SIRE BREED EFFECTS ON GESTATION LENGTH OF CALVES IN THE SUBTROPICS

N.J. Corbet[1], R.G. Miller[2], P.F. Fraser[3], A.G.Lloyd[4] and H.M. Burrow[1]

[1]CSIRO, Tropical Agriculture, Meat Quality CRC, Box 5545, Rockhampton, Qld 4702
[2]QDPI, Meat Quality CRC, Box 6014, Rockhampton, Qld 4702
[3]Nogoa Pastoral Company, Box 1554, Emerald, Qld 4720
[4]Brigalow Research Station, MS 1855, Theodore, Qld 4719

SUMMARY

Calving data on 317 Brahman heifers mated to British (Angus, Hereford and Shorthorn), European (Charolais and Limousin) and Tropical (Belmont Red, Santa Gertrudis and Brahman) breed sires were used to study breed effects on gestation length. Mean (±SEM) gestation length was 284 (±1.5) days within a range of 271 to 296 days. Sire breed ($P<0.01$), sex ($P<0.05$) and birth weight ($P<0.01$) were significant sources of variation in gestation length. Gestation length of calves by European and Brahman breed sires was on average 5 (±0.7) days longer than calves by British breed sires. The 25 day range indicated that cows from AI programs should be kept from back-up bulls of the same breed for at least a full heat cycle in order to accurately assign sires at calving using gestation length.

Keywords: Gestation length, beef breeds, crossbreeding, sire evaluation.

INTRODUCTION

Crossbreeding is a management tool used by Australian beef producers to supply carcasses that fulfil fluctuating beef market specifications. Sires used in crossbreeding programs have the potential to improve reproduction (Barlow *et al.* 1994), growth (Hearnshaw *et al.* 1995) and carcass (Arthur *et al.* 1995) traits. A pre-requisite to breeding programs in tropical north Australia is that the dam breed be adapted to conditions of high temperatures, heavy parasite burdens and periods of poor nutrition (Turner 1975). This role is commonly filled by Zebu (*Bos indicus*) or Zebu derived breeds. Gestation length is an important trait that, added to post-partum anoestrus period, measures calving interval. Breeders of seed-stock cattle use gestation length to differentiate between calves sired by artificial insemination (AI) and back-up bulls. There is a paucity of published information on gestation length of Brahman dams mated to produce crossbred calves. This paper reports gestation length of Brahman dams artificially mated to sires of other breeds. The range of gestation length across sire breeds was examined to test the feasibility of using gestation length to differentiate conception by AI or back-up sire.

MATERIALS AND METHODS

The data used in this study were from Brahman heifers that calved at two sites in Central Queensland ('Duckponds', Comet and Brigalow Research Station, Theodore). All heifers were nulliparous and 2 to 3 years of age at time of mating.

Mating. The heifers at 'Duckponds' were randomly allocated to sire breed within property of origin of the dam in two AI programs. The first group of heifers (n=114) averaging 359kg live weight (range 296-470kg) were inseminated between mid-November and mid-December 1994. The second group (n=95) averaged 301kg (254-396kg) and were inseminated between mid-January and mid-February 1995. The Brigalow Research Station heifers (n=108) were randomly allocated to breed and sire but were not weighed at time of joining in November 1994. Three to five sires each from Angus, Belmont Red, Brahman, Charolais, Hereford, Limousin, Santa Gertrudis and Shorthorn breeds (n=34) were used. In all AI programs heifers were inseminated on detection of oestrus following oestrus synchronisation treatment. In the subsequent heat cycle heifers that returned to oestrus were reinseminated. All heifers were then allocated to single-sire natural mating families. The natural mate sire for each heifer was of a different breed to the AI sire. The heifers at 'Duckponds' were weighed again at the end of the natural mating period in March 1995.

Calving. Birth dates were recorded daily during the calving period. Calves were tagged and had dams identified within 24 hours of birth. At 'Duckponds' birth weights were also recorded. Sire breed of each calf was determined either by visual appraisal or DNA fingerprint if the calf genotype was equivocal. Gestation length was measured as the number of days from successful AI to day of birth. Neo-natal mortality (NNM) included death of the newborn or dam from parturition to 1 week after birth. Occurrence of twinning (TWN) was also recorded.

Statistical analysis. Data were analysed using least squares procedures (SAS 1989) fitting sire breed, sire within breed, property of origin of dam, AI group, sex of calf, and incidence of NNM and TWN as fixed effects and gestation length as the dependent variable. Sire breed was tested against sire within breed. Birth weight of the calf and live weight of the dam before and after the mating period and weight gain during the mating period were included as covariates in a separate analysis of the 'Duckponds' data (n=209). First order interactions were initially fitted to the models but subsequently deleted if found to be statistically nonsignificant (P>0.05). Covariates were similarly deleted from the models if found to be nonsignificant.

RESULTS AND DISCUSSION

The contributions of sire breed (P<0.01), calf sex (P<0.05) and birth weight (P<0.01) to variation in gestation length were significant. Sire within breed, property of origin of the dam, AI group, NNM (5.3%), TWN (2.8%), dam weight before and after the mating period, dam weight gain during the mating period and first order interactions of the main effects were not significant sources of variation in gestation length (P>0.05). Significant sire within breed effects on gestation length have been reported (Plasse *et al.* 1968; Batra *et al.* 1982) but small cell sizes in the data presented here may have masked this possible source of variation.

Effects of sex and birth weight. Gestation length for male calves was longer (P<0.05) than for their female contemporaries (284±0.4 versus 283±0.4). Plasse *et al.* (1968) and Newman *et al* (1993) also reported that males had longer gestations. In the Brahman herds in south Florida studied by Plasse *et al.* (1968) male calves were *in utero* 1.9 days longer on average than the females. Fitted as a covariate calf birth weight showed a positive ($P<0.01$) relationship to gestation length. The regression showed that an increase in birth weight of 0.4 (±0.08) kilograms was associated with an increase in gestation length of one day. In their models used to study birth weight of calves born to Angus, Brahman, Brangus and Africander-Angus cross cows, Reynolds *et al.* (1968) showed that for each day increase in gestation length, birth weight increased by an average of 0.25 to 0.30 kilograms.

Table 1. Least squares means for gestation length and unadjusted gestation ranges of calves by sire breed

Sire breed	Number of dams	Gestation length (days±SEM)	Gestation range (days(SD))
Angus	53	281^{a}	271-294
Belmont Red	17	284^{abc}	272-293
Brahman	35	287^{b}	274-296
Charolais	44	286^{bc}	272-295
Hereford	52	280^{a}	271-294
Limousin	44	286^{bc}	277-296
Santa Gertrudis	30	282^{ac}	275-288
Shorthorn	42	283^{ab}	271-294
Overall.	317	284±1.5	271-296(5.7)

^{a,b,c} Means with no superscripts in common differ ($P<0.05$)

Gestation length means. Least squares means for gestation length are shown in Table 1. The average gestation length of 284 days reported in this study was shorter than gestations reported in some earlier studies cited by Plasse *et al.* (1968). They reported mean values to be consistently over 290 days for Zebu cows (Nellore, Gir and Guzerat) in Brazil. Reynolds (1980) and Paschal *et al* (1991) reported a mean of 291 days gestation for Brahman cows in Louisiana and Texas respectively. The shorter gestation length reported here may reflect differences between nulliparous heifers and multiparous cows. The gestation length range of 271-296 days (Table 1) with a standard deviation about the mean of 6 days agrees with the accepted normal range for the bovine species. Assuming the average oestrus cycle is 21 days, there is likely to be an overlap in birth days of calves resultant of conceptions to AI and back-up sires in subsequent heat periods.

Breed effects. Sire breed significantly affected length of gestation of crossbred calves born to Brahman dams ($P<0.01$). Most published studies showed sire breed differences (*Bos taurus* versus *Bos indicus)* in gestation length (Reynolds *et al.* 1980; Paschal *et al.* 1991; Browning *et al.* 1995). The study of Herring *et al.* (1996) though, compared Brahman with Boran and Tuli breed sires and reported no sire breed differences. The studies of Reynolds *et al.* (1980), Paschal *et al.* (1991) and Browning *et al.* (1995) all reported that Angus-sired calves (282 to 284 days) had shorter gestations than Brahman-sired calves (291 to 294 days). Similar differences are shown here (Table 1). Browning *et al* (1995) hypothesised that gestation lengths were positively influenced by the expected gestation length of the service sire breed used in crossbreeding programs. A comparison of *Bos taurus* sire breeds here, showed that calves by European sires had gestation lengths 4.7±0.69 days longer (P<0.01) than calves by British breed sires. This may reflect a difference in the genetic make-up of these *Bos taurus* breed groups related to separate evolutionary processes from geographically isolated gene-pools. Gestation length of straightbred Brahman calves was longer (Table 1) than crossbred calves by British sires (eg. Angus and Hereford) but not than those by European sires (eg. Charolais and Limousin). Gestation lengths of calves by the tropical composite breeds (Belmont Red and Santa Gertrudis) were intermediate between Hereford and Brahman sired calves.

Implications. The breed differences, though statistically significant, show no cause for concern about unfavourable effects on gestation in Brahman heifers mated to sires of other breeds. Although longer pregnancies usually resulted in heavier calves, stillborn calves were not associated with either shorter or longer pregnancies. Because of the 25 day range in pregnancy length, cows leaving AI programs will need to be held over for one heat cycle (21 days) following AI before going to back-up bulls of the same or similar breed. This will avoid overlapping of birth days of calves by AI and back-up bulls conceived on following heat cycles. Using a back-up bull of a different breed to the AI sire will also help with assigning sires at calving. DNA fingerprinting may be warranted where sire identification is in doubt.

ACKNOWLEDGMENTS

The authors wish to acknowledge the efforts of Peter Howard, Anthony Nicholls and the stock crews from 'Duckponds' and Brigalow Research Station for recording calving details. We also thank Scott Newman for his advice on data analysis.

REFERENCES

Arthur, P.F., Hearnshaw, H., Johnston, D. and Stephenson, P.D. (1995) *Aust. J. Agric. Res.* **46(6)**: 1245.

Barlow, R., Hearnshaw, H., Arthur, P.F. and Darnell, R.E. (1994) *J. Agric. Sci., Camb.* **122**: 121.

Batra, T.R., Roy, G.L., McAllister, A.J., Darisse, J.P.F., Lee, A.J., Vesely, J.A. and Winter, K.A. (1982) *Canadian J. Anim. Sci.* **62(3)**: 709.

Browning, R., Leitebrowning, M.L., Neuendorff, D.A. and Randel, R.D. (1995) *J. Anim. Sci.* **73(9)**: 2558.

Hearnshaw, H., Arthur, P.F., Johnston, D. and Stephenson, P.D. (1995) *Aust. J. Agric. Res.* **46(6)**: 1231.

Newman, S., Macneil, M.D., Reynolds, W.L., Knapp, B.W. and Urick, J.J. (1993) *J. Anim. Sci.* **71(8)**: 2026.

Paschal, J.C., Sanders, J.O. and Kerr, J.L. (1991) *J. Anim. Sci.* **69**: 2395.

Plasse, D., Warnick, A.C., Reese, R.E. and Koger, M. (1968) *J. Anim. Sci.* **27**: 101.

Reynolds, W.L., DeRouen, T.M., Moin, S. and Koonce, K.L. (1980) *J. Anim. Sci.* **51**: 860.

SAS Institute Inc., (1989) SAS/STAT® Users Guide, Version 6, Fourth Edition, Volume **2**, Cary, NC: 846.

Turner, H.G. (1975) AMRC Review No.24.