THE REPRODUCTIVE PERFORMANCE OF NATURALLY MATED AND ARTIFICIALLY INSEMINATED EWES TREATED WITH FECUNDIN AT VARIOUS INTERVALS BEFORE THE START OF BREEDING

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ABSTRACT

Two experiments were conducted to determine whether an interval longer than 2 wk between the last injection of Fecundin and the start of breeding would improve the reproductive performance of mature Merino ewes. In both experiments the ovulation and twinning rates of the immunized ewes were significantly higher than in the untreated ewes irrespective of whether the interval was 2, 3 or 4 wk. In Experiment 1, ovulation rates (ORs) for untreated and 2 and 4 wk were 1.02, 1.24, and 1.17, respectively ($P < 0.001$). Percentage lambing ewes with twin lambs for untreated and 2 and 4 wk: 5.8, 21.2, 17.4, respectively ($P < 0.05$). In Experiment 2, ORs for untreated and 2, 3, and 4 wk were 1.45, 1.92, 1.90, and 1.98, respectively ($P < 0.01$). Percentage of lambing ewes with twin lambs for untreated and 2, 3, and 4 wk were 36.8, 93.3, 63.0 and 68.6, respectively ($P < 0.001$). There were significantly more barren ewes when the interval between the last injection and the start of breeding was only 2 wk compared with either the untreated ewes or those injected 4 wk before the start of breeding (Experiment 1, 11.0, 32.5, 11.5% and Experiment 2, 7.4, 20.2, 9.5% for the untreated, 2- or 4-wk groups, respectively). An interval of approximately 4 wk should avoid a depression in the reproductive performances of immunized ewes.

Key words: ewes, fecundin, injection interval, reproductive performance, artificial insemination.

INTRODUCTION

ORs of ewe flocks can be increased following immunization against estrogens or androgens (1-6) and recently polyandroalbumin, androstenedione -7- α carboxyethylthioether: human serum albumin in diethylamino-ethyl - dextran adjuvant (Fecundin, Glaxo (Australia) Pty Ltd, Boronia, Vic.) has become available commercially (7, 8).

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Glaxo (Aust.) Pty Ltd generously provided the Fecundin used in Experiment 1.

Cox and coworkers (9) reported that the earlier problems of anestrus and increased barrenness associated with immunization (10,11) had been largely overcome in tests in Eastern Australia. On examination of a large number of results obtained in an evaluation of Fecundin on farms, it was found that as the intervals between the second injection and the start of breeding increased the lambing percentages improved and the incidence of barrenness decreased (7,12). The maximum percentage increase in lambs born to immunized ewes was obtained when the interval between the second injection and breeding was between 2 and 4 wk.

Under the Mediterranean climatic conditions experienced in Western Australia, ORs and lambing percentages also are increased when ewes are immunized against androstenedione (a'dione) (13), but in three of these four experiments the incidence of barrenness in the immunized ewes was greater than in the untreated ewes. Two experiments were conducted to determine whether intervals longer than 2 wk between the last injection and the start of breeding, or artificial insemination (AI), reduced the barrenness and hence improved the reproductive performance of mature Merino ewes treated with Fecundin.

MATERIALS AND METHODS

Experiment 1

This experiment was carried out on the Western Australian Department of Agriculture's Research Station at Wongan Hills situated about 160 km northeast of Perth. The climate is Mediterranean with approximately 75% of the mean annual rainfall (380 mm) falling from May to September.

Strong-wool Collinsville Merino ewes (1978 and 1979 born) treated with a'dione immunogens in previous years were randomly allocated to two groups, one was injected with 2 ml of Fecundin subcutaneously in the neck 4 wk before breeding with intact rams while the other group received the Fecundin 2 wk before breeding started in 1984. The untreated ewes from these previous investigations were again not treated. In addition 200 ewes born in 1981 were randomly allocated to three groups: an untreated group, a group injected 8 and 4 wk and a third group injected 6 and 2 wk before the start of breeding. The numbers of ewes in the treatment groups were as follows:

Treatment	Year ewes born		
	1978	1979	1981
Untreated	39	33	100
Immunized, 2 or 6 and 2 wk	20	16	50
Immunized, 4 or 8 and 4 wk	20	16	50

All ewes were grazed together from November 10, 1983. Four wethers treated with Banrot (Wellcome Australia Ltd, Cabarita, New South Wales) (14) were joined with the ewes on December 22, 1983. These were replaced by 7 mature, harnessed intact rams on January 5, 1984 (Day 0) and mating records were obtained at 7-d intervals during the 42-d breeding period.

The ewes marked by rams during the first 7 d of breeding were examined by laparoscopy on Day 12 while all other ewes were examined on Day 21 to record the incidence of ovulations. Forty-nine days after the intact rams were removed all ewes were scanned using real-time ultrasound to determine which were pregnant. Approximately 7 d prior to the expected start of lambing, the ewes were split into groups and individual ewe lambing performances were recorded.

The ewes were weighed straight off the pasture on three occasions. Body condition also was determined by feeling the lumbar region and giving each ewe a score within the scale of 1-5. One corresponds to very poor condition and the animals are weak while for 5 the backbone is not detected and the animals are overfat (15).

Experiment 2

This experiment was on a commercial farm at Kojonup, about 250 km southeast of Perth, which also has a Mediterranean climate with a mean annual rainfall of 550 mm. Four hundred and forty-seven $2^1/_2$ year old strong-wool Australian Merino Society-type Merino ewes were allocated 8 wk before the start of an AI program to four groups, one untreated (147 ewes) and three treated (100 ewes each). All ewes were weighed on allocation and grouped until inseminated.

The three treated groups were injected twice with 2 ml of Fecundin either 8 and 4, 6 and 3 or 5 and 2 wk before the day of the first insemination (February 12, 1984). Ewes marked by teasers were drafted from the flock each morning and within 2 h they were inseminated at the external os of the cervix with 0.1 ml of fresh, undiluted semen. The insemination program lasted 14 d. Three days after its completion, harnessed, intact rams were put with the regrouped ewes (February 29). The rams were removed on March 28, and the marked ewes were recorded.

Seventeen days after the start of the AI program 50 ewes from each group were examined by laparoscopy to determine the ORs. Thirty-six days after the removal of the rams all ewes were scanned using real-time ultrasound to determine which were pregnant. Approximately 7 d before the expected start of lambing the ewes were split into treatment groups and their udders were examined to identify those that were going to lamb. During lambing the dead lambs were removed daily. At the completion of lambing the ewes not previously identified as close to parturition were reexamined for evidence of lambing (16).

Statistical Analysis

The significance of liveweight differences between groups was tested by analyses of variance. Differences in the incidence of service records, ovulations, and lambing performances were tested by Chi-square analyses.

RESULTS

Experiment 1

There were no significant differences in the reproductive performances of the different-aged ewes and so only the combined results are presented.

The mean liveweights of the ewes are recorded (Table 1). On the first day (Day 56) there was a significant age-by-treatment interaction ($P < 0.05$): this disappeared by Day 28 when there was only a difference between age groups ($P < 0.01$). However, on Day 0, the day breeding started, there were no significant differences between ewe groups. On none of these days were there significant differences in the body condition scores of the ewes.

Table 1. Mean liveweights (kg) and body condition (BC) scores of untreated ewes and ewes injected with Fecundin at different intervals before the start of breeding at Wongan Hills

Treatment	Days relative to start of breeding -56 wt	-56 BC	-28 wt	-28 BC	0 wt	0 BC
Untreated	43.9	2.4	41.0	2.3	41.8	2.1
Immunized, 2 or 6 and 2 wk	43.2	2.5	39.7	2.2	41.8	2.4
Immunized, 4 or 8 and 4 wk	44.0	2.6	39.4	2.2	41.0	2.4

The percentages of ewes marked by rams during breeding that returned to estrus are recorded (Table 2). Significantly fewer of the immunized ewes than the untreated ewes were marked after 21 d ($P < 0.001$) and at the end of breeding (untreated vs 6 and 2 wk, $P < 0.05$; untreated vs 8 and 4 wk $P < 0.001$). The percentage of marked ewes that were re-marked at least once during breeding was significantly larger in the 6 and 2 wk group than in the untreated group ($P < 0.05$), whereas the 8 and 4 wk group did not differ significantly from the untreated ewes.

Table 2. Mating records from untreated ewes and ewes injected with Fecundin at different intervals before the start of breeding at Wongan Hills

Treatment	Ewes marked after 21 d of breeding (%)	Ewes marked at end of breeding (%)	Marked ewes that returned to estrus (%)
Untreated	80.5	94.2	13.1
Immunized, 2 or 6 and 2 wk	49.4	84.4	27.7
Immunized, 4 or 8 and 4 wk	44.9	74.4	19.0

At laparoscopy there was no significant difference in the percentages of ewes that had ovulated (Table 3). The difference in the incidence of multiple ovulations between the untreated and immunized ewes was highly significant ($P < 0.001$) but the difference between the two immunized groups was not significant.

Significantly fewer of the ewes in the 6 and 2 wk group lambed than did those in the other groups (6 and 2 wk vs untreated, $P < 0.001$; 6 and 2 wk vs 8 and 4 wk, $P < 0.01$; Table 3). In addition, of the ewes that did lamb, more of the untreated ones had their lambs during the first 3 wk of the lambing period (untreated vs 6 and 2 wk, 84.7 vs 69.4%, $P < 0.05$; untreated vs 8 and 4 wk, 84.7 vs 73.5%, $P < 0.05$). Significantly more of the immunized ewes that lambed had multiple births than did the untreated ewes (6 and 2 wk vs untreated, $P < 0.01$; 8 and 4 wk vs untreated, $P < 0.05$).

There was no significant difference between treatment groups in the levels of lamb mortality.

Table 3. Ovulation and lambing data from untreated ewes and ewes injected with Fecundin at different intervals before the start of breeding at Wongan Hills

Treatment	Ewes ovulating (%)	Ovulation rate[a] (%)	Ewes lambed[b] (%)	Ewes twinned[c] (%)	Lambs born[b] (%)	Lambs alive[d] (%)
Untreated	80.1	1.02	89.0	5.8	94.2	79.2
Immunized, 2 or 6 and 2 wk	87.2	1.24	67.5	21.2	83.1	74.0
Immunized, 4 or 8 and 4 wk	79.7	1.17	88.5	17.4	103.8	91.0

[a] Ovulation rate of ewes ovulating.
[b] Percent of ewes present at end of lambing.
[c] Percent of pregnant ewes.
[d] Percent lambs alive at marking time.

Experiment 2

Eight weeks before the start of breeding the average liveweights of the untreated ewes and those immunized 8 and 4, 6 and 3 and 5 and 2 wk before the start of breeding were 63.5, 61.5, 62.3 and 63.9 kg, respectively.

Significantly more of the immunized ewes had multiple ovulations ($P < 0.001$); the ORs of the ewes ovulating are recorded (Table 4). There were no significant differences between the immunized groups. A high proportion (36.8%) of the ewes were marked during the backup breeding that followed the completion of the AI program, but there were no significant differences between treatment groups.

Table 4. Data for ovulations and returns to estrus of untreated ewes and ewes injected with Fecundin at different intervals before the start of an AI program at Kojonup

Treatment	Ewes inseminated (no.)	Ovulation rate	Ewes returned (no.)	(%)
Untreated	140	1.45	50	35.7
Immunized, 5 and 2 wk	96	1.92	36	37.5
Immunized, 6 and 3 wk	96	1.90	32	33.3
Immunized, 8 and 4 wk	95	1.98	39	41.1

In the 5 and 2 wk group, significantly fewer of the ewes were pregnant than in the untreated group ($P < 0.01$; Table 5), whereas none of the other differences in pregnancy rate were statistically significant. The immunized ewes all had significantly more multiple births ($P < 0.001$) than did the untreated ewes and the 5 and 2 wk group result was higher than those for other two immunized groups ($P < 0.001$).

Table 5. Reproductive performances of the untreated ewes and ewes injected with Fecundin at different intervals before the start of an AI program at Kojonup

Treatment	Ewes (no.)	Ewes lambed (%)	Ewes twinned (%)	Lambs born (%)	Lambs alive (%)
Untreated	135	92.6	36.8	126.7	107.4
Immunized, 5 and 2 wk	94	79.8	93.3	154.3	83.0
Immunized, 6 and 3 wk	94	86.2	63.0	140.4	92.6
Immunized, 8 and 4 wk	95	90.5	68.6	152.6	87.4

A similar proportion of the total lambs born in each group had been born after 3 wk of lambing (66, 61, 67, and 62% for the untreated, 5 and 2, 6 and 3, and 8 and 4 wk groups, respectively), which approximates the lambing to AI. By using the numbers of lambs born during the first and second 21 day periods, it was shown that there were similar responses to the immunization treatment for both the AI and backup breeding (Table 6).

Table 6. Estimated lambing performances for the AI program and the backup breeding of untreated ewes and ewes injected with Fecundin at different intervals before the start of AI at Kojonup

Treatment	Period[a]	Ewes present (no.)	Ewes lambed (%)	Lambs born[b] (%)
Untreated	AI	89	94.4	127.0
	Backup	46	89.1	126.1
Immunized, 5 and 2 wk	AI	59	86.4	150.8
	Backup	35	65.7	160.0
Immunized, 6 and 3 wk	AI	64	92.2	139.1
	Backup	30	73.3	143.3
Immunized, 8 and 4 wk	AI	56	92.9	160.7
	Backup	38	86.9	144.7

a Lambing performances for either the AI or backup breeding.
b Percent lambs born to ewes present based on numbers born during the first and second 21-d periods.

There was a significantly ($P < 0.001$) higher level of lamb mortality amongst the immunized ewes (15.2, 46.2, 34.1, and 42.8% for the untreated, 5 and 2, 6 and 3, and 8 and 4 wk groups, respectively); therefore, these groups had lower percentages of lambs alive at the end of lambing (Table 5). The differences in lamb mortality between the immunized groups were not significant.

DISCUSSION

The results from these experiments provide further evidence that both ORs and twinning rates are increased in Merino ewes treated with Fecundin. In addition, when the interval between the last injection and the start of breeding was increased from 2 to 4 wk, ORs during the first estrous cycle of breeding did not decline; this finding is similar to the recent observations of Cox and coworkers (17), who found that ORs in immunized ewes were maintained for at least 7 wk after the second injection.

The results also confirmed that the fertility of Merino ewes in Western Australia is depressed when intact rams are bred with immunized ewes 2 wk after the booster or second injection. It would appear that an interval of 4 wk overcomes this detrimental effect of Fecundin treatment. These results support the observations reported by Scaramuzzi and coworkers (7) and by Geldard (12) who suggested, following an examination of their survey data, that as the interval between the second injecton and the start of breeding increased, the lambing percentages improved and the incidence of barrenness decreased.

In Experiment 1, although the 6 and 2 wk group had more multiple births, the number of lambs born per 100 ewes present was less than in the untreated group, due to the high level of barrenness. In the other groups in both experiments, immunization resulted in improved lambing percentages due to the additional twin births. However, in Experiment 2 the high levels of lamb mortality in the immunized groups meant that these groups had lower numbers of lambs alive per 100 ewes present at the end of lambing. For effective use of Fecundin treatment, practices that minimize lamb mortality must be adopted.

Although detailed records of the individual ewe lambing performances were not possible in Experiment 2, it would appear from estimates of the reproductive performances after 21 d and at the end of lambing that there were responses to the treatment for both the ewes that conceived following AI and during the backup breeding. This provides evidence that Fecundin can be used effectively with an AI program.

More ewes lambed in the 8 and 4 wk group in Experiment 1 than were marked during the breeding period. This would suggest that there were inaccuracies in detection of the mating records, but similar discrepancies were not observed for the other groups in this experiment. Therefore, the use of mating records to interpret what occurs during breeding may require some caution.

Although there also were some other inconsistencies in the results obtained (e.g., no decrease in the incidence of twin births in the 5 and 2 wk group in Experiment 2 compared with the OR as occurred in the other groups), the results of these experiments show that intervals longer than 2 wk between the last injection of Fecundin and the start of breeding is necessary to reduce barrenness in immunized ewes.

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