USE OF WITHIN HERD INFORMATION TO IMPROVE CONCEPTION RATES IN BEEF HERDS IN NORTHERN AUSTRALIA

V.J. ANDERSON*, P.K. O'ROURKE**, G. FORDYCE+ and T.H. McCOSKER++

SUMMARY

Reproductive rates in extensively run beef cattle herds in northern Australia are low, ranging from 40 to 80%. In north Queensland and the Northern Territory records dealing with identification, fertility, weaning and live weight are available for some breeding herds, and have been used to illustrate the development of statistical models of factors affecting conception rates. The predictive value of factors thus identified is used to indicate how conception rate may be improved by managerial options such as culling, selection and segregation, with appropriate treatment for different classes of animals.

Keywords: fertility, beef cows, Bos indicus, management, dry tropics.

INTRODUCTION

Reproductive rates in extensively run beef cattle herds in northern Australia vary from 40 to 80%, with a suggested average of 50 to 60% (Holroyd 1977). Branding rates on properties in Cape York Peninsula average 45% (Boorman and Hosegood 1986). In the Burdekin-Dalrymple area of north Queensland, branding rates for uncontrolled mated herds vary from less than 50% to as high as 85% (Round 1978), while Gardiner et al. (1983) reported branding rates of 54 to 78% for the south-east Pilbara region of Western Australia. The range of reproductive rates indicates the potential for improvement. For extensive, uncontrolled-mated herds in northern Australia, Entwistle (1984) suggested that properties with an average weaning rate of less than 70% are experiencing reproductive failure of economic importance, and need to develop management strategies that improve fertility.

Our approach to improving conception rates uses information on individual cows to determine factors affecting conception rates.' Pre-mating prediction of the probability of conception for different classes of cows would assist management to improve reproductive efficiency.

FACTORS AFFECTING CONCEPTION

In reports from northern Australia, fertility of mature cows has been shown to increase linearly with increasing live weight at mating (Goddard et al. 1980; Rudder et al. 1985). Fertility is lowest in lactating first-calf cows since they are subjected to the stress of lactation and continue to grow after their first calving (Entwistle 1983). Goddard et al. (1980) found that lactating three-year-old Droughtmaster cows weighing less than 320kg were unlikely to conceive, but at 400kg, 50% conceived. Liveweight change during a three month mating period affects pregnancy rate, but generally is of lesser importance than live weight at

* Qld Dept Primary Industries, Oonoonba Vet Lab, P 0 Box 1085, Townsville 4810
** Qld Dept Primary Industries, G.P.O. Box 46, Brisbane 4001
+ Qld Dept Primary Industries, Swan's Lagoon, Millaroo, via Ayr, 4807
++ Resource Consulting Services, G.P.O. Box 4168, Darwin 5794

mating. Goddard et al. (1980) reported that liveweight change during mating and pregnancy rate were positively correlated in mature Droughtmaster cows, but not in younger cows.

Non-lactating cows have consistently higher conception rates in northern Australia than lactating cows (Holroyd 1977). Lactation and nutritional stress both affect body condition and live weight. As a result, lactating cows in poor condition have low fertility (Entwistle 1984). Date of calving has been shown to influence re-conception rates. Ramlibakry (1981) reported that the later within a season that a cow calved, the lower the probability of re-conception. Rudder et al. (1985) found this effect was more marked in younger than in older cows.

Cows older than 8 to 10 years of age in northern Australian herds show a marked decline in fertility, probably due to poor dentition and reduced ability to walk long distances (Holroyd 1977).

These reports indicate the influence of, and interactions between, cow age, lactation status, calving date and live weight/body condition on conception rate. A statistical model using such data could predict the probability of conception of individual cows and be used in making managerial decisions.

ANALYTICAL APPROACH TO MODELLING CONCEPTION RATES

Factors in the statistical analysis of conception rate within a herd fit into classes. Inherent animal factors are age, live weight, body condition and liveweight change during critical periods. Live weight and body condition at the previous weaning, in the middle of the dry season and at the start and end of mating are considered to be important for understanding biological aspects and for developing predictive models of conception rate. Stage of gestation as an estimate of expected calving date and lactation status indicating the outcome of previous calving are reproductive factors. Environmental factors include year, type of season, class of country and pasture type.

As non-lactating cows generally have high conception rates, models for this class of cow are not necessary. Predictive models for the probability of re-conception are needed for cows that will be lactating during the mating season as they are most susceptible to nutritional stress and consequently have lower re-conception rates. Because the relative importance of reasons for this may be age dependent, maiden heifers, first calf-cows, mature cows and aged cows need to be considered separately.

Conception-can be coded as 1 for established pregnancy and 0 for non-pregnant for each cow. Within age classes, least squares analysis of variance can be used to screen a range of models for conception for each year of data with explanatory variables consisting of the reproductive factors and one of the liveweight or body condition factors. A stepwise selection procedure progressively eliminating non-significant interactions and main effects can be used to obtain final models (O'Rourke 1986). These models aim to be predictive so that, in practice, management decisions can be implemented to improve conception rates within the herd.

Application in Northern Territory

Data from 900 Brahman breeders grazing 14 000 ha of native pasture from 1980 to 1985 at Mt. Bundey near Darwin, described by McCosker and Eggington (1986), illustrate this analytical approach. Mating was restricted to December to May and calves were weaned at musters in May and August. Cows were individually identified and aged from year brand. Live weight, condition score, lactation

status and stage of gestation, as an estimate of expected calving date, were recorded at each muster. These data were screened through a series of statistical models to identify factors likely to influence and predict re-conception rates.

The overall re-conception rate for mature lactating cows was 49%. Month of expected calving had a major effect with re-conception rates for those expected to calve in September being 60%, in October 54%, in November 51% and in December or later 31%. Live weight corrected for weight of foetus, in the mid-dry season was also influential with rates for those <250 kg being 30%, those 250-275 kg 34%, 275-300 kg 43%, 300-325 kg 51% and plateauing at 58% for >325 kg. Hence, both late calving and low live weight were detrimental. to high re-conception rates. The scope of improvements possible by within herd selection, segregation and management decisions can be illustrated by contrasting the best and worst sub-groups within this herd. Cows of >325 kg calving in September had a re-conception rate of 69% while those of <250 kg calving after November had a rate of only 12%.

Application in north Queensland

Two consecutive breeder trials, with 280 and 140 mature Brahman cows were conducted at Swan's Lagoon in north Queensland from 1975 to 1980 (Holroyd et al. 1983; Holroyd 1985). A restricted mating period from January to April was used and calves were weaned between April and July. Live weight, body condition score and stage of gestation were recorded at least three times during the gestation period. Calf birth date and survival to weaning were also recorded. Statistical analysis was similar to that for the Mt. Bundey data.

The overall re-conception rate for lactating cows was 71%. 'Expected time of calving, outcome of previous calving and body condition score in the mid-dry' season all influenced re-conception rate. The re-conception rate for cows expected to calve before December was 74%, while for those expected to calve later it was 68%. Cows rearing a calf in the previous year had a re-conception rate of 74% compared with 69% for those which did not. The effect of body condition in the mid-dry season depended on the year, with reduced response to improved body condition in years with above average rainfall. In an average year, based on body condition in the mid-dry season, re-conception rates for those in backward store condition or' worse were 13%, those in store condition. 42%, those in forward store condition 77% and those in prime condition or better' 84%.

PRACTICAL OPTIONS

The effect of expected date of calving on subsequent r&conception rate agrees with the findings of Ramlibakry-(1981) and Rudder et al. (1985). In controlled mated herds, cows calving late in the calving season have only a short time in which to reconceive, and have a lower chance of re-conception.

The relationship between live weight in the mid-dry season and subsequent re-conception is similar to that reported between mating* weight and fertility (Goddard et al. 1980; Rudder et al. 1985). In the absence of weighing facilities, body condition score may be a practical alternative to live weight. Goddard et al. (1980) found a positive relationship between body condition at mating and pregnancy rate for Droughtmaster cows in north Queensland. There is a similar relationship between body condition in the mid-dry season and subsequent re-conception for the Swan's Lagoon herd. Early weaning of calves reduces lactation stress thus preserving body condition. Therefore, a possible consequence of this management strategy is increased wet season conception rate.

Many properties in northern Australia have developed facilities for segregating groups of animals, often as a consequence of the Brucellosis and Tuberculosis Eradication Campaign. A muster in the middle of the dry season could be used to segregate groups of cows, using decisions based on predicted probability of re-conception. All non-pregnant cows and those cows of high live weight or body condition in the mid-dry season and expected to calve early have a high likelihood of conception during the subsequent mating period. Conversely, pregnant cows of low live weight or body condition in the mid-dry season and expected to calve late have a low re-conception rate. In the mid-dry season, cows with a low probability of re-conception could be segregated and given preferential treatment to improve live weight/body condition, thus increasing the likelihood of re-conception in the subsequent wet season. Possible preferential treatments include access to better native pasture paddocks, access to improved pasture, reduced stocking rate and supplementation. For some groups of cows, with low probability of re-conception, it may not be economically viable to attempt to improve re-conception rates by preferential treatment.

From information on individuals within breeder herds, cows with a low probability of re-conception can be identified and managerial options proposed to improve fertility. This work is being extended to include other regions in northern Australia and aims to provide information on how management strategies could be used to improve fertility for a range of environments and production systems. Data from commercial breeding herds will be used to test and validate the statistical models for conception rate developed from the more detailed data sets.

ACKNOWLEDGEMENTS

The authors wish to thank the Australian Meat and Livestock Research and Development Corporation for their partial financial support of the project.

REFERENCES

BOORMAN, A.J. and HOSEGOOD, G.J. (1986). Proc. Aust. Soc. Anim. Prod. 16:155
ENTWISTLE, K.W. (1983). A.M.R.C. Rev. No. 43:1.
ENTWISTLE, K.W. (1984). In "Beef Cattle Production" Proc. No. 68:311. Post-Graduate committee in veterinary science, University of Sydney.
GARDINER, H.G., SHACKLETON, K.R. and MORRISSEY, J.G. (1983). Aust. Rangel. J. 5:48.
GODDARD, M.E., ENTWISTLE, K.W. and DIXON, R. (1980). Proc. Aust. Soc. Anim. Prod. 13:65.
HOLROYD, R.G. (1977). "Reproductive performance of beef cattle in northern Queensland". M.Sc. Thesis, James Cook University of North Queensland.
HOLROYD, R.G. (1985). "Aspects of reproduction in Bos indicus genotypes". Ph.D. Thesis, James Cook University of North Queensland.
HOLROYD, R.G., O'ROURKE, P.K., CLARKE, M.R. and LOXTON, I.D. (1983). Aust. J. Exp. Agric. Anim. Husb. 23:4.
McCOSKER, T.H. and EGGINGTON, A.R. (1986). Tech. Bull. No. 90, N.T. Dept.. Prim. Prod.
O'ROURKE, P.K. (1986). Proc. Aust. Soc. Anim. Prod. 16:65.
RAMLIBAKRY, W. (1981). "Reproductive performance of Bos indicus cattle in coastal north Queensland". M.Sc. Thesis, James Cook University of North Queensland.
ROUND, P.J. (1978). Beef Cattle Husb. Branch Tech. Bull. No. 14, Qld. Dept. Prim. Ind., Brisbane.
RUDDER, R.H., SEIFERT, G.W. and BURROW, H.M. (1985). Aust. J. Exp. Agric. 25:489.