Effects of breed and feed supplementation on the fertility of cows developed for milk production in Zimbabwe

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Fifty-six indigenous Sanga-type (Nkone and Tuli breeds) cows and 46 crossbred (Nkone x Jersey and Tuli x Jersey) cows were randomly allocated to four treatment combinations in a 2 x 2 factorial arrangement with two breeds and two dietary levels, a control diet and a diet supplemented with dairy meal containing 14 per cent crude protein at the rate of 2 kg per cow per day. The progesterone concentration was measured in milk samples taken three times a week from 10 days postpartum for up to 200 days, and the cows' body weights and body condition scores were recorded fortnightly. The pregnancy rate in the crossbred cows was significantly higher (P<0.05) than in the indigenous cows, and the assumed pregnancy loss rate 30 days after conception was significantly higher (P<0.05) in the indigenous cows than in the crossbred cows. The supplemented crossbred cows had a lower pregnancy loss rate than the supplemented indigenous cows (P<0.05). All the supplemented indigenous cows that lost pregnancies were in their first parity, whereas all the crossbred cows that lost pregnancies were multiparous and were not supplemented. The indigenous cows weighed significantly more (P<0.05) than the crossbred cows irrespective of diet, and the supplemented cows of both breeds weighed more (P<0.05) than the control cows. The supplemented indigenous cows had significantly higher (P<0.05) body condition scores than the control cows. The mean daily milk yield of all the breeds was generally low but significantly higher (P<0.05) in the crossbred than in the indigenous cows.

AFTER milk production, the fertility of dairy cattle is considered to be their most important economic trait (Hodel and others 1995), and there is a need to increase conception rates and to reduce embryo and fetal loss (Webb and Armstrong 1998). Under ideal conditions the conception rate can be as high as 90 per cent (DeJeanette and others 1992, Nadir and others 1993), but many embryos die (Ayalaon 1978, Seeenan and Diskin 1986). The extent and timing of embryo mortality in cattle is reported to vary from eight to 42 per cent (from 9 days before pregnancy to day 2 after conception, with most losses occurring between eight and 16 days after conception (Seeenan and Diskin 1986, Zavy 1994). After the completion of implantation, approximately 42 days, only 3 to 8 per cent of fetuses are lost before calving (Seeenan and Diskin 1986, Peters 1996). Although such fetal losses account for a smaller proportion of reproductive failure than a failure at conception or early fetal loss, they are critical in that more time is wasted and, in some cases, the re-establishment of normal cycles and conception is delayed for some time after the losses occur (Ball 1997). This becomes a serious problem in semi-arid areas where dairy production by smallholders is seasonal. In these areas breeding and calving are restricted to a short period of the year, in order to match the feed requirements for milk production to the seasonal pattern of pasture growth (Grashows and others 1997).

Recent studies have indicated that the development of the zygote can be influenced by the ovarian environment within which the oocyte develops before ovulation, and that the animal's level of nutrition can modify this environment (McEvoy and others 1997). As a result, nutritionally mediated effects on the maturation of the oocyte and the early development of the embryo are central to its survival. A fairly severe and extended period of undernutrition is required to cause significant reductions in the growth and survival of embryos in cattle, sheep and goats (Robinson 1986); however, overfeeding rapidly reduces pregnancy rates and increases embryo losses. Ashworth (1993) discovered that overfeeding ewes during early pregnancy was associated with a reduction in the proportion of embryos that survived. Ducker and others (1985), working with first-lactation dairy heifers, also reported that a high level of feeding during lactation resulted in poor pregnancy rates and a higher rate of embryo loss after 24 days postpartum.

The Nkone and Tuli breeds and their Jersey crosses are kept by smallholder dairy farmers in Zimbabwe; the Tuli and Nkone are medium-sized beef breeds indigenous to Zimbabwe and are categorised as Sanga-type cows (Grillan 1989). The reproductive performance of these breeds and their crosses with dairy breeds such as the Jersey has not been adequately evaluated. The objective of this study was to assess the effect of breed and feed supplementation on pregnancy rates and pregnancy loss in Nkone and Tuli cows and their crosses with the Jersey breed in a semi-arid region of Zimbabwe.

MATERIALS AND METHODS

The study was carried out at Matopo Research Station, which is located at longitude 28°E and latitude 20°S, in the Natural Region IV of Zimbabwe, an agroecological zone where farming is semi-extensive (Central Statistical Office 1997). The site lies at an altitude of approximately 1340 m. The mean annual rainfall is 570 mm and falls between October and April, but the area experiences periodic droughts during the rainy season. The mean maximum annual temperature is approximately 30°C, and the mean annual temperature is 20°C. The site is prone to frost from May to July. The soils are broadly referred to as granitic sands. The vegetation is mainly savanna woodland with Hyparrhenia and Acacia species as the predominant grass and tree species, respectively. The natural pasture is of good quality and quantity in summer but declines in quantity and quality in the dry season.

Twenty-three indigenous Nkone and 23 Tuli cows, along with 23 Nkone x Jersey and 23 Tuli x Jersey cows, were used. The indigenous cows and the crosses were in their first to fourth parity, and their ages ranged from two to six years.

A completely randomised experimental design in a 2 x 2 factorial arrangement, with two breeds and two dietary levels, was conducted. The control diet consisted of natural grass

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and browse fed alone, and the treatment diet consisted of the same diet supplemented with 2 kg/day of a mazo/soybean-based commercial dairy meal (Urelac National Foods) containing 14 per cent crude protein. The stocking rate was one livestock unit per 15 ha. The cows receiving supplementary feed were fed individually once a day up to a maximum of 60 days after breeding and for a maximum of 200 days after calving.

Regular observations for oestrus were made by trained herdsmen between 05.00 and 18.00, commencing 10 days after calving for up to 200 days after calving. The cows were presented to a bull for mating at the first observed oestrus on or after 60 days postpartum. Bulls ran with the herd from 60 days after the last cow had calved to ensure that no cow was mated before 60 days postpartum. A veterinarian checked whether the cows were pregnant by palpation per rectum approximately seven months after the first mating.

The cows were milked by hand every morning, starting at 07.30, in the absence of their calves, and the milk yield was recorded. The cows were suckled after milking until the evening and the calves were separated overnight. Milk samples for progesterone analysis were taken every Monday, Wednesday, and Friday from 10 days postpartum up to a maximum of 200 days postpartum. Progesterone was measured in whole milk by solid-phase radioimmunoassay, using a commercial kit (Coat-ACount; Diagnostic Products). The cows were weighed fortnightly and their body condition was assessed on a scale from 1 (very thin) to 5 (obese) (Mulvany 1981). The body condition scores and bodyweights were recorded every fortnight.

A progesterone profile was plotted for each of the cows under observation. Assumed pregnancy rates were determined from these profiles by expressing the number of cows assumed to be pregnant as a percentage of the total number of cows. The cows were assumed to be pregnant if their milk progesterone concentration remained high at day 21 through to day 30 and beyond after the previous ovulation. The estimate of pregnancy loss rate was based on a sustained production of progesterone during the first 30 days after breeding, followed by a sudden decline in progesterone levels with or without a return to cyclical progesterone patterns between 30 and 90 days after breeding. The pregnancy loss rate was calculated by expressing the number of cows losing their pregnancy as a percentage of all the cows assumed to be pregnant. Actual pregnancy rates were determined by expressing the number of cows confirmed to be pregnant by rectal palpation at seven months as a percentage of all the cows.

Of the 46 indigenous and 46 crossbred cows that were allocated to treatment, nine indigenous cows were dried off within one month after calving because their milk yield was less than 0.2 litres/day, and one crossbred cow fell into a pit and died. These 10 cows were removed from the experiment, so that data from 37 indigenous and 45 crossbred cows were available for final analysis. The associations between pregnancy status and dietary treatment and breed combinations were determined by the chi-squared test using the PROC FREQ procedure of SAS (1994). The effect of breed and diet on milk yield, bodyweight, and body condition score were analysed by analysis of variance using the PROC GLM procedure, and the significance of differences between pairs of means for the treatment combinations was determined by using the PDIFF statistic.

**RESULTS**

The results of the study are shown in Table 1. Both the assumed pregnancy rate and the actual pregnancy rate were higher (P<0.05) in the crossbred cows than in the indigenous cows. The supplemented indigenous cows had a higher assumed pregnancy rate than the indigenous controls. The actual pregnancy rate in the supplemented crossbred cows was higher (P<0.05) than in the supplemented indigenous cows. The assumed pregnancy rates determined from the milk progesterone profiles were higher (68 per cent, 56 of 82 cows) than the actual pregnancy rates determined by rectal palpation (50 per cent, 41 of 82 cows).

The assumed pregnancy loss rate 30 days after conception was significantly higher (P<0.05) in the indigenous cows than in the crossbred cows, and the supplemented crossbred cows had a lower pregnancy loss rate than the supplemented indigenous cows (P<0.05). All the supplemented indigenous cows that lost pregnancies were in their first parity, whereas all the crossbred cows that lost pregnancies were multiparous and were not supplemented.

The mean daily milk yield was low but significantly higher in the crossbred cows than in the indigenous cows (P<0.05). Supplementation did not significantly increase the average milk yield. The indigenous cows were heavier (P<0.05) than the crossbred cows, irrespective of diet. In both breeds the supplemented cows were heavier (P<0.05) than the control cows. The supplemented indigenous cows had higher (P<0.05) body condition scores than the control cows.

**DISCUSSION**

The results reported here are the first from trials in Zimbabwe in which milk progesterone profiles have been used to determine the reproductive performance of Sanga cows and their Jersey crosses in terms of pregnancy rate and pregnancy loss. There were significant differences in pregnancy rates between the crossbred cows and the indigenous cows, the crossbred cows having higher assumed and actual pregnancy rates than the indigenous cows. Because the assumed pregnancy rates were determined from milk progesterone profiles 30 days after breeding, it was not possible to determine whether this difference resulted from a failure of fertilisation or from very early embryo loss.

The supplemented indigenous cows had a higher assumed pregnancy rate than the control cows but this beneficial effect of supplementation was masked by the higher pregnancy losses in the supplemented group. A similar effect of a high plane of nutrition on pregnancy loss has been reported in sheep (El-Sheikh and others 1955). Ashworth (1995) also observed that overfeeding ewes during early pregnancy was associated with a reduction in the proportion of embryos that survived. Ashworth (1995) found an inverse relationship between the plane of nutrition and progesterone concentrations, which would be expected to be due to an increase in progesterone metabolism arising from increases in both hepatic mixed function oxidase activity and portal blood flow in the well fed animals. Thus, the low progesterone concentration might be responsible for high
embryo losses in well fed ewes. Ducker and others (1985) also reported that a high level of feeding during lactation resulted in poor pregnancy rates and a higher embryo loss rate after 24 days postpartum in first-lactation dairy heifers.

All the indigenous cows that were supplemented and lost pregnancies were in their first parity, whereas all the crossbred cows that lost their pregnancies were multiparous and were not supplemented. This agrees with the review by Robinson and others (1999) in which it was reported that the adverse effect of a high plane of feeding during early pregnancy on fetal growth appears to be specific to adolescent pregnancies. In contrast, reduced fetal growth and its associated changes in fetal muscle development are usually a result of undernutrition during early pregnancy in non-adolescent pregnancies. It is possible that poor nutrition in the control crossbred cows eventually led to fetal losses, because there was none in the supplemented group.

The crosses between Jersey and Sanga (Nkone and Tuli) cows were superior to the indigenous Sanga in their reproductive performance. Their pregnancy rates were higher and they lost fewer pregnancies. In addition, supplementary feeding improved the pregnancy rates and reduced the rate of pregnancy loss in the crossbred cows.

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REFERENCES


ABSTRACTS

Prevalence of anthelmintic-resistant cyathostomes on horse farms in the USA

The prevalence of anthelmintic resistance in cyathostome nematodes of horses was investigated in 786 horses on 44 farms in Georgia, South Carolina, Florida, Kentucky and Louisiana. Forty-three of the farms had cyathostome worms resistant to fenbendazole, 24 had worms resistant to oxibendazole and 18 had worms resistant to pyrantel pamoate, but none had worms resistant toIVERMECTIN. These prevalences were higher than previously reported and suggest that anthelmintic resistance is becoming widespread throughout the southern USA.


Retrospective study of 143 dogs with a pericardial effusion

In 44 of 143 dogs with a pericardial effusion a mass could be identified by echocardiography, but no mass could be identified in the other 99. The median survival time (MST) of the dogs with a mass was only 26 days, whereas the MST of the others was 1068 days. Dogs with a history of collapse were more likely to have a mass, and their MST was 30 days compared with 605 days for the dogs which did not collapse. The dogs without a mass tended to have ascites and a larger volume of pericardial effusion; the MST of the dogs with ascites was 605 days compared with 45 days for those without ascites. Thirty-one of the dogs without a mass were treated surgically by a partial pericardiectomy; four of them died perioperatively, but the others had a MST of 1218 days compared with 532 days for the dogs not which did not undergo surgery.