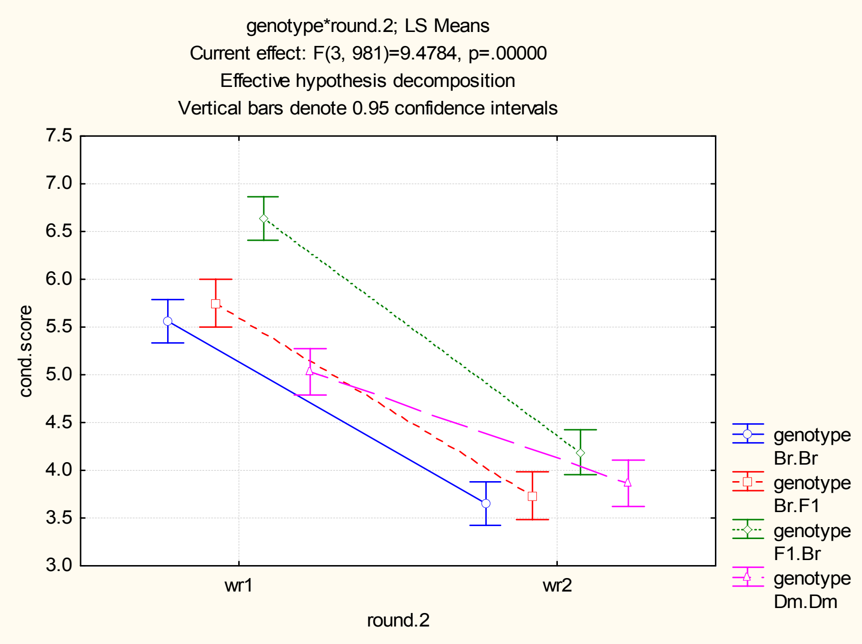
1999 CS for all breeds

	Univariate Tests of Significance for cond.score (All.Breeders.sta) Sigma-restricted parameterization Effective hypothesis decomposition				
Effect	SS	Degr. of Freedom	MS	F	p
Intercept	22701.74	1	22701.74	12466.60	0.000000
genotype	137.23	3	45.74	25.12	0.000000
round.2	878.89	1	878.89	482.64	0.000000
genotype*round.2	51.78	3	17.26	9.48	0.000004
Error	1786.40	981	1.82		

	genotype; Weighted Means (All.Breeders.sta) Current effect: F(3, 981)=25.120, p=.00000 Effective hypothesis decomposition					
Cell No.	genotype	cond.score Mean	cond.score Std.Err.	cond.score -95.00%	cond.score +95.00%	N
1	Br.Br	4.631579	0.103828	4.427147	4.836011	266
2	Br.F1	4.756637	0.116792	4.526491	4.986784	226
3	F1.Br	5.416988	0.107552	5.205196	5.628781	259
4	Dm.Dm	4.441176	0.094590	4.254832	4.627520	238

	genotype*round.2; Weighted Means (All.Breeders.sta) Current effect: F(3, 981)=9.4784, p=.00000 Effective hypothesis decomposition						
Cell No.	genotype	round.2	cond.score Mean	cond.score Std.Err.	cond.score -95.00%	cond.score +95.00%	N
1	Br.Br	wr1	5.566176	0.149328	5.270853	5.861500	136
2	Br.Br	wr2	3.653846	0.080035	3.495494	3.812198	130
3	Br.F1	wr1	5.747826	0.157615	5.435591	6.060061	115
4	Br.F1	wr2	3.729730	0.106270	3.519127	3.940332	111
5	F1.Br	wr1	6.638462	0.097680	6.445200	6.831723	130
6	F1.Br	wr2	4.186047	0.116352	3.955825	4.416268	129
7	Dm.Dm	wr1	5.033898	0.141356	4.753950	5.313846	118
8	Dm.Dm	wr2	3.858333	0.101319	3.657712	4.058955	120


genotype; LS Means
Current effect: F(3, 981)=25.120, p=.00000
Effective hypothesis decomposition
Vertical bars denote 0.95 confidence intervals
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
cond.score
Br.Br
Br.F1
F1.Br
Dm.Dm
genotype

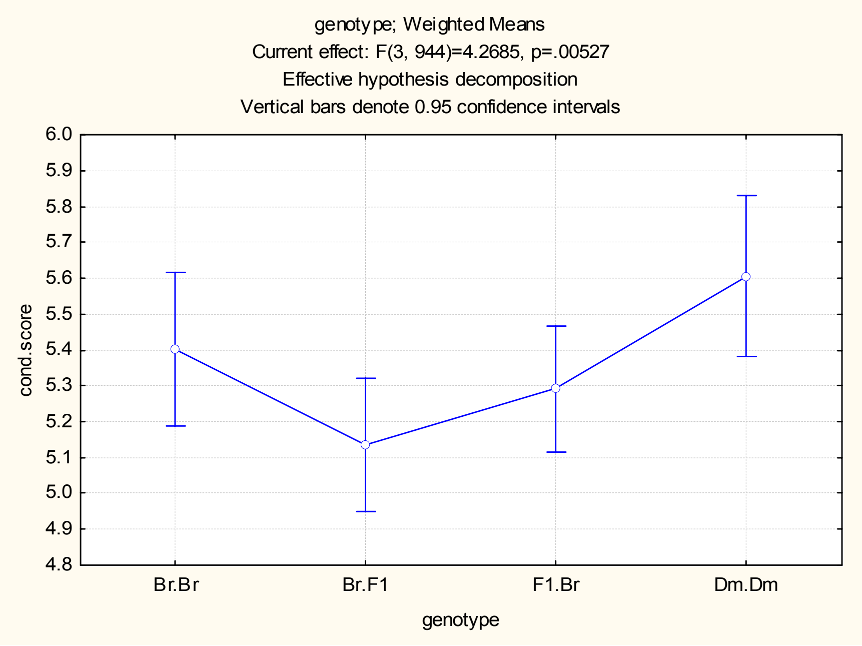

genotype*round.2; LS Means
Current effect: F(3, 981)=9.4784, p=.00000
Effective hypothesis decomposition
Vertical bars denote 0.95 confidence intervals
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
cond.score
wr1
wr2
round.2
genotype Br.Br
genotype Br.F1
genotype F1.Br
genotype Dm.Dm

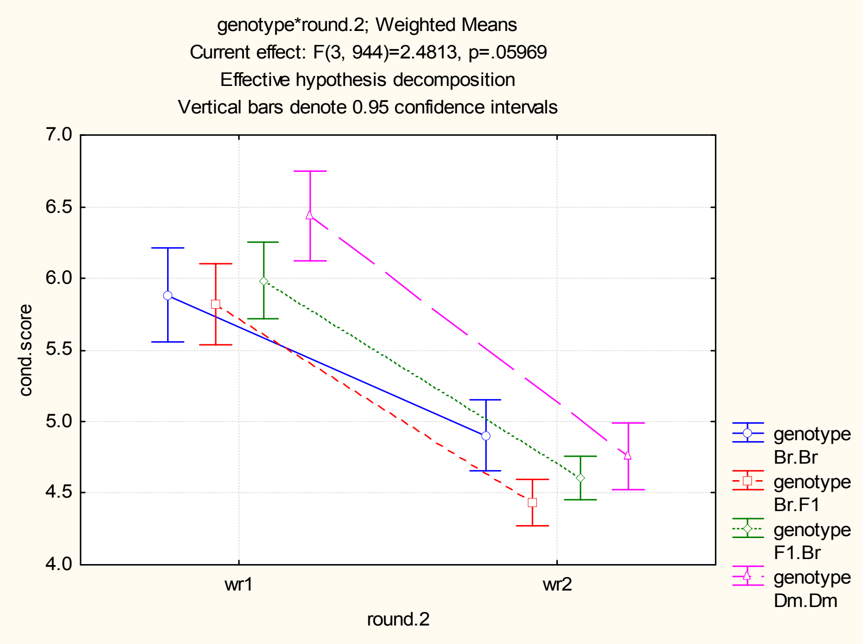
2000 – CS for all breeds

Effect	Univariate Tests of Significance for cond.score (All.Breeders.sta) Sigma-restricted parameterization Effective hypothesis decomposition SS	Degr. of Freedom	MS	F	p
Intercept	27139.58	1	27139.58	13394.99	0.000000
genotype	25.95	3	8.65	4.27	0.005268
round.2	435.24	1	435.24	214.82	0.000000
genotype*round.2	15.08	3	5.03	2.48	0.059690
Error	1912.64	944	2.03		

Cell No.	genotype; Weighted Means (All.Breeders.sta) Current effect: F(3, 944)=4.2685, p=.00527 Effective hypothesis decomposition genotype	cond.score Mean	cond.score Std.Err.	cond.score -95.00%	cond.score +95.00%	N
1	Br.Br	5.403162	0.108812	5.188865	5.617459	253
2	Br.F1	5.134884	0.094983	4.947662	5.322105	215
3	F1.Br	5.292490	0.089118	5.116978	5.468002	253
4	Dm.Dm	5.606061	0.113394	5.382638	5.829484	231

Cell No.	genotype*round.2; Weighted Means (All.Breeders.sta) Current effect: F(3, 944)=2.4813, p=.05969 Effective hypothesis decomposition genotype	round.2	cond.score Mean	cond.score Std.Err.	cond.score -95.00%	cond.score +95.00%	N
1	Br.Br	wr1	5.883721	0.165681	5.555893	6.211548	129
2	Br.Br	wr2	4.903226	0.125661	4.654488	5.151964	124
3	Br.F1	wr1	5.816514	0.142287	5.534477	6.098551	109
4	Br.F1	wr2	4.433962	0.081560	4.272243	4.595681	106
5	F1.Br	wr1	5.984127	0.135217	5.716515	6.251739	126
6	F1.Br	wr2	4.606299	0.078383	4.451181	4.761417	127
7	Dm.Dm	wr1	6.435897	0.158456	6.122056	6.749739	117
8	Dm.Dm	wr2	4.754386	0.117919	4.520767	4.988005	114


genotype; Weighted Means
Current effect: F(3, 944)=4.2685, p=.00527
Effective hypothesis decomposition
Vertical bars denote 0.95 confidence intervals
cond.score
6.0
5.9
5.8
5.7
5.6
5.5
5.4
5.3
5.2
5.1
5.0
4.9
4.8
Br.Br
Br.F1
F1.Br
Dm.Dm
genotype


genotype*round.2; Weighted Means
Current effect: F(3, 944)=2.4813, p=.05969
Effective hypothesis decomposition
Vertical bars denote 0.95 confidence intervals
cond.score
7.0
6.5
6.0
5.5
5.0
4.5
4.0
wr1
wr2
round.2
genotype Br.Br
genotype Br.F1
genotype F1.Br
genotype Dm.Dm

2001 – CS for weaning round 1 only

Univariate Tests of Significance for cond.score (All.Breeders.sta)
Sigma-restricted parameterization
Effective hypothesis decomposition

Effect	SS	Degr. of Freedom	MS	F	p
Intercept	8642.628	1	8642.628	6292.302	0.000000
genotype	25.610	3	8.537	6.215	0.000385
Error	602.977	439	1.374		

genotype; Weighted Means (All.Breeders.sta)
Current effect: F(3, 439)=6.2151, p=.00038
Effective hypothesis decomposition

Cell No.	genotype	cond.score Mean	cond.score Std.Err.	cond.score -95.00%	cond.score +95.00%	N
1	Br.Br	4.541667	0.110952	4.321971	4.761363	120
2	Br.F1	4.036585	0.119526	3.798767	4.274404	82
3	F1.Br	4.728000	0.101839	4.526433	4.929567	125
4	Dm.Dm	4.612069	0.113399	4.387448	4.836690	116