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Induced seasonal reproductive performance in two breeds of sheep

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Abstract

The objective of the present experiment was to determine whether failure to become pregnant through out-of-season reproductive management regimes is attributable to a failure to stimulate normal corpora lutea (CL) production. Romney ewes and East Friesian Composite (EF) ewes were mated in summer, autumn, winter, and early and late spring after administration of intravaginal progesterone inserts (plus eCG in spring and summer) in a factorial (two breeds × five mating periods) experimental design. Oestrus rate was determined from mating data, and the numbers of CL were determined by laparoscopy 9 days after ram introduction. Conception rate, pregnancy rate and litter size were determined by transabdominal ultrasonography 62 days after ram introduction.

Proportions of ewes displaying oestrus did not differ significantly (75–100%) between seasons or breeds, except for the Romney ewes in summer (67%; $P < 0.05$). Numbers of CL on Day 9 for EF ewes was lowest in autumn (1.5) and winter (1.5), and highest in late spring (2.1; $P < 0.05$). In contrast, Romney ewes had the lowest CL count in summer (1.3), and the highest in autumn (1.8) and winter (1.6; $P < 0.05$). Only in summer was there a difference between breeds (EF 1.8; Romney 1.3; $P < 0.01$). The proportion of ewes that failed to conceive despite having one or more CL present was highest in late spring (EF 41%, Romney 43%), and lowest in autumn (EF 9%, Romney 4%) and winter (EF 14%, Romney 4%; $P < 0.05$). Conception and pregnancy rates followed similar patterns with values for autumn (EF 91%, 91%; Romney 96%, 96%) and June (EF 86%, 82%; Romney 91%, 83%) being significantly ($P < 0.05$) higher than in early (EF 50%, 40%; Romney 54%, 50%) and late spring (EF 44%, 36%; Romney 42%, 36%). Pregnancy rate in summer was higher for EF ewes (60%) than for Romney ewes (39%) but conception rates were not statistically different (EF 68%; Romney 60%). Numbers of foetuses identified at scanning was highest in autumn (1.5) and lowest

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in late spring (0.5 $P < 0.001$): Litter size in pregnant EF ewes was highest in early spring and lowest in winter (1.8 versus 1.2; $P < 0.01$), but for pregnant Romney ewes was highest in winter and lowest in early spring (1.9 versus 1.3; $P < 0.001$).

It was concluded that seasonal differences in the ability of ewes to conceive are not the consequence of failure to display oestrus or to ovulate, but probably are a result of failure of fertilisation or the establishment of pregnancy.
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Keywords: Ewe; Out-of-season; Corpora lutea; Pregnancy rate; Romney; East Friesian

1. Introduction

Year-round lambing systems depend on the ability of ewes to breed outside of the normal breeding season. Although much is known about the physiological principles that underlie the regulation of transitions between the breeding and non-breeding season, attempts to breed sheep out of season have generally resulted in variable, and low, overall pregnancy rates, with poor consistency between different studies and between different breeds/husbandry systems. This is so whether out-of-season breeding has been induced with (3–67%; Dawe et al., 1969; Carpenter and Spitzer, 1981; Smith et al., 1988a; Knight et al., 1989; Ungerfeld and Rubianes, 1999; Knights et al., 2003; Morris et al., 2004) or without (0–28%; Goot and Maijala, 1977; Lewis et al., 1996) the use of exogenous hormones. Conversely, despite such poor results in terms of pregnancy rates, the ability of out-of-season breeding regimens to induce behavioural oestrus is generally good. In the studies of Dawe et al. (1969), Smith et al. (1988a), Knight et al. (1989), and Ungerfeld and Rubianes (1999) oestrus was displayed by up to 95% of ewes. Whilst some data exist on the extent to which out-of-season breeding regimens induce normal follicular and luteal activity (e.g. Hunter et al., 1986; Hunter and Southee, 1987; Smith et al., 1988b; Southee et al., 1988), the contribution that failure to induce such activity makes to the eventual pregnancy outcomes either in whole-flock management regimens, or when out-of-season management protocols are employed at different stages of the non-breeding season, has received relatively little attention.

In a recent experiment (Morris et al., 2004) in which reproductive activity was induced at five different seasons through the year, it was found that only 46–61% of those ewes which had been induced to breed out of season were subsequently identified as pregnant. Unpublished data from the same study indicated that, even though the pregnancy rate was low, 82–99% of those ewes displayed oestrus when they were exposed to rams. However, it was not established whether the low out-of-season pregnancy rates reported in that study, as in many other similar studies, were due to inadequate follicular development, a reduced ability of the ewe to ovulate, failure of conception or implantation, or embryonic/early foetal mortality.

The objective of the present study was to examine the ovarian activity of two breeds of ewes (Romney and East Friesian Composite), to determine whether failure to induce corpora lutea was responsible for the discrepancy between high numbers of ewes displaying oestrus and low out-of-season pregnancy rates, especially in animals that were induced to breed during deep anoestrus.

2. Materials and methods

A study was undertaken to examine the reproductive performance of ewes at five different breeding dates (early spring: mid-August, late spring: early-November, summer: mid-January,

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