# USE OF THE PROSTAGLANDIN ANALOGUE, ICI 80996, TO SYNCHRONISE OVULATION IN SHEEP IN AN ARTIFICIAL INSEMINATION PROGRAMME

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## Summary

The effects on fertility of single or double treatments with the prostaglandin analogue ICI 80996 were studied in a flock of Merino ewes in an artificial insemination programme. The number of ewes lambing in the double treatment group and the untreated group was significantly higher ($P<0.001$) than the number of ewes lambing in the single treatment group. However there were large day to day variations in both treatment groups which appeared to be attributable to day to day variations in ambient temperature.

## I. INTRODUCTION

Artificial insemination (AI) of sheep offers a method of rapidly increasing rate of genetic gain in such productive traits as live weight and fleece weight. In the past two years, 54,000 ewes have undergone AI in a programme controlled by the Australian Merino Society in Western Australia. One of the factors limiting progress in this programme was the lack of control over which ewes and the numbers of ewes which came into oestrus each day. This experiment was designed to investigate the effectiveness of AI following either single or double treatments with the prostaglandin analogue ICI 80996. Endogenous prostaglandin $F2\alpha$ results in the demise of the corpus luteum and prostaglandin analogues have been shown to cause luteolysis in the luteal phase of the oestrus cycle in both sheep and cattle (Hearnshaw, Restall, Nancarrow and Mattner 1974). Results in this experiment were compared to lambing following AI at an unsynchronised oestrus.

## II. MATERIALS AND METHODS

The experiment was conducted on a property between Morowa and Mullewa in Western Australia. Twenty vasectomised rams were joined with a flock of 2000 mature Merino ewes on Oct.7. Twenty days later these rams were replaced with 20 harnessed vasectomised rams. Marked ewes were drafted off and identified on Oct.29, Oct.31 and Nov.2, when the harnesses were removed. The marked ewes were allotted at random to two groups receiving either one or two injections of ICI 80996 (125 Ug i.m.). The first injection of the double treatment was given ten days after drafting off (i.e. Nov.8,10 or 12). The second injection for this group was given either 14 or 15 days later i.e. some ewes were injected each day from Nov. 22 to 27. The ewes in the single treatment group were injected 24 or 25 days after drafting (i.e. Nov. 22 to 27). The ewes in all groups were shorn between Nov. 4 and 8. The rams used as semen donors for AI were transported 370 km to the site of the experiment on the day prior to inseminations commencing, Nov. 24. Sixteen hours prior to starting AI 40 harnessed vasectomised rams were released into the flock and daily inspections for mating marks were carried out in the two hour period immediately preceding commencement of each day's insemination programme. Ewes were inseminated using the procedures described by Martin and Fairnie (1976). At 64-70 h after the second or only injection of ICI 80996, ewes were inseminated regardless of whether or not they had been marked by the vasectomised rams. Records were kept of the presence of mating marks at

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the time of insemination. Ewes from the three groups were mixed in the yards prior to AI and inseminated in random order. A proportion of unsynchronised ewes from the same flock as the treated ewes served as controls. These ewes had been marked by vasectomised rams in the 24 h preceding AI. The number selected was determined so as to approximate the number in each of the treatment groups.

Laparoscopic examination of 50 ewes per group inseminated on the first two days of the AI programme was carried out 6-7 days following insemination. The ovaries of each ewe were examined and corpora lutea (CL) counted to determine group ovulation rates expressed in terms of ovulations per ewe examined. Harnessed fertile rams were joined with the flock nine- days after completing inseminations. Ewes were lambed in separated paddocks according to whether or not they returned to the harnessed entire rams. Udders of ewes were examined 25 days after lambing to AI was complete to determine which ewes had lambed. Ambient temperature data was recorded at the Morowa Post Office for the Bureau of Meteorology, Australian Department of Science.

## III. RESULTS

Over the six day insemination programme 54 and 56% of single and double treatment ewes were marked by the vasectomised rams at AI. However there was considerable day to day'variation in the proportion marked (Figure 1).

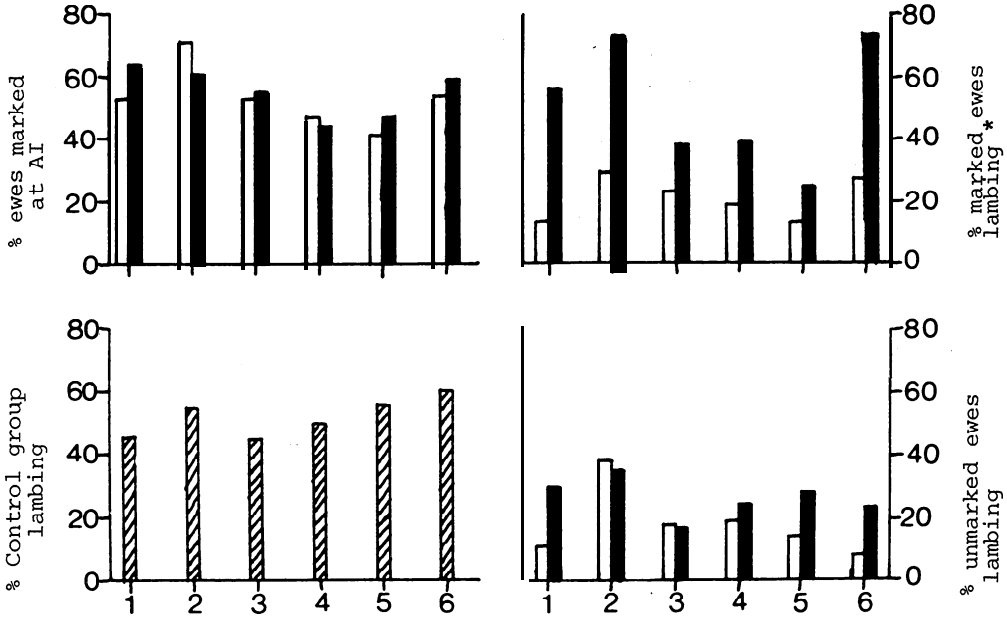


Fig. 1. The percentage of ewes in each group marked at the time of insemination, and the number of marked and unmarked ewes lambing to AI over the six day insemination period. control ▨, single treated □, and double treated ■.
* The % marked ewes lambing in the double treated group on the six days of the AI programme was heterogeneous ($X^2_5 = 18.94$, $P<0.01$)

At laparoscopy all 50 control ewes had CL on their ovaries. All but two of the 50 ewes in the single treatment group had ovulated even though 18 had not been marked at the time of insemination. There were 19 ewes in the double treatment group which were not marked; one of these ewes had no CL. The respective ovulation rates were 1.04 (control ewes), 1.03 and 0.88 (marked and unmarked single treatment ewes) and 1.06 and 0.95 (marked and unmarked double treatment ewes).

Consistently fewer ewes ($P<0.001$) lambed after synchronisation both with a single treatment (20%) and in the unmarked double treatment ewes (26%) when compared to the control group and the marked double treatment group. The proportion of ewes lambing was similar in the control group (52%) and in those marked ewes in the double treatment group (53%) but there were large day to day variations in the proportion of ewes lambing in this latter group causing a heterogeneous effect in the data for the group.

Temperature recordings were examined in terms of daily maxima and minima and the number of hours each day in which the temperature exceeded 30°C. Maxima exceeded 30°C on days 3 (for 3 hours), 4 (6 hours), 5 (6 hours), and day 6 (4 hours) and exceeded 35°C on days 4 and 5. Minima exceeded 15°C on days 3 to 6, and 20°C on day 4. There were several hot periods in the post-insemination period. The most severe occurred Dec. 16 to 21 whilst lesser periods occurred on Dec. 12 (about the time of implantation) and Dec. 2 to 3 and Dec. 6 in the pre-implantation phase.

## IV. DISCUSSION

Synchronisation of ovulation following a double treatment regime of ICI 80996 as used in this experiment was followed by acceptable fertility (41% ewes lambing to one insemination) similar to that seen in paddock matings in Western Australia over a similar time of year (Knight, Oldham, Lindsay and Smith 1975). Lambing results in the double treated ewes marked at the time of AI were comparable to those achieved in the control group over the six day AI programme. However results were less encouraging in ewes receiving the single treatment and in the unmarked ewes of the double treatment group. The results in the single treatment group give little hope that a programme administered in the manner described in this experiment will be of any practical benefit.

Consideration must be given in any commercial AI venture as to whether or not all ewes should be inseminated following a double treatment regime as described or only 'those ewes marked at AI. If all ewes were inseminated the overall lambing to AI would be lower, but there would be more ewes lambing to the rams used in AI. This would enable greater use to be made of superior sires and in addition there would be more lambs born earlier, an advantage in areas with short growing seasons. In addition, fewer vasectomised rams could be retained on the property retaining only sufficient to induce the "teasing-effect" which is of importance in Western Australia in initiating ovarian activity in the summer. It is difficult to postulate reasons for the difference in overall fertility between the single and double treated groups (20% v. 41%) particularly as a similar percentage of ewes in each group were marked at the time of AI. Apparently oestrous expression was not related to the observed differences in fertility between the two treatment groups. One important reason may be the variation in the period between induced ovulation and the previous ovulation. In the double treated group, the

previous ovulation occurred 10 to 12 days before the final injection whereas the interval in the single treatment group would have been 7 to 8 days. In two other experiments conducted at different times and in different areas of Western Australia, 21% of 1514 ewes lambed following a single injection of ICI 80996 given nine days after marking by vasectomised rams (Fairnie, Cumming and Martin 1975 unpublished data).

For successful sperm transport, fertilisation and embryonic development there must be a delicately balanced hormonal milieu. If the synchronisation programme had affected this balance, it could be expected that external environmental factors would have a greater effect on these ewes. The day to day variation in ewes lambing to AI in the unsynchronised group -ranged between 45% and 60%, but the variations in the marked double treated ewes (25% to 74%) were sufficiently large as to cause the data to be heterogeneous. These fluctuations have been examined with reference to ambient temperature about the time of AI. It appears that synchronised ewes are less likely to be marked if the night preceding AI has had a high minimum temperature and that these ewes are less likely to lamb to AI if the day of insemination is hot. Lindsay, Knight, Smith and Oldham (1975) showed a negative correlation to ambient temperature (coinciding with mating or for a few weeks after mating) with lambing performance and suggested that high ambient temperatures affected embryo survival. The data presented here suggests an effect due to high ambient temperature occurs about the day of insemination. The later periods of heat within a few weeks of insemination may also have had an effect on embryo survival although our data do not suggest any specific time at which this may occur. Although synchronisation of ovulation has advantages in terms of increasing efficiency in an AI programme, the consequent compression of the joining period places more ewes at risk to high ambient temperatures at the time of insemination and in the period immediately following, than would occur in unsynchronised flocks. In addition, it appears that the synchronised ewes in this experiment were more susceptible than unsynchronised ewes to these adverse environmental factors.

## IV. ACKNOWLEDGEMENTS

We wish to thank Mr. R. Jardine for help with the statistical analysis, Mr. T.C. Gardiner and Miss D.J. Overheu for technical assistance, Mr. Alan Heitmen for the provision and care of the ewes used in the experiment, and Dr. D.R. Lindsay and Mr. C.M. Oldham of the University of Western Australia for making the laparoscopic examinations. The prostaglandin analogue was kindly supplied by Dr. G.E. Shepherd of ICI Australia Ltd.

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