CONTROL OF REPRODUCTIVE ACTIVITY IN EXTENSIVELY MANAGED CATTLE IN THE SEMI-ARID TROPICS

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SUMMARY

An experiment was conducted at Katherine, Northern Territory, to control oestrus, and subsequent conception, in *Bos indicus* cross heifers with Vaxstrate® an anti-reproductive vaccine. The aim was to delay the onset of puberty, so that the heifers would attain a higher liveweight before their first conception, with subsequent improvements in calving rate and survival. A computer projection suggested that immuno-suppression of ovarian activity for 1 year would be cost effective. However, the timing of return to ovarian activity proved highly variable and a large proportion of calves were born at unsuitable times of the year. As some heifers conceived much less than a year after treatment while others took much more than a year, an increase or decrease in the period of activity of the vaccine did not seem to be a solution.

Keywords: Vaxstrate, oestrus, suppression, fertility, heifers.

INTRODUCTION

The semi-arid tropics of northern Australia has an annual rainfall of 500-1000 mm which falls almost exclusively in a single wet season between November and March (McCown 1981). The resulting growth pattern of young stock is one of rapid wet season growth, followed by a slow liveweight decline over the long dry season (Winter 1988; Sullivan *et al.* 1992). About 250,000 km^2 of pastoral land in the Northern Territory falls under this category.

Bulls are generally run with the females year round. A calving peak in October to January reflects optimal pasture conditions the previous December to March (O'Rourke *et al.* 1991b). October to December is the most suitable period for calves to be born, as peak lactation corresponds with optimal pasture availability. These early calves can gain sufficient liveweight to be branded and weaned in the main muster between April and June (Sullivan *et al.* 1992) and the cows are more likely to reconceive than those that calve later in the wet season (O'Rourke *et al.* 1991a). Most stations also conduct a second muster in August and September to wean later calves. Some heifers reach sufficient physiological maturity to conceive in the first wet season following weaning (aged 12-18 months), while others do not.

Overall cattle growth rates are low, but the annual pasture flush can induce oestrous activity even in heifers and cows in poor condition (Sullivan *et al.* 1992). Despite difficulties in recording deaths in extensively run cattle, a picture has emerged over a number of years of breeder mortalities in the range of 5-15 % (Sullivan *et al.* 1992). The highest death rates occur in underweight breeders, particularly second calf heifers (Stockwell and Norton 1990). It is suggested that animals most at risk are those that conceive for the first time at a low liveweight, below about 240 kg, and then calve below about 270 kg. At that size, they lose weight while lactating even through the wet season and at the beginning of the following wet season, they are in very poor condition (R.N. MacDonald, unpublished data). Although the majority do not then re-conceive, the subsequent mortality of those that do is high.

A 4 year trial on a commercial station in the Katherine region (1988-93) attempted to demonstrate the value of segregating small heifers from the bulls until they had reached a suitable mating liveweight of about 300 kg (T.G.H. Stockwell pers.comm.). However, as most large stations in the region have found, the long fencelines repeatedly failed to keep the bulls out.

The failure of physical segregation stimulated interest in possible immunological methods of controlling oestrus. The product tested was Vaxstrate® (Arthur Webster Pty Ltd), a vaccine against Gonadotrophin Releasing Hormone (GnRH), and registered for immuno-spaying of cull females (Hoskinson *et al.* 1990).

In a previous trial in Katherine (unpublished data) two doses of Vaxstrate, 5 weeks apart, on 10 August and 20 September 1990 had been shown to control conception in a group of 52 dry cull crossbred cows until February 1991, the second half of the wet season. By the time the cows were slaughtered in June 1991, 53% of the vaccinated cows had reconceived, compared with 71% of the control group. The improved average carcase weight of the vaccinated group, leading to a financial return of $20.85 for an investment of $11.00, was mainly attributed to reduced foetal development.

The study reported here aimed to utilise the reversible aspect of Vaxstrate to suppress oestrus in replacement breeders entering their first wet season post-weaning. D'Occhio *et al.* (1992) had reported high variation in the duration of the immuno-spayed response. However, in the semi-arid tropics, it was expected that as the effect of the vaccine wore off through the dry season, a declining plane of nutrition would continue to suppress ovarian activity and the heifers would begin to cycle during the following wet season.

MATERIAL AND METHODS

A dynamic herd projection package, Rangepack Herd-Econ (CSIRO National Rangelands Program, Alice Springs), was used to model the effect of delaying by 1 year the first conception of heifers weighing between 210 and 260 kg liveweight at the end of the dry season, in a extensive station running 14,000 breeders. This liveweight range was assumed to cover 40% of annual replacement breeder requirements. Parameters used in the model were derived from unpublished regional herd recording data. The major assumption was a reduction in the mortality rate of 3-5 year old cows from 9% to 5.5%, with no effect on mature cows. The number of calves born to 2.5 year old heifers was cut by 67% but there was an improved rate the following year. The branding percentage of mature cows was increased by 4%. A treatment cost of $13/hd and a discount rate of 10% was applied.

A subsequent trial at Katherine Research Station tested the use of Vaxstrate as a means of temporary oestrous suppression. A group of 200, 18 month old Brahman cross heifers were selected as an even line in terms of weight and phenotype. One hundred and thirty five were vaccinated in 13 September and 18 October 1991 (5 weeks) and 65 left as untreated controls. Allocation to group was made on stratified liveweights. The 2 groups averaged 230 (s.d. 11) kg liveweight/hd in September 1991.

The 2 groups were run together with 4% bulls on native pasture, predominantly *Heteropogon contortus* and *Themeda triandra* with some undersown *Stylosanthes hamata* cv Verano. They had access to year round mineral supplementation (wet season supplement mix contained 8% phosphorus, 10% urea and 50% sodium chloride; dry season supplement mix contained 3% phosphorus, 30% urea and 45% sodium chloride). The heifers were weighed monthly and conception patterns were determined by pregnancy diagnosis each April and September.

RESULTS

Figure 1 shows the result of the herd model over a run of 10 average years with the benefit of better survival converted to additional heifer turn-off. After a lag of 4 years the treatment starts to show a significant financial advantage. If poorer years were simulated, the treatment benefit improved.

Table 1 shows the season of conception (from pregnancy diagnosis) for the vaccinated and unvaccinated heifers for the 2 years after treatment in late 1991. November to April has been classified as wet season and March to October as dry season.

Figure 2 shows the heifers' conception dates from October 1991 to June 1992 (derived from pregnancy diagnosis) and the rainfall recorded at Katherine Research Station over that period.

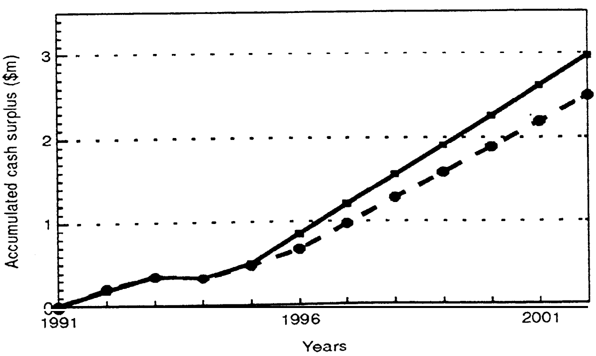

Figure 1. Rangepack herd projection. Comparison of accumulated cash surplus with (solid line) and without (broken line) oestrus suppression treatment, over a run of 10 average years, with herd numbers kept stable

Table 1. Season of conception of heifers after treatment with Vaxstrate in October and November 1991

	Percentage Conception		
Season of conception	Vaccinated n=126	Control n=65	Total n=19
Wet 1991-2	23.8	52.3	33.5
Dry 1992	31.0	23.1	28.3
Wet 1992-3	37.3	20.0	31.4
Dry 1993 A	24.6	32.3	27.2
Not yet pregnant A	7.1	1.5	5.2

A Conceptions up to July 1993 (from pregnancy diagnosis September 1993)

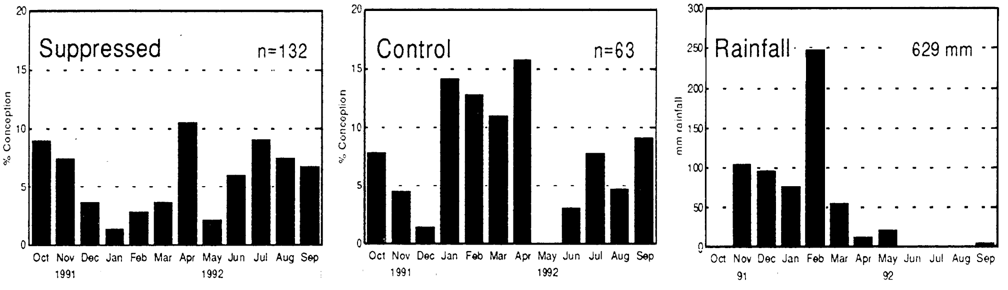

Figure 2. Conception dates related to rainfall at Katherine

DISCUSSION

The basis of the strategy studied in this experiment, was the sacrifice of the chance of an early calf, in favour of improvements in survival and subsequent calving rate. As shown in Figure 1, the results of the herd projection concluded that this form of reproductive control would have application in the semi-arid region, if the technology proved effective.

The performance of Vaxstrate in the study was similar to that reported by D'Occhio *et al.* (1992) and D'Occhio (1993) on heifers in the subtropical areas with a less marked seasonal rainfall pattern. The vaccine was effective in suppressing oestrus but the pattern of resumption of fertility was too irregular for the product to be of practical use for delaying puberty. The conception pattern in Table 1 shows that half of the first calves, from vaccinated animals, were born either earlier or later than the target season, with surprising little synchrony brought by the long and severe dry season. An extension of the period of activity of the vaccine would not overcome that problem.

Although the 629 mm of rainfall recorded over the wet season of 1991-92 was well below Katherine's long term average of 972 mm, the annual rainfall pattern was not atypical of the semi-arid tropics, and reduced rainfall was not considered to have significantly affected the outcome of the trial.

A successful method of delaying puberty in replacement breeders, without increasing the proportion of calves born in unsuitable seasons, would require a form of immuno-suppression in which the timing of reversal was either highly predictable or initiated by intervention. D'Occhio (1993a, 1993b) reviewed the range of possible target sites for immunological control of fertility, and suggested that the use of GnRH agonists have the potential to provide a flexible method of reversible reproductive control, provided the necessary delivery technology can be developed.

Other possible ways of avoiding early pregnancy depend on changes in management. The use of slower maturing breeds would relieve problems associated with early conception but other detrimental effects to commercial production are likely. If heifers in the critical weight range can be identified and drafted, it may prove viable to give those required as replacement breeders selective feeding.

Alternatively, as improved management in the region leads to a gradual heifer surplus, weaner heifers in the critical weight range could be spayed or sold.

ACKNOWLEDGMENTS

Support for these trials came from Arthur Webster Pty Ltd and thanks are due to Dr Mark Lindsey from Websters and Dr Tim Trigg of Peptide Technology Pty Ltd. The advice of Dr Michael D'Occhio of CSIRO Division of Animal Production, and Tom Stockwell, Department of Primary Industry and Fisheries, was invaluable. Technical support was provided by Jack Wheeler, Larry McLaughlin and the staff of Katherine Research Station. Pregnancy diagnosis was carried out by Gehan Jayawardhana and David Zuill.

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