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Short-term nutritional treatments grazing legumes or feeding concentrates increase prolificacy in Corriedale ewes

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ABSTRACT

We tested whether short periods of increased nutrition will improve ovulation rate and prolificacy, irrespective of the method used to synchronise the cycles of the ewes. In Experiment 1, we used 138 Corriedale ewes to evaluate two factors: synchronization treatment (sponges versus a single injection of prostaglandin) and type of pasture (native versus improved with *Lotus corniculatus*). Ewes were mated at the end of the grazing period and prolificacy was evaluated at lambing. Grazing *Lotus corniculatus* for 12 days tended to increase the number of twin lambs born ($P = 0.09$). The percentage of ewes showing oestrus during a 9-day period was similar among synchronization treatments. Animals in Experiments 2 ($n = 282$) and 3 ($n = 288$) were allocated to a control group or a group fed a supplement of corn grain and soybean meal for 7 days. Ewes received 2 prostaglandin injections and the supplement was fed from Days 11 to 17 after the second prostaglandin. Ovulation rate was measured in 65 (Experiment 2) and 61 (Experiment 3) ewes that were confirmed to have consumed the supplement and showed oestrus in a 4-day period. The supplement increased ovulation rate by 14% in both experiments ($P < 0.05$). We conclude that Corriedale ewes can respond with increases in prolificacy to a 12-day period grazing *Lotus corniculatus* and in ovulation rate to 7 days feeding with a supplement rich in energy and protein. Moreover, in these studies, prostaglandin was as effective as sponges for synchronising oestrus, an important factor in future decisions about hormonal management of fertility.

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1. Introduction

Nutrition is one of the most important factors that can be used to manage the reproductive performance of sheep in pasture-based farming systems (Martin et al., 2004). For example, short-term nutritional supplementation, or 'focus feeding', is a credible strategy for improving ovulation rate and the costs can be minimised by feeding supplements such as lupin grain (*Lupin angustifolius*) for periods as short as 4 days, as long as the supplement is offered only during the late luteal phase (Oldham and Lindsay, 1984; Stewart and Oldham, 1986). It has been shown that such supplements lead to increases in the blood concentrations of glucose, insulin and leptin (Teleni et al., 1989a,b; Viñoles et al., 2005). Since glucose is the major source of energy for the ovary, and the follicles have glucose transporters, an increase in the availability of glucose and metabolic hormones should increase the energy available to the follicles, and thus their ability to grow (Muñoz-Gutiérrez et al., 2004, 2005; Williams et al., 2001). The concentrations of glucose and metabolic hormones reach peak values 3 days after the start of feeding, then decrease (Teleni et al., 1989a,b; Viñoles et al., 2005). Considering the brief nature of these endocrine responses and that they seem to be essential for increasing ovulation rate, there would seem to be a major advantage in feeding the full amount of any supplement from the first day, rather than introducing it gradually. If acidosis is to be avoided, the only supplements that can be used are those containing low levels of fermentable starch, such as lupin grain (White et al., 2007). Alternative feeds that might be more readily available in some regions, such as corn grain or soybean meal, can be used to increase ovulation rate but need to be introduced more gradually over longer periods (Molle et al., 1995, 1997). However, this is less cost-effective so, for regions where lupin grain is not readily available, there is a need to continue the search for alternatives.

Another alternative is short periods of grazing high quality pasture, particularly if the pasture contains legumes such as *Lotus* spp. The foliage of many varieties of *Lotus* contain high concentrations of condensed tannins that protect protein from rumen degradation so it can be absorbed in the small intestine (Waghorn et al., 1987; Min et al., 1999, 2001; Ramírez-Restrepo et al., 2005), perhaps making available nutrients that promote follicle development in the ovary. Most studies on the effect of legumes such as *Lotus* on reproductive performance have been based on increases in the availability of dry matter for ewes already grazing improved pastures for long periods (Min et al., 1999, 2001). They can, nevertheless, be effective—for example, grazing *Lotus uliginosus* cv. Maku for 18 days increases ovulation rate by 12%, compare to grazing native pastures (Banchero and Quintans, 2006). The value of this strategy for increasing the number of lambs born now needs confirmation.

Very short-term supplements are only effective when fed from Day 8 to Day 5 before ovulation, so are best used when the cycles of ewes have been synchronized (Gherardi and Lindsay, 1982; Martin et al., 2004). During the breeding season, cycles can be synchronized with intravaginal sponges or prostaglandin injections (Scaramuzzi and Martin, 1984). Sponges have two problems: first, a high percentage of the steroidogenic compound remains after the end of the treatment; second, antibiotics are needed to avoid bacterial infections (Moore and Robinson, 1967; Greyling et al., 1997). The disposal of excess hormone, the possibility of hormonal contamination of meat animals, and the excessive use of antibiotics in farm practice are all developing into difficult issues for animal management because, worldwide, consumers are beginning to demand products that are 'clean, green and ethical' (Martin et al., 2004). Prostaglandins avoid the problem of sponge disposal and the routine use of antibiotics, and also offer the advantage that 99% of the product is metabolised during the first 24 h after injection, reducing the risk of residues in the tissues (Tomlinson et al., 1984). We therefore need to re-evaluate prostaglandin as a replacement for intravaginal devices for synchronising oestrus.

This paper describes three studies. In the first, we extended the work of Banchero and Quintans (2006) by testing whether a 12-day grazing period on improved pastures will improve the numbers of lambs born, irrespective of the method used to synchronise the cycle. In the second and third studies, we tested the hypothesis that feeding ewes a supplement of corn grain and soybean meal for 7 days (Days 8–14 of the oestrous cycle) will induce an increase in ovulation rate in ewes synchronized with prostaglandin.