

MULTI-STEROID IMMUNISATION TO INCREASE TWINNING FOR "CARRY-OVER" PRIME LAMBS IN WESTERN AUSTRALIA

J.T.B. MILTON^a, P.A. WILSON^a, S.R.D. SUTHERLAND^a and R.H. DAVIDSON^a

^aFaculty of Agriculture (Animal Science), University of Western Australia, Nedlands, W.A. 6009

^bCSIRO, Division of Animal Production, Locked Bag 1, Delivery Centre, Blacktown, N.S.W. 2148

SUMMARY

In Western Australia (WA), Merino ewes increased fecundity when immunised with 2 similar multi-steroid vaccines. Matings were delayed in both immunised groups and in 1 group there was a significant percentage of non-pregnant ewes. Lamb deaths were high in the immunised ewes and negated the benefits from increased fecundity. Management strategies to ensure that multi-steroid immunised ewes are of optimum liveweight during joining, that their steroid titres are ideal, and to increase lamb survival may allow this reproductive technology to be cost-effective to increase production of "carry-over" prime lambs in WA.

Keywords: steroid immunisation, Merino ewes, twinning, prime lambs.

INTRODUCTION

Most prime lambs in Western Australia (WA) are Merino crossbred lambs and their production reflects the short pasture growing season with around 60% of lambs marketed from August to November and the remainder sold over the other 8 months of the year. A large proportion of this latter group are "carry-over" lambs that are born in late winter/spring and after weaning are finished for sale from January to July as the prices increase with the low supply.

A marked increase in the supply of "carry-over" lambs is required if WA is to improve the year-round supply of prime lambs and so enhance the efficiency of all sectors of the prime lamb industry. Increased twinning amongst Merino ewes producing crossbred lambs in late winter/spring in the south-west of WA, when feed conditions are favourable for lamb survival and growth, appears a useful strategy to provide a greater number of lambs suitable to carry-over for summer/autumn finishing.

Young *et al.* (1990) indicated that immunisation against reproductive steroid hormones was 1 of the cheapest strategies to increase weaning rates in Merino flocks at a cost of \$0.54 per 10% increase in weaning percentage per ewe present. Wilson *et al.* (1992) reported that a prototype multi-steroid vaccine that provides simultaneous immunisation against a combination of the steroids androstenedione, testosterone and oestrone gave more consistent gains in lambing percentages with fine-wool Merino ewes than androstenedione immunisation (Fecundin) alone. This paper reports the antibody and reproductive responses of Merino ewes vaccinated with 2 similar prototype multi-steroid vaccines to enhance twinning at a late winter/spring lambing. The application of this strategy for production of "carry-over" prime lambs is discussed.

MATERIALS AND METHODS

The study was conducted in 1992 with 400 mature Merino ewes on "Kayanaba", Dandaragan in the Central Midlands of WA. The ewes were randomly allocated to 3 groups; an untreated control group (200), a Multi A group (100) and a Multi B group (100). The ewes in the Multi A and B groups were immunised with similar prototype multi-steroid vaccine mixtures, those in the Multi A group with a previously tested formulation and those in the Multi B group with an untested, but similar formulation. The control ewes were not immunised, while each of the ewes in the treated groups were immunised with 1.85 ml of the respective vaccine at both 9 and 5 weeks prior to the introduction on 10 March of 3% Border Leicester rams for a 5 week joining.

The ewes ran together for joining and grazed dry pasture and were supplemented with lupin seed twice weekly from the beginning of March until adequate green feed was available in mid-May. The quantity of lupin seed fed varied from 275 to 375 g/hd.day depending on the green feed available after sporadic falls of rain. The rams were fitted with harnesses and raddles and all ewes were inspected for raddle marks every 8 or 9 days during joining. The raddle colour was changed on day 18 and the ewes marked up to day 17 (cycle 1) and between days 18 to 35 (cycle 2) of joining were recorded. A random sample of 30% of the ewes in each group was weighed and condition scored (1 - 5) on day 18 of joining.

Blood samples were collected from the same 10 ewes in each of the control and immunised groups 4 weeks before and on the day the rams were introduced for joining to measure antibody titres (Wilson *et al.* 1992). Antibody titres were determined as the reciprocal dilution of serum showing 50% of maximal

binding of tritium labelled steroids, and expressed for each group as the geometric mean titre. The ewes were scanned by real-time ultrasonography (Fowler and Wilkins 1982) 44 days after the rams were removed to determine the number of fetuses present.

All ewes were shorn 1 month before lambing commenced on 4 August and both immunised groups were run together in a lambing paddock separate from the control ewes after shearing. The combined immunised groups and the control group received minimal attention during lambing, but the lambing paddocks, especially for the combined immunised groups, had features to enhance neonatal survival of twin lambs (Fowler 1990); excellent feed, adequate area and shelter to provide seclusion for lambing.

The male lambs were castrated and all lambs were tailed, vaccinated against Clostridial diseases and cheesy gland and injected with vitamin B₁₂ when the oldest lambs were about 8 weeks of age. All lambs were shorn on 5 November, weaned 11 days later and finished for sale during the autumn of 1993.

For statistical analysis, paired Chi Square comparisons were made to determine differences between ratios or percentages for the relevant attributes (Brown 1988).

RESULTS

The antibody titre responses to the immunisation treatments are shown in Table 1. The response of the Multi A group 4 weeks before joining was higher than preferred, but both immunised groups had oestrone titres lower than the androgen titres at this time. Although all antibody titres declined by the start of joining, the oestrone titre for both immunised groups had declined proportionally less than the androgen titres, and at joining was still high in the Multi A group and higher than the androstenedione titre in the Multi B group.

Table 1. Antibody titre responses 4 weeks before and at joining for Merino ewes immunised against androstenedione (A), testosterone (T) and oestrone (E)

Group	4 wk pre join, antibody titre to			At joining, antibody titre to		
	A	T	E	A	T	E
Control	-	-	-	-	-	-
Multi A	4500	7100	2290	1200	2560	1070
Multi B	1320	2840	1100	360	1280	540

The mean liveweight of the ewes in the Multi B group on day 18 of joining (46.6 kg) was lower ($P < 0.05$) than that of the control ewes (49.1 kg) and, although not significant, was less than that for the ewes in the Multi A group (48.0 kg). The mean condition score of the ewes in all 3 groups at weighing on day 18 of joining was 2.3.

Table 2. The percentage of Merino ewes marked on days 1 to 17 (cycle 1) or days 18 to 35 (cycle 2) of joining, ewes marked in both cycles and ewes not marked

Group	cycle 1	Ewes marked cycle 2	cycles 1 & 2	Ewes not marked
Control	81.5 ^a	11.5 ^a	24.0	7.0
Multi A	64.6 ^b	27.3 ^b	18.2	8.1
Multi B	53.0 ^c	37.0 ^b	19.0	10.0

Values within a column followed by a different letter are different ($P < 0.05$).

Table 2 shows the percentage of ewes that were marked by the rams in cycles 1 and 2 of the 35 day joining and the percentage of ewes that were marked in both cycles. In cycle 1, the percentage of ewes marked in both of the immunised groups was less than the percentage of control ewes marked ($P < 0.05$) and the Multi B group had the lowest percentage of ewes marked. The lower percentage of immunised ewes marked in cycle 1 appeared to be compensated for in cycle 2 since the percentage of ewes not

marked by the end of cycle 2 was similar for all groups. There were no differences between the 3 groups in the percentage of ewes returning to service in cycle 2.

The scanning results for the control and treated groups are shown in Table 3. The conception rate (ewes pregnant/ewes joined) for the Multi B group was lower ($P < 0.05$) than that for the controls, with the percentage of non-pregnant ewes in the Multi B group (22%) being double that of the control group (11.1%). Nevertheless, the number of fetuses/ewe joined or per ewe pregnant in both of the immunised groups were significantly higher than the control group, largely due to increases in the number of twin fetuses. Only 3 ewes in the Multi A group and 6 ewes in the Multi B group had 3 fetuses.

Table 3. Number of Merino ewes with 0, 1, 2 or 3 fetuses, ewes pregnant per ewe joined (EP/EJ), fetuses per ewe joined (F/EJ) and fetuses per ewe pregnant (F/EP) for untreated control and multi-steroid treated ewes

Group	Number of fetuses				Reproductive attributes		
	0	1	2	3	EP/EJ	F/EJ	F/EP
Control (n=198)	22 ^a	130	46	0	0.89 ^a	1.12 ^a	1.26 ^a
Multi A (n=99)	17 ^{ab}	37	42	3	0.83 ^{ab}	1.31 ^b	1.58 ^b
Multi B (n=100)	22 ^b	29	43	6	0.78 ^b	1.33 ^b	1.70 ^b

Within 0 fetuses and reproductive attributes, values followed by a different letter are different ($P < 0.05$).

At marking there were 190 lambs from the control group and 168 lambs from the combined immunised groups. Based on the number of fetuses scanned, significantly more ($P < 0.001$) fetuses were realised as lambs at marking in the control group (85.6%) than in the combined immunised groups (63.9%).

Two hundred and thirteen lambs were sold on 11 May (176 days after weaning) for a net return of \$28.00/hd (early finishers) and 50 days later the remaining 112 lambs were sold for a net return of \$30/hd (late finishers). The mean weaning weight of the late finishers (22.5 kg) was lower ($P < 0.001$) than that of the early finishers (28.4 kg).

DISCUSSION

The lower percentage of immunised ewes marked in cycle 1 indicates that some ewes were anoestrus during this cycle. Wilson *et al.* (1991) suggested that high antibody titres against oestrone tends to increase anoestrus and considered it desirable to have oestrone titres lower than the androgen titres to minimise the incidence of anoestrus. Croker *et al.* (1991), working with similar multi-steroid vaccines under conditions that produced antibody titres to meet these criteria, did not report any disturbances to oestrus in maiden Merino ewes. Thus at joining, the relatively high oestrone titre in the Multi A group, and the oestrone titre being higher than the androstenedione titre in the Multi B group, may have distorted the steroid balance in a number of ewes resulting in anoestrus and delayed matings. Increasing the booster-to-joining interval lowered the titres of all 3 steroids, but did not improve the reproductive performance of maiden ewes in the study of Croker *et al.* (1991). Nevertheless, it may be worthwhile to investigate if this strategy can lower the oestrone titres and overcome the delayed mating of multi-steroid immunised mature Merino ewes.

In this trial the ewes were randomly allocated to the 3 groups prior to the initial immunisation treatments, but the allocation was not according to liveweight. In view of this, the lower mean liveweight of the Multi B ewes on day 18 of joining may reflect differences in liveweight that existed from the start of the study. Ewes immunised with multi-steroid vaccines in similar studies have not lost weight (Croker *et al.* 1991) and the liveweight differences on day 18 of joining is probably not due to an untoward response to vaccination. The mean condition score for the ewes in all 3 groups was the same (2.3) on day 18 of joining and this further suggests that the Multi B ewes had not lost weight. A condition score of 3.0 or better at joining is considered desirable for optimum fertility of Merino ewes in WA (Suiter and Fels 1970), so the ewes should have all been about 1 condition score higher for optimum fertility. If a unit increase in condition score is equivalent to 6 kg increase in liveweight (SCA 1990), all the ewes

should have weighed about 55 kg at joining. The ewes in the Multi B group had the lowest percentage marked in cycle 1, the highest percentage non-pregnant at scanning and they had the lowest mean liveweight during joining (46.6 kg). This lower liveweight at joining may have been another factor contributing to the delayed mating and the higher percentage of non-pregnant ewes in the Multi B group.

The large difference between the control and immunised groups in the number of fetuses realised as lambs at marking shows that lamb deaths were extremely high in the immunised groups. The reasons for this are considered to be due to a combination of factors associated with more twin births than the controls as well as increased vulnerability to foxes (Putu 1990). The immunised groups mated later and therefore lambed later than the controls and were the last group of ewes to lamb on Kayanaba in 1992. Consequently, the lambs from the immunised ewes would have been heavily predated upon by the fox population that built up in the spring of 1992. The large number of juvenile foxes shot on Kayanaba during the summer of 1993 strongly suggests that fox numbers would have been high when the ewes were lambing.

In other studies we have found that lambs reared as multiples have lighter weaning weights and take longer to reach market weight than single lambs (Milton and Sutherland unpublished data). Since the mean weaning weight of the late finishing lambs was considerably lower (6 kg) than that of the early finishing group and most of the multiple fetuses were twins rather than triplets, the group of late finishing lambs is likely to have contained a higher proportion of lambs reared as twins than the early finishers. In this case, the study indicates that late finishing twin-born lambs may be useful as "carry-over" lambs for marketing in early winter when prices are high.

It is concluded that multi-steroid immunisation of autumn mated mature Merino ewes in WA can increase ewe fecundity, but the percentage of non-pregnant ewes needs to be reduced for efficient production of additional "carry-over" lambs. Even when feed is not limiting, marked improvements in lamb survival will be necessary to enable the gains in fecundity to be fully realised as extra "carry-over" lambs.

ACKNOWLEDGMENTS

The authors wish to thank the Roberts families of "Kayanaba" Grazing Company, Dandaragan for providing the animals and facilities and their kind co-operation throughout the study. The Meat Research Corporation is acknowledged for their full financial support of this work as part of the UWA.005 project. We are grateful to Dr R.I. Cox for providing the antigen preparations and to Dr K.P. Croker for helpful comments during various phases of this study.

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