# Development of systems for out-of-season lambing at Limestone Downs

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## ABSTRACT

An experiment was conducted in which 1402 Romney ewes, aged 2 to 5 years, were treated with intravaginal controlled internal drug releasers (CIDR) followed by 1 of 2 pregnant mares' serum gonadotrophin (PMSG) preparations (Pregnecol ®, 530 iu v Pharmochem ®, 460 iu) for mating on 1 of 3 dates (December 19, 28 or January 3). Of the 1402 ewes joined with the ram, 71% conceived to the first cycle. Conception rates, proportion of ewes conceiving multiples and foetuses per ewe joined were assessed by ultrasound pregnancy diagnosis at day 50 of pregnancy. Reproductive performance was highest in 2-year-old ewes but was not influenced by previous reproductive history (wet v wet/dry in the previous spring). All measures of reproductive performance declined at later mating dates compared with those at December 19. Substantial premiums were obtained for early-born lambs, and for their dams when slaughtered at weaning the following September. Out-of-season lambing systems appear to offer economic benefits in areas characterised by good winter and spring growth rates but dry summers.

**Keywords** Seasonal breeding; ewe age; mating date; lamb production.

## INTRODUCTION

Limestone Downs is a 3220 ha coastal sheep and beef cattle property situated in Raglan County, 15 km south of Port Waikato. The area enjoys relatively good winter and spring growth, but is prone to dry summers and difficulty has been experienced in finishing lambs born at the conventional time (August). The property is administered by the C. Alma Baker Trust, whose objective is *furtherance of the science of agriculture.* Policy at Limestone Downs has therefore been to explore new production methods which are of potential interest to New Zealand agriculture but not necessarily proven in practice.

In regions which experience seasonal patterns of pasture growth similar to those at Limestone Downs, lambing out-of-season appears to offer a number of opportunities:

1. Lambs may be grown to heavy weights before the onset of dry summers.
2. Out-of-season premiums on lambs and ewes may be attracted.
3. Lamb production per ewe may be increased by having ewes lamb twice in a year, or by obtaining an additional lambing from ewes which would otherwise be cast for age at normal weaning time.
4. Pasture control may be improved as a result of having mobs of dry ewes available at 2 periods in the year.
5. Labour demands on the farm may be spread and more efficient use made of available labour.

The objective of this study was to investigate the potential for large scale out-of-season breeding on Limestone Downs and to identify factors influencing the responsiveness of ewes to controlled internal drug releasers (CIDR) and pregnant mare serum gonadotrophin (PMSG) treatment.

## MATERIALS AND METHODS

### Animals and Treatments

A total of 1402 commercial Romney ewes were selected for the programme in December 1986. Of these, 385 had reared at least 1 lamb in the previous spring and had been weaned for about 6 weeks at the time of first mating. The balance of the ewes had experienced a pregnancy but no lactation (wet/dry). Ewes were aged 2 to 5 years (as of the previous spring) with the exception of 111 ewes whose age was unknown.

Ewes were divided into 3 groups (balanced for age and previous reproductive performance) for mating on 3 dates (December 19 and 28, January 3).

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In each group, ewes were treated with CIDRs (Type S, AHI Plastic Moulding Co., Hamilton) for 11 d followed by a single intramuscular injection of PMSG at CIDR removal. Two sources of PMSG, Pregnecol® (Cheriot Agvet Pty Ltd, Victoria, Australia) (530 iu/ewe) and Pharmochem® (Pharmachem Co., Auckland, New Zealand) (460 iu/ewe) were used in a factorial design with date of treatment. Ewes in each of the 3 mating groups were weighed at CIDR removal. At the first mating date, Poll Dorset 2-tooth rams (10 ewes per ram) were introduced immediately after PMSG treatment and ewes mated for 2 oestrous cycles. Rams were harnessed during the second cycle (17 d). At the 2 later matings, 30% of the Poll Dorset rams were replaced by mixed-age Romney rams because of a suspected *Brucella ovis* problem in the former group. Romney rams were selected on the basis of apparent sexual activity as determined by veterinary testicular palpation. Response to treatment was assessed in all ewes by ultrasound pregnancy diagnosis (Anon, 1984) at day 50 of pregnancy.

### Statistical Analysis

Response to treatment was assessed in terms of the conception rate, proportion of ewes conceiving which carried multiple foetuses, and number of foetuses per ewe joined. Data relating to conception rate and proportion of ewes carrying multiples were subjected to logit-transformation (Snedecor and Cochran, 1967) while number of foetuses per ewe joined was analysed without prior transformation. All analyses were undertaken using the computer package REG (Gilmour, 1985).

## RESULTS AND DISCUSSION

Of the 1402 ewes treated, 71% conceived to the first oestrous cycle and only 4% to the second cycle. Results presented here relate only to the former group. There was no effect of previous lambing history (wet *v* wet/dry) on performance and neither were there interactions between the effects of mating date, ewe age and PMSG source.

### Mating Date

Effects of mating date on performance are presented in Table 1. Conception rate was significantly higher at the December 19 mating than at the 2 subsequent matings, while the proportion of ewes conceiving multiples continued to decline as the season progressed. As a result, there was a marked effect of mating date on the number of foetuses per ewes joined. Mating live weight of the ewes declined from the December 19 to December 28 mating but had increased again by the last mating date (Table 1). However, the magnitude of these live weight differences was very small.

It is not clear whether the effect of mating date was due to the change in ram breeds (replacement of 30% of the Dorset rams by Romney rams) or to other factors such as general reproductive performance of the rams. However, 2 observations point to the latter explanation. First, the proportion of ewes conceiving multiples (and, as a result, the number of foetuses per ewe joined) declined significantly between the December 28 and January 3 matings, even though the ratio of Dorset to Romney rams remained constant. In addition, observations made at lambing suggested that the ratio of Romney to Dorset x Romney lambs was roughly in proportion to the ratio of rams of the 2 breeds. Thus, the poorer ewe reproductive performance at later mating dates was apparently not due to sexual inactivity or low fertility of the Romney rams alone. It may, however, have been due to declining fertility in all rams consequent upon their being presented with large numbers of cycling ewes at 6 to 9 d intervals.

### Ewe Age

Both the conception rate and number of foetuses per ewe joined were significantly greater in 2-year-old ewes than in other age groups but there was no

**TABLE 1** Effect of mating date on ewe performance (first cycle).

| | Mating date | | | Pooled |
|---|---|---|---|---|
| | December 19 | December 28 | January 3 | S.E. |
| Number of ewes | 468 | 476 | 458 | — |
| Mating weight (kg) | 55.8[a] | 55.0[b] | 56.2[a] | 0.3 |
| Conception rate | | | | |
| Logit-transformed | 1.17[a] | 0.83[b] | 0.74[b] | 0.08 |
| Back-transformed (%) | 76.3 | 69.7 | 67.7 | — |
| Conceiving multiples | | | | |
| Logit-transformed | 0.03[a] | -0.37[b] | -0.63[c] | 0.10 |
| Back-transformed | 50.7 | 41.0 | 34.7 | — |
| Foetuses/ewes joined | 1.16[a] | 0.99[b] | 0.90[c] | 0.03 |

Means with different superscripts differ at $P<0.05$.

**TABLE 2** Effect of ewe age on performance (first cycle).

| | Ewe age (years) 2 | 3 | 4 | 5 | Unknown | Pooled SE |
|---|---|---|---|---|---|---|
| Number of ewes | 587 | 267 | 204 | 233 | 111 | — |
| Mating weight (kg) | 54.0[a] | 54.8[a] | 56.6[b] | 59.5[c] | 56.5[b] | 0.3 |
| Conception rate | | | | | | |
| Logit-transformed | 1.36[a] | 0.57[c] | 0.96[b] | 0.78[bc] | 0.92[b] | 0.17 |
| Back-transformed (%) | 79.6 | 63.8 | 72.3 | 68.6 | 71.0 | — |
| Conceiving multiples | | | | | | |
| Logit-transformed | -0.43 | -0.48 | -0.67 | -0.33 | 0.08 | 0.14 |
| Back transformed (%) | 39.3 | 38.2 | 33.7 | 41.9 | 52.0 | — |
| Foetuses/ewes joined | 1.13[a] | 0.89[c] | 0.98[b] | 0.99[b] | 1.10[a] | 0.05 |

**TABLE 3** Effect of PMSG source (dose) on ewe performace (first cycle).

| | PMSG source (dose) Pregnecol ® | Pharmochem ® (460iu) | Pooled S.E. |
|---|---|---|---|
| Number of ewes | 709 | 693 | — |
| Conception rate | | | |
| Logit-transformed | 0.76[a] | 1.11[b] | 0.06 |
| Back-transformed(%) | 68.0 | 74.6 | — |
| Conceiving multiples | | | |
| Logit-transformed | -0.11[a] | -0.54[b] | 0.07 |
| Back-transformed(%) | 47.3 | 36.8 | — |
| Foetuses/ewe joined | 1.05 | 1.06 | 0.02 |

Means with different superscripts differ at $P<0.05$.

consistent relationship between age and performance amongst the older ewes (Table 2). Proportion of ewes conceiving multiples was not influenced by age. The superior performance of young ewes, while unexpected given their low live weight (Table 2), may have arisen because of an intensive selection programme for fecundity undertaken at Limestone Downs during the past 5 years. The programme, together with improved management, has lifted total farm lambing performance from 70% to 100% during this period.

### PMSG Source and Dose

Although the original trial protocol called for equal doses of the 2 types of PMSG, and injections were made on that basis, it subsequently transpired that equal quantities (in terms of International Units) had not been supplied. Thus the difference between PMSG sources (Pregnecol® and Pharmochem®) was confounded with a small difference in dose (530 iu v 460 iu). Despite receiving a lower dose, ewes injected with the Pharmochem ® material exhibited significantly higher conception rates than those injected with Pregnecol ®. However, the reverse effect occurred with respect to proportion of ewes conceiving multiples so that there was no net effect of PMSG source (dose) on foetuses per ewe joined (Table 3).

Differences between the PMSG sources in the proportion of ewes conceiving multiples could presumably be accounted for by the difference in dose since numerous studies have shown that ovulation rate increases with dose over the range 450 to 550 iu/ewe (Holst, 1969; Gherardi and Lindsay, 1980). The difference in conception rate is more difficult to explain but suggests a difference between PMSG preparations in their ability to stimulate fertility in ewes bred out-of-season.

## CONCLUSION

The results of this study have provided important information which has assisted in the design of an out-of-season lambing operation at Limestone Downs. The observations that age of ewe (excluding 2-year-olds) and previous lambing history do not have a substantial effect on performance is of particular interest. One important attribute of an out-of-season breeding system, particularly on large-scale properties such as Limestone Downs (18,000 ewes), may be the ability to utilise previously wet/dry ewes or those due to be cast for age. Such ewes can be mated in December and January and slaughtered after weaning in September when prices

are normally high and feed supply for the main ewe mob is limited. For the early-lambing ewes described in this paper, the premium was $8/head with the same margin for their lambs (compared with those normally born in the spring). These premiums are to some extent offset by the costs of CIDRs and PMSG treatment (approximately $5 per ewe treated in this study), and by the lower than normal conception rates in ewes mated early. Conversely, the recent observation that early lambing ewes produce up to 0.5 kg/head more greasy wool than normally lambing ewes (S.T. Morris, personal communication) suggests that early lambing systems are likely to be economically viable. This will be particularly true in situations where use of PMSG can be avoided altogether.

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## REFERENCES

Anon. 1984. *Pregnancy diagnosis by ultrasound.* Massey University Farms Series, Massey University, Publication No. 1.

Gherardi P.B.; Lindsay D.R. 1980. The effect of season on the ovulatory response of Merino ewes to serum from pregnant mares. *Journal of reproduction and fertility* **60**: 425-429.

Gilmour A.R. 1985. *REG: A generalised linear models programme.* Division of Agricultural Services, N.S.W. Department of Agriculture, Australia. Miscellaneous Bulletin No. 1.

Holst P.J. 1969. The ovarian response to pregnant mares' serum (PMS) administered after intravaginal progestagen treatment of cyclic and anoestrus ewes. *Australian journal of agricultural research* **20**: 1143-1150.

Snedecor G.W.; Cochran W.G. 1967. *Statistical methods.* The Iowa State University Press, Ames, Iowa. pp. 593.