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# Factors influencing the success of a large scale artificial insemination programme in sheep

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## ABSTRACT

The MAFTech Sire Referencing Scheme is a national programme to evaluate rams, via progeny testing, throughout New Zealand. Phenotypic effects are reduced by using "Link sires" to make comparisons between properties valid. To enable link sires to be used over large numbers of animals in diverse locations, extensive use is made of Artificial Insemination (AI).

Data from over 3,000 ewes mated by AI during the 1989 breeding season are presented. Various factors and their interactions were examined by fitting a generalised linear model with binomial distribution. The model showed that: the non-return rate from cervical insemination with chilled semen was 61% for ewes which had been treated with CIDRs and 62% (SED 3.4) for naturally cycling ewes; for frozen/thawed semen inseminated by the intra uterine route the corresponding rates were 70% and 40% (SED 7.0). In ewes treated with CIDRs the non-return rate was lower for cervical compared to intrauterine insemination (61% vs 70% SED 4.0). Ewes which were in oestrus more than 24 hours before insemination had a non return rate of 58% compared to 63% (SED 2.6) for ewes which were in oestrus between 24 and 17 hours before AI and 71% (SED 3.1) when oestrus occurred less than 17 hours before AI. There was no evidence of an interaction between AI method and time from oestrus to AI affecting non-return rates. Non-return rate decreased significantly as the average age of the ewe flock inseminated increased. (Coefficient for logit regression - 0.14 se 0.064). Technicians success rate ranged from 51% to 76% non returns, when adjusted for other factors. Although differences among the 31 sires did not contribute significantly to this model, predicted non-return rates when sire was added to the model ranged from 39% to 86%. There was no evidence that ewe breed influenced non-return rate.

**Keywords** Sheep, artificial insemination, AI technique, breeding programme, CIDR.

## INTRODUCTION

In 1987 MAF began a national Sire Referencing Scheme. By using BLUP analysis of progeny test data, rams from throughout New Zealand are ranked for various production traits. By including link sires in the analysis environmental factors can be accounted for when comparing home bred sires between flocks. Each year participating breeders must choose at least two of the available link sires of the appropriate breed for use in their flock. Since the link sires are required for use in diverse locations at similar times, the selected rams are stood at AB Centres at Ruakura and Invermay, where semen is collected and distributed for artificial insemination (AI) into participant flocks. Breeders are required to inseminate a minimum of 20 ewes with semen from each of the selected link sires. Both fresh and frozen semen is available and insemination techniques are based on work reported by Harvey *et al.*, (1984) using fresh semen with cervical insemination and Tervit *et al.*,

(1984) using frozen semen via the intrauterine route.

Since the scheme has been operating, non-return rates to AI have varied both within and between flocks. Breeders tend to place a high emphasis on the AI component of the scheme and are invariably interested in "conception rates". Under the scheme, guarantees of 50% and 60% non-returns are made for cervical and intrauterine insemination respectively. This paper examines data from over 3000 ewes artificially inseminated in the 1989 season in an effort to identify factors which influenced non- return rates.

## MATERIALS

Members of the scheme were asked to fill in recording sheets at the time of AI. The information included date, AI method, ewe age and breed, the use of progesterone impregnated devices for synchronisation, sire, technician, time of AI in relation to oestrus and the date on which ewes were marked by a follow up entire ram. AI

sires and method were chosen by the farmers. AI technicians were used on a location basis and each technician was trained in only one AI method. Ewes were randomly allocated to sire within farms, and these sire groups were used for analysing the data.

Due to the diversity of location and for logistical reasons most inseminations were "fixed-time" following synchronisation of ewes. Breeders were recommended to include some naturally cycling ewes in their AI flocks to ensure that enough ewes were available for AI. Progesterone impregnated devices (CIDR; Carter Holt Harvey, Hamilton, NZ) were inserted in ewes for 12 days. At withdrawal of the devices ewes were joined with harnessed teaser rams. Marked ewes were drafted off after 24 hours (period 1), 31 hours (period 2) and 47 hours (period 3). AI began approximately 48 hours after withdrawal of the devices, in the order: period 2 (24-17h after oestrus), period 3 (<17hr after oestrus), period 1 (>24hr after oestrus, (if required)). In many cases when naturally cycling ewes were available, they were inseminated in preference to period 1 ewes. Dose rate of fresh semen was  $100 \times 10^6$  in 0.125 - 0.2 cc and frozen/thawed  $100 \times 10^6$  in 0.25 cc with a minimum of 25% post thaw motility.

### Statistical

Non-return rate was analysed by fitting a generalised linear model with binomial distribution. AI method, synchronisation usage and their interaction, period, technician and ewe age were included in the model. The effect of sire and breed and other first-order interactions were fitted and found not to be significant. Statistical significance was assessed at the 5% level.

## RESULTS AND DISCUSSION

### Synchronisation

There was no significant difference in non-returns between synchronised and naturally cycling ewes following cervical insemination. Synchronised ewes inseminated by the intrauterine method also performed well but naturally cycling ewes performed poorly (Ta-

ble 1). While the result with cervical insemination was as expected and agrees with Harvey *et al.*, (1984), this significant interaction between intrauterine insemination and natural oestrus was unexpected. The reduction in non-return rate did not appear to be associated with any other factor. Intrauterine AI with fresh semen at the natural oestrus routinely provides very satisfactory non-return rates (G.H. Shackell, unpublished), and Smith (pers. comm.) has shown no difference between conception rates to intrauterine AI with frozen/thawed semen between a synchronised oestrus and the following natural oestrus. We cannot offer any apparent reason for the result recorded here. For synchronised ewes, intrauterine AI resulted in a significantly higher non-return rate than cervical insemination (70% vs 61% SED 4.0). This result was expected and agrees with Tervit *et al.* (1984).

**TABLE 1** Mean non-return percentage for ewes inseminated cervically or intrauterine, and with or without synchronisation.

	Synchronised	Natural Oestrus	SED
Cervical	61	62	3.4
Intrauterine	70	40	7.0
SED	4.0	8.1	

### Oestrus period

There was a significant oestrus period effect on non-return rate (Table 2). Ewes which were first in oestrus less than 17 hours prior to AI (period 3) had a non-return rate 8% and 13% higher than ewes marked in periods 2 and 1 respectively. This is consistent with the finding of Dziuk (1970) who suggested that conception rates are best in sheep when AI occurs about 12 hours prior to ovulation, implying that AI should take place about 18 hours after the start of oestrus. In contrast, Amir and Schindler (1972) noted no difference in conception rate of ewes inseminated at various times 4-8 and 32-36 hours after oestrus.

**TABLE 2** Mean non-return percentage for ewes according to oestrus period prior to AI

	Oestrus Period		
	1 (>24h)	2 (17 - 24h)	3 (<17h)
Non Return rate	58	63	71
SED from Period3	2.6	3.1	-

**Age of ewe group**

Non-return rate decreased significantly (coefficient of logit regression  $-0.14 \pm 0.064$  (SE)) by 3 percentage points per year of age difference as the average age of ewe group increased. (Table 3). The high performance of two tooth ewes was surprising and warrants further investigation.

**TABLE 3** Predicted non-return percentage with average age of ewe group.

	Average age of ewes (Years)				
	2	3	4	5	6
Predicted non-returns	69	66	63	60	57

**Technician**

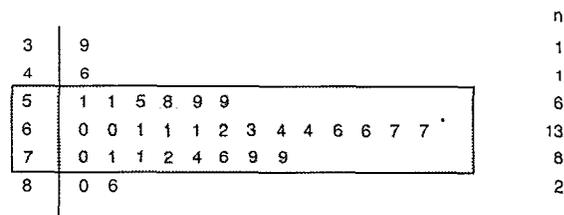
There was a significant technician effect, with success varying from 51% to 76% when adjusted for other factors. However, the interpretation of this result is made difficult by an apparent location difference in cyclic activity of ewes and non-return rates. As technicians are chosen for proximity to the participating farms and their skill in the AI method chosen, there is no way of judging technician performance in different localities. Also, while all technicians are MAF approved operators, minor differences in procedures, which are not monitored, may influence success rates.

**Sire**

The sire effect was not significant when added to this model, although it is still of interest. Fitted values for

sire (Figure 1) had a narrow inter-quartile range (59% - 71%) relative to the extreme values (minimum = 39%, maximum = 86%).

**Fig 1.** Stem-and-leaf diagram of fitted values for non-return percentages of 31 sires



**FIG 1** Stem and leaf diagram of fitted values for non-return percentage of 31 sires.

**CONCLUSIONS**

The AI results collated from the 1989 Sire Reference Scheme mating suggest that non- return rates can be significantly improved by keeping the oestrus to AI period less than 17 hours and by using young ewes. Where "fixed-time" insemination is used intrauterine AI will give best results. However, a number of breeders wish for various reasons to use cervical AI, and several in the south of the South Island have been trained to inseminate their own ewes. The majority of these breeders are using naturally cycling ewes, and some include a small number of synchronised animals. The poorer results from using natural oestrus in conjunction with intrauterine AI with frozen semen requires further controlled study. The apparent geographical differences also require clarification.

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