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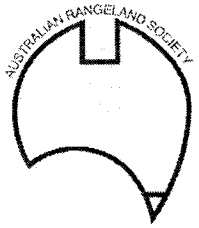

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ECONOMIC ANALYSIS OF CATTLE GENOTYPE, WEANING AND TURNOFF STRATEGIES UNDER KIMBERLEY CONDITIONS.

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ABSTRACT

Three hypothetical Kimberley cattle herds representing Shorthorn and Brahman cross genotypes were studied to compare potential earning capacities and income variability from different herd structures and turn-off strategies. Results show potential for gross income to increase by 50 per cent by changing from the traditionally managed Shorthorn herd to a weaned Brahman cross herd of the same stocking rate size. Income variability caused by seasonal factors was shown to be less in the weaned Brahman cross herd than in the traditional shorthorn herd. Optimal herd structure and turnoff strategy varied between herds exhibiting different reproductive capacities and growth rates.

INTRODUCTION

The Kimberley cattle industry has the information, technology and markets available to operate more biologically efficient cattle herds. Improved herds require greater management control and capital investment in infrastructure. Turn-off of younger steers and a higher proportion of breeders is characteristic of an improved herd structure. If pastoralists are to fully adopt these technologies they must be satisfied that running a herd, with a higher proportion of breeders, requiring higher capital investment will be more profitable and at worst no more risky than existing production systems.

Stock control is also a prerequisite for effective rangeland management. Businesses which exercise better stock control and make more profitable use of the range resource are not only practising better rangeland management but are in a financial position to feel they can afford it.

Three sets of parameters representing a traditional unweaned Shorthorn herd and two Brahman cross herds, managed with and without weaning were studied under both average season conditions and settings depicting seasonal variation. For businesses which already run weaned Brahman cross herds it provides an indication of optimal turnoff strategies and for those which do not, an indication of the potential gains to be made.

BACKGROUND

Shorthorn cattle were first introduced into the Kimberley region from Queensland and New South Wales in the 1880s. The herd is still predominantly Shorthorn but the number of Brahman crosses is increasing, these cattle are run over a wide range of environments and degrees of control. The Kimberley now supports about 650,000 cattle, which represent 40 per cent of Western Australia's total herd. Each year between 10 and 15 per cent of the herd are turned off to earn about 35 million dollars for the region.

The Kimberley herd has low branding and high mortality rates compared with herds in agricultural areas. Weaning calves from their mothers is a viable method of increasing branding rates and reducing cow and weaner mortality. The Department of Agriculture commenced trials in 1980 at Ord Regeneration

Research Station to evaluate the fertility, mortality and growth rates of Brahman and Africander breeds and their crosses. Trials have also been conducted to measure the effects of weaning calves in Shorthorn and Brahman cross herds. Results from these trials form the basis of data used in this analysis.

HISTORICAL DATA AND TRIAL RESULTS

Mortality

Mortality in pastoral cattle can be very high in drought years (Armstrong *et al.* 1968) and old cows, calves and bulls suffer significantly higher mortality than the herd average (Jenkins and Hirst 1966). Gardiner (1983) in a Pilbara study found the mortality in a drought year for the whole herd increased from 4% to 15%. The number of calves and cows older than six years that died were much higher than the herd average.

Kok (1975) compiled results from a survey of the beef industry from 1968/69 to 1970/71 and estimated cow, heifer and calf mortality at 9 per cent and other cattle at 4 per cent

Pratchett and others (1988) in their genotype study found few cows died and it was not possible to detect major differences between the genotypes studied. Likewise few steers died once they were 12 months old. However calf death rates were high and variable from year to year. Calves averaged a mortality rate of 10 per cent from birth to 10 months.

Results from Pratchett (1989) showed that over three years during a study on weaning, mortality in unweaned cows averaged 19 per cent where as mortality in the weaned cows was 9 per cent.

Growth

Unpublished data (Pratchett) and data from Frapple's (1987) abattoir survey reports 1978-87 provided the following weight and age figures. Note the Frapple data is aged by dentition, but Pratchett's data assumes the first weight is one year after branding and then continues at about 12 month intervals. Age at the first weighing would range from 1.5 years to 2 years of age.

Table 1. Live weights (kg/head)

Age		1.5	2.5	3.5	4.5	5.5
Cows	* BX	240	300	330		
	* SH	225	285	300	315	320
	# SH	195	225	265	310	
Steer	* BX	250	400	490		
	* SH	235	330	420	460	470
	# SH	245	330	380		490

BX=Brahman cross, SH=Shorthorn
Source: * D.Pratchett (Unpublished data)
P.Frapple (Abattoir survey results)

Reproduction

Kok (1975) estimated an average Kimberley herd had a branding rate of 51 per cent. Unweaned cows in Pratchett's (1989) weaning trial averaged 47 per cent branding, cows in herds where weaning was undertaken twice per year averaged 81 per cent. In Pratchett's (1988) genotype trial heifer calving percentage averaged 30 per cent when joined at 15 months, adult shorthorn cows averaged 76 per cent and Shorthorn Brahman cross cows averaged 88 per cent.

Seasonal variations

The Kimberley Pastoral Industry Inquiry (1985) report reconciled a set of traditional shorthorn herd parameters over a 14 year period and produced the following figures shown on Table 2.

Table 2. Variation in herd parameters

	Low	Ave.	High
Brandings as % cows	12.4	42.8	69.8
Mortality % (Total herd)	4.7	12.2	17.4

DATA USED

The models used in this study required production parameters to be defined for each age and sex class within the three herds. Trial data, D.Pratchett (pers. comm.), survey results and industry experience provided a measure of likely performance in the field. The data used is presented below. It has been collated in a form that is at least consistent if not always substantiated by trial data. Seasonal data is expressed as poor, average and good for the weaned Brahman cross herd only. The average year data is used for comparison with the unweaned herds.

Mortality

Table 3. Mortality rates (per cent)

Age	.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5
Unweaned Shorthorn cows												
	7	5	10	10	10	10	10	14	18	28	45	75
Unweaned Brahman cross cows												
	6	5	8	8	8	8	8	12	16	24	45	75
Weaned Brahman cross cows												
Poor	12	8	10	10	10	10	10	16	25	40	88	100
Ave	6	5	6	6	6	6	6	10	14	20	45	75
Good	3	4	4	4	4	4	4	7	8	10	16	63
Shorthorn steers												
	8	4	4	4	4	4						
Brahman cross steers									Bulls			
Poor	14	6	6	6	6	6			9			
Ave	7	4	4	4	4	4			6			
Good	4	3	3	3	3	3			5			

Growth

Table 4. Live body weights (kg/head)

Age	.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5
Unweaned Shorthorn cows	140	210	265	290	325	350	350	340	325	300	260	220
Unweaned Brahman cross cows	150	235	305	340	375	390	390	380	360	330	285	240
Weaned Brahman cross cows												
Poor	140	216	302	342	378	383	383	378	320	296	256	216
Ave	155	240	335	380	420	425	425	420	400	370	320	270
Good	163	252	352	399	441	446	446	441	440	407	352	297
Shorthorn steers	150	240	340	420	470	500						
Brahman cross steers									Bulls			
Poor	144	243	351	441	473	482			450			
Ave	160	270	390	490	525	535			500			
Good	168	284	410	515	551	562			525			

Reproduction

Table 5. Branding rates (per cent)

Age	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5
Unweaned cows	38	50	52	55	52	48	40	30	20	10
Weaned Brahman X										
Poor	32	44	46	47	46	42	21	16	0	0
Ave	45	62	65	68	65	60	52	40	25	15
Good	52	72	75	78	75	69	68	52	38	23

This analysis assumes weaning will increase branding rates by 12.5 per cent. This is lower than recorded by Pratchett (1989), who weaned off two musters each season. Only one muster and one round of weaning may be practical for the industry, consequently a conservative level of branding rate improvement is budgeted.

Seasonal analysis assumes branding rates assigned to season type are effective in the following rather than current year. Body weights are assumed to be independent of the previous season type and are set for the current season type only. Sequences where a good year follows a poor year may over estimate growth rates.

Prices

The abattoir price schedule used in these calculations was based on an analysis of 7000 cattle slaughtered for the season ending October 1989. Store prices used also reflect 1989 prices. The absolute value of these prices may well change, however the relative prices paid for slaughter cattle and stores may be reasonably consistent from year to year.

Table 6. Abattoir price schedule

Dressed wt	Live wt		cents/kg live wt		
	Steers	Cows	Steers	Cows	Bulls
81-	156-	180-	53	47	60
101-	194-	224-	59	53	63
121-	233-	269-	62	57	66
141-	271-	313-	72	60	71
61-	310-	358-	79	61	75
181-	348-	402-	84	63	78
201-	387-	447-	90	65	82
221-	425-	491-	94	67	85
241-	463-	536-	94	68	86
261-	502-		94		87

Source:W.A.D.A.

The standard or expected liveweight prices for stores are $1.20/kg for weaners, $1.10/kg for 18 month stores and export steers, and $1.00/kg for 2.5 year old store steers.

Table 7. Freight rates ($/head)

Age	Wnr	1.5	2.5	3.5	4.5	5.5
Steers						
No per deck	45	35	30	25	23	22
Cost-Broome		13.6	15.8	19.0	20.6	21.6
Cost-Harvey	48.30	62.2	72.5			
Cows						
No per deck	45	37	32	25 (for 3.5 and older)		
Cost-Broome		12.8	14.8	19.0		

Station-Broome $475/deck
Station-Harvey $2175/deck

METHOD

The economics of the three herds were compared under two sets of season conditions. Firstly a linear programme model was used to analyse optimal herd structure and turnoff strategies using average year production parameters. This model presents a herd of static size in equilibrium with annual brandings and purchases equalling sales and losses. Parameters were defined for each age and sex classes within the herd, the year was partitioned into two seasons and grazing pressure of each class defined for each season. Stocking rate was limited to 5000 LSU, post sales, for the dry season. Pregnancy is assumed to increase breeder grazing pressure in the wet season.

A spreadsheet model was then used to evaluate seasonal fluctuation effects on herds of different age and gender composition. Three season types were distinguished to provide three sets of parameters. These parameters represent livestock production changes not vegetative production changes. No account is taken for stocking rate effects as herd size changes with season. All parameters are assumed to result from constant grazing pressure. No tactical response to season type was assessed in this study, turnoff strategies were maintained across all season types.

A poor production year was defined to occur 2 years in 10, and an average and a good year 4 in 10. The production parameters were then defined so the expected value (given the season's probability) would equal the average value used in the static model. Ten sets of 15 year season sequences were randomly generated, based on the probability of each season occurrence. Each herd structure and turnoff strategy was then compared over the same set of 10 season sequences.

RESULTS

The efficiencies of herd structures are determined by economic and biological factors. Efficiency is important not only in absolute terms but in terms of the relative efficiencies between the male and female components of the herd. Turnoff of younger age steers requires a herd structure dominated by breeders. The sale value and reproductive efficiency of females in this herd is relatively more important than in a herd geared to the sale of older bullocks. All results assume stocking to the 5000 LSU, gross income is net of freight costs.

Effects of Brahman genotypes and weaning

Figure 1 displays gross income generated from a range of steer turnoff ages from unweaned Shorthorn and Brahman cross herds and a weaned Brahman cross herd. These results assume all steers 2.5 years and older are sold to the local abattoir, 18 month old Brahman cross steers are exported for $1.10/kg live-weight and weaners are sold as stores for $1.20/kg live-weight to the south west agricultural region of Western Australia. All shorthorn cattle are assumed to be sold to the local abattoir.

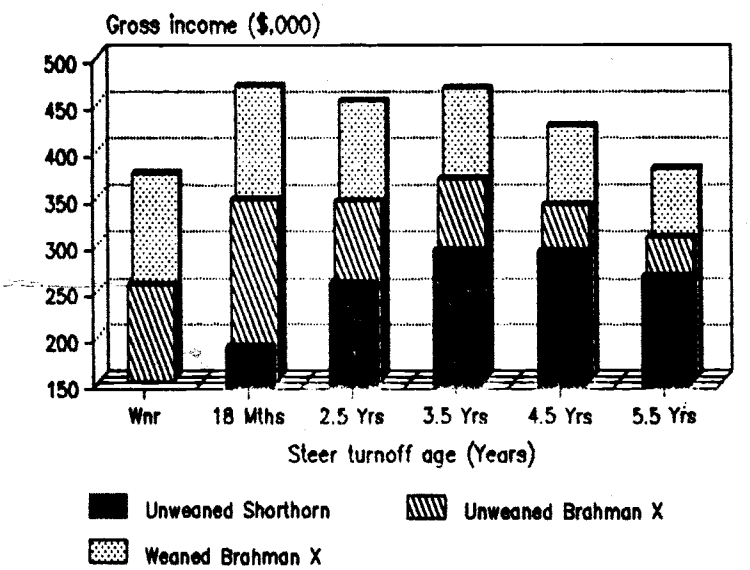

Figure 1. Genotype and weaning effects

Gross income generated increased by 50 per cent from $300,000 to $450,000 between the Shorthorn and the weaned Brahman cross herds. Should operating costs be deducted then the proportional increase in profit would be much greater.

Optimal breeder herd structure is unchanged regardless of the age of steer turnoff. As steer turnoff age is lowered the proportion of breeders in the herd increases but the structure of the female herd is unchanged. Cows are

sold at 8.5 years from the unweaned herds and most cows at 6.5 from the weaned Brahman cross herd. The analysis assumes no cows are culled for type younger than the turnoff age.

Optimal steer turnoff age for the Shorthorn herd is shown to be 3.5 and 4.5 years. Low reproductive efficiency and high cow mortality mean herd structures with a high proportion of breeders are relatively inefficient. Lower cow mortality and heavier body weights of the unweaned Brahman cross herd improve the economics of younger steer turnoff. Export market opportunities make the turnoff of 18 month Brahman cross steers feasible, this and the sale of and 2.5 or 3.5 year old Brahman cross appear as the most profitable options.

Weaning Brahman cows improves reproductive efficiency to a point where the majority of cows can be sold as young as 6.5 years. This results in lower average cow mortality and proportionally more income from the sale of females. The sale of 18 month, 2.5 and 3.5 year old Brahman cross steers appear as the most profitable options.

Table 6 indicates the proportion of breeders required and the turn-off generated from herds selling weaners and steers to 5.5 years.

Table 8. Per cent breeders and turnoff for each steer turn-off age.

Age (Years)	Wnr	1.5	2.5	3.5	4.5	5.5
Shorthorn unweaned						
Breeders %	59	53	48	44	41	38
Turn-off %	19.5	16.5	14.5	13.0	11.7	10.7
Brahman cross weaned						
Breeders %	56	50	45	41	38	35
Turn-off %	24.1	20.5	18.1	16.1	14.6	13.3

Steer turn-off age and price effects

The sensitivity of turnoff strategies to steer price variations is indicated in Figure 2. These results are based on weaned Brahman cross herd parameters. The first three bars on the graph indicate the gross income received from the sale of weaners and 1.5 and 2.5 year old steers as stores. The next two bars indicate the income received from the sale of 1.5 and 2.5 year old steers for export. The line graph shows the gross income generated by selling steers to the local abattoir.

The live export market has been taking steers weighing between 250 and 320 kg live weight. The analysis has assumed steers at 2.5 years to weigh 390 kg. These may be too heavy for the market but their inclusion in the study provides an indication of the potential income from selling steers in that age and weight range.

Using the sale of 3.5 year old steers to the abattoir as a benchmark, weaners would need to fetch $1.65/kg to be a comparable option. Eighteen month and 2.5 year old stores would need to fetch $1.30/kg and $1.10/kg respectively.

Export steers have been selling for $1.10/kg, at this price selling 18 month steers is one of the best options. If 2.5 year old steers can meet market requirements weighing 390 kg then at a price of $1.00/kg that would appear to be the best option. Selling 18 month or 4.5 and 5.5 year old steers to

the local meatworks are inferior strategies for the weaned Brahman cross herd.

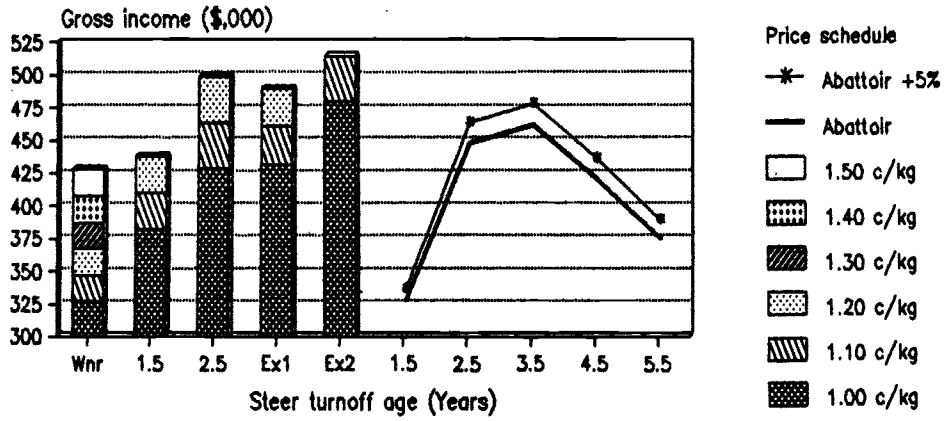

Figure 2. Steer age and sale price effects

Steer growth rate effects

The price effects discussed above are based on one set of growth rate figures. Table 9 provides an indication of the sensitivity to changes in annual growth rate. Standard weights are reduced by 10 and 20 kilograms each year.

Table 9. Annual steer growth rate effects on gross income ($,000)

			Standard Wts		-10 kg/yr		-20 kg/yr	
Age	Price	Market	Kg	$,000	Kg	$,000	Kg	$,000
Wnr	$1.20/kg	Store	160	367	150	351	140	335
1.5	$1.10/kg	Export	270	461	250	437	230	413
2.5	$1.05/kg	Store	390	447	360	419	330	391
3.5	Abattoir		490	459	450	431	410	403
4.5	Abattoir		525	418	475	388	425	358
5.5	Abattoir		535	373	475	341	425	309

As growth rates are reduced optimal strategies trend towards favouring the sale of younger steers. This trend is likely to apply to steers grazing Pindan country which may have lower growth rates than cattle grazing on good black soil plains.

Branding rate variations

Brahman cross breeder branding rates were varied to assess the sensitivity of income to reproductive rate. The results shown on Figure 3 indicate the turnoff of younger steers tends to be favoured as branding rates increase. Selling weaners was never the best alternative even when branding rates as high as 80 per cent were assumed. As branding rates increase the required price for weaners to be the best option is reduced marginally from $1.65/kg to $1.60/kg.

At an average branding rate of 40 per cent breeders are retained until 9.5 years old, when branding rates increase to an average of 60 per cent cows can be sold at 6.5 years. This enables cows to be sold in better condition and before higher mortality rates of the older age groups reduce the number available for sale. If branding rates higher than 60 per cent are achieved

then cows must be sold even younger or severe culling of heifers undertaken to prevent overstocking.

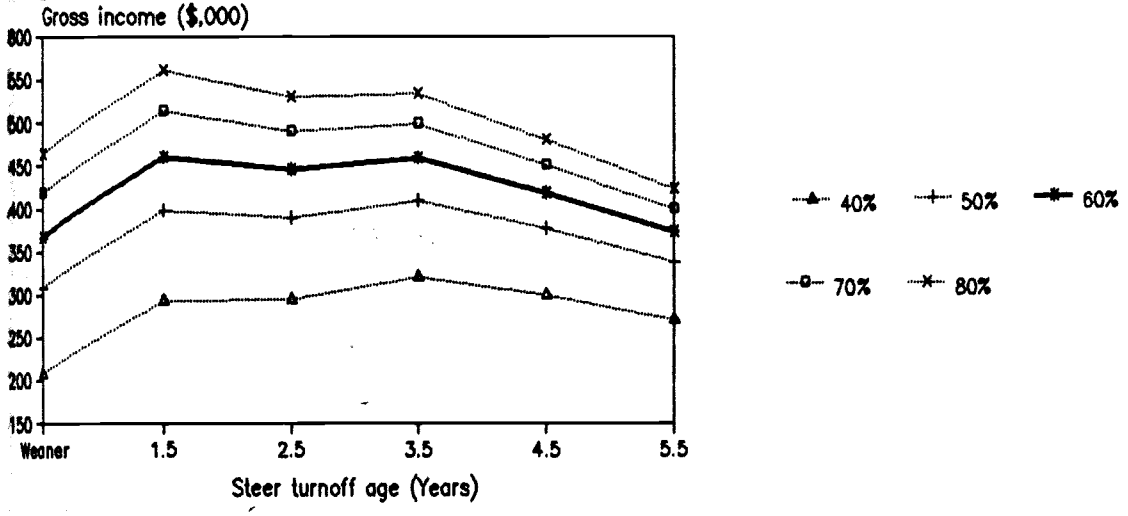

Figure 3. Branding rate effects

Age of cow turnoff

A comparison between cow selling ages for the three herds is illustrated in Figure 4. Cows must be retained for a minimum of 8.5 years in the unweaned herds and 6.5 years in the weaned herd to satisfy herd reproduction requirements. In all examples gross income increases as cows are sold at a younger age. Older cows have lower branding rates and by selling breeders as young as possible mortality losses are reduced.

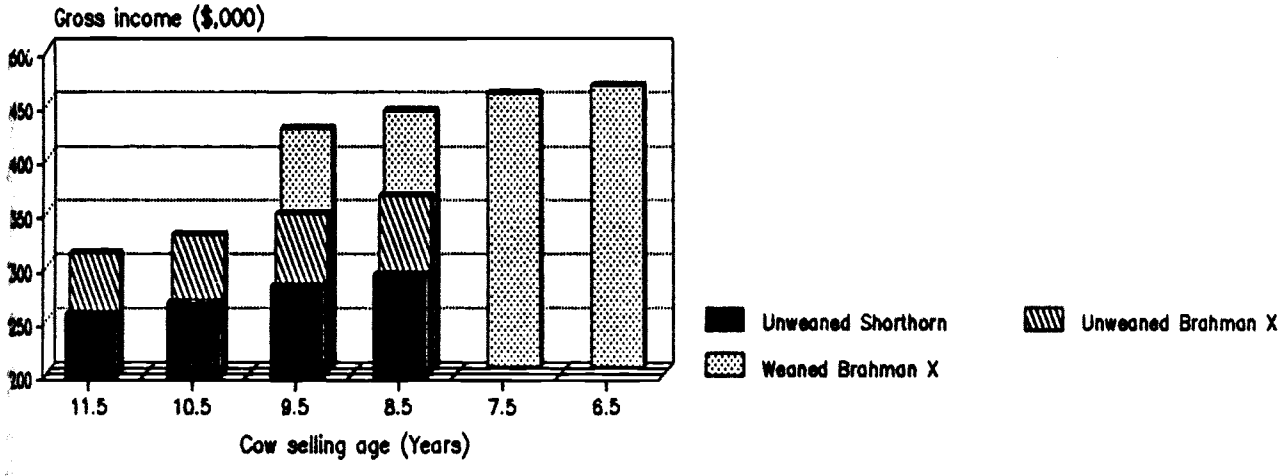

Figure 4. Cow selling age effects

Seasonal effects

The ranking of optimal turnoff ages did not alter after each option was studied using parameters representing three season types. Herd structures having proportionally more breeders were shown to have higher income variability. This includes herds turning off younger steers, herds of low reproductive performance and herds retaining older cows. Higher average incomes generated from improved herds selling younger steers would offset any marginal increases in income variability. As branding rates increase and mortality rates decline seasonal fluctuations in income will be reduced.

$$\text{Co-efficient of variation} = \frac{\text{Standard Deviation}}{\text{Mean}} * \frac{100}{1}$$

Table 10. Co-efficients of variation and mean income ($,000)

Turnoff Age	Wnr	18 mth	2.5	3.5	4.5	5.5
Shorthorn (unweaned, cows sold at 8.5 years)						
Mean Income		194	262	298	297	277
Co of Var		22%	21%	19%	18%	16%
Brahman cross (weaned, cows sold at 6.5 years)						
Mean Income	367	461	445	459	418	373
Co of Var	18%	18	18%	16%	15%	14%
Brahman cross (weaned, cows sold at 9.5 years)						
Mean Income	312	414	403	423	385	343
Co of Var	20%	19%	19%	17%	16%	15%

DISCUSSION

The Kimberley Pastoral Industry Inquiry (1985), noted that production systems requiring capital investment must have the potential to generate greater profit with more confidence than the current less sophisticated and less capital intensive system. Results show potential for gross income to increase by 50 per cent by changing from the traditional shorthorn herd to a weaned Brahman cross herd. Results also indicate income variability caused by seasonal factors to be less in a weaned Brahman cross herd even with herd structures containing a higher proportion of breeders.

Optimal herd structure and turnoff strategy is shown to vary between herds of different reproductive and growth capacity. Selling older bullocks maybe the best option for herds with low branding and growth rates but is not optimum for improved herds. Unless the herd structure is adjusted to herd performance then some of the potential gains will not be realized. This highlights the value of measuring individual herd performance and adjusting management plans to that unique situation.

Improved reproductive performance also requires more cows to be sold and at a younger age. Failure to do so will result in over stocking and loss of income from cow sales. Younger cows should be in better condition and preferred by the meatworks to older lightweight cows. Selling cows at a younger age can also accelerate the rate of genetic improvement through the herd.

The Kimberley environment is variable consequently cattle production parameters will also vary. Cattle off black soil plains and cattle off Pindan country would be expected to perform differently, these different herds are likely to have different optimal management strategies. Lower steer growth rates were shown to favour the turn-off of younger steers. It is important to know the growth rate parameters for cattle off different land classes to plan and implement the best management strategy for that environment.

The study makes no attempt to assess any capital expenditure required to implement these improvements nor is any comparison of operating costs made

between associated herd types and management practices. Existing properties operate over a range of states of capital and herd improvement, consequently any evaluation of capital investment is best undertaken on an individual property basis.

The herd structures tested over a range of season sequences were assumed to be managed on the basis of strategic rather than tactical management plans. Turnoff strategies were maintained regardless of season type. Income variability could be further reduced by adopting turnoff plans which aim to sell steers from say more than one age class. An example may be to sell some eighteen month steers for export, some 2.5 year olds as stores or to the meatworks and the remainder at 3.5 years old to the meatworks. The proportion sold from each group could be adjusted to market fluctuations and season type.

Results show the potential to increase gross income by up to 50 per cent and reduce income fluctuations caused by seasonal factors. This can be achieved by weaning Brahman cross cattle and adjusting herd structure and turn-off strategies to suit production capabilities. Conversely the results indicate the potential to reduce stocking rates and still maintain existing income levels.

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