

“FOCUS FEEDING”: THE STRATEGY FOR INCREASING GAMETE PRODUCTION AND EMBRYO SURVIVAL IN MERINO SHEEP

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“Focus feeding” is an integral component of the “clean, green and ethical package” for improving the reproductive performance of Merino flocks. In this paper, we consider the use of nutrition to improve sperm and egg production while, at the same time, avoiding any potential problems with embryo survival.

Feeding Merino rams with lupins increases testicular size within 4 weeks but sperm output is not increased until another 4 weeks later because this amount of time is required for the germ cells to turn into spermatozoa. Farmers thus need to start feeding their rams 8 weeks before mating (Cameron *et al.* 1988). Alternatively, maintaining a high plane of nutrition through to the end of the breeding season improves mating potential and may reduce the percentage of rams needed to assure good fertility (Viñales *et al.* 2006 unpub. data). Either of these approaches will improve the return on investments in ram genetics.

In ewes, a high plane of nutrition over the long term is consistently associated with high ovulation rates (Rhind and McNeilly 1986; Xu *et al.* 1989). On the other hand, short-term (4-6 days) lupin supplements have inconsistent effects, with the response in ovulation rate ranging from -18% to +54% (Nottle *et al.* 1997; Stewart and Oldham 1986). Clearly, the response is affected by other factors such as static and dynamic changes in body condition at the time of supplementation. In addition, the lack of progress in this area could be due to poor control of the experimental model that is used for studying ovulation rate, particularly the status of the follicular waves in the ovaries at the start of nutritional treatment. At present, we are testing a new “one wave” model that is based on a series of 3 injections of prostaglandin at 7-day intervals. This should synchronise the emergence of the ovulatory waves among all of the ewes in a group. Prostaglandin does this by rapidly reducing progesterone concentrations, the key event that induces the ewe to ovulate and thus reset follicular development. This model will also help with another important issue in focus feeding to improve ovulation rate, namely the need to find alternatives to lupins in regions of Australia where this grain is not readily accessible.

Obviously, any investment in high ovulation rates needs to be reflected in an increase in the number of lambs born. The biggest potential impediment is embryo mortality during the first 3 weeks after mating, perhaps one of the most important sources of reproductive wastage in Merinos (range 10 to 25%; Wilkins and Croker 1990). These 3 weeks are critical because they include the period during which the ewe and her embryos are establishing the ‘cross-talk’ that assures the high progesterone levels that are needed to maintain pregnancy. Interestingly, compared to ewes fed to maintenance, undernourished ewes have higher circulating progesterone levels but the action of progesterone in the uterus is diminished (Sosa *et al.* 2004) and embryo development is delayed (Abecia *et al.* 1997). Over-feeding may also reduce embryo survival because it reduces circulating concentrations of progesterone (Parr, 1992), but we still need evidence as to whether this is important under field conditions. Clearly, this issue needs to be resolved because gains in ovulation rate from supplements before mating can be lost if continuation of the supplement after mating increases the incidence of embryo mortality. At this stage, we offer conservative advice to farmers and suggest that they reduce supplementation during the post-mating period.

The use of nutrition to control reproductive performances in male and female sheep is an ancient concept, but we are still not certain about the timing and duration of the periods of focus feeding that are relevant to the different stages of the reproductive process. To achieve our goal of strategies that consistently maximise reproductive performance and profitability in Merino flocks, we need a better understanding of the physiological systems that mediate the effects of nutrition on gamete production and embryo survival in the sheep.

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