Hogget oestrus synchronisation: a comparison of CIDR and sponges

W.H. McMILLAN

Whatawhata Hill Country Research Station
Ministry of Agriculture and Fisheries, Hamilton.

ABSTRACT

Oestrus synchronisation in hoggets was compared using either polyurethane sponges containing progestagen or 9 mm diameter silicone elastomer CIDRs (controlled internal drug releasers) in 600 hoggets in 3 trials. CIDRs and sponges were removed after 12 days in late May and 200 IU PMSG given to hoggets in 2 of the trials. Hoggets in the third trial received 0 or 300 IU PMSG. Half of the hoggets were shorn 1 month prior to the 4-day joining with entire rams.

The loss rate of CIDRs and sponges was low (2%). No hoggets mated in the first 24 hours after removal and most matings occurred during the second day. During the peak of mating, more CIDR-treated hoggets appeared to mate in 2 trials, but fewer in the third (28 *v* 44% $P < 0.01$). By the end of the entire joining, there was little difference in total mated. Treatment with CIDRs or sponges did not affect ovarian activity. Pregnancy rates were unaffected by method of synchronisation in 2 trials and improved by CIDRs in the third (38 *v* 20% $P < 0.05$). Shearing generally had no effect on reproductive performance. PMSG improved oestrous and ovarian activity, but did not affect pregnancy rate.

CIDRs were an effective substitute for sponges in achieving synchronised pregnancies in hoggets. Low pregnancy rates limited the ability to fully capitalise on the benefits of synchronisation.

Keywords CIDRs; oestrus synchronisation; hoggets; hogget lambing; sponge; progesterone; GGT; sporidesmin

INTRODUCTION

Synchronisation of oestrus could be used to increase the efficiency of reproduction in sheep. In particular, it may have application in inducing earlier and more compact lambing in hoggets and thereby increase the appeal of this practice.

Oestrus synchronisation in ewes is normally achieved using intravaginal polyurethane sponges containing progestagen (Tervit, 1983). The recent development of silicone elastomer CIDRs (controlled internal drug releasers) offers another alternative (Welch, 1983). Although sponges and adult ewe CIDR are satisfactory for previously lambed ewes, their insertion, retention and withdrawal can be difficult in maiden ewes and hoggets.

In an attempt to overcome these problems, a 9 mm diameter "hogget" CIDR with a similar surface area but slimmer shape compared to CIDRs used in adult ewes has been developed (Welch, 1984). This study was undertaken to compare the ability of slim CIDRs and sponges to induce synchronised pregnancies in hoggets. The findings demonstrate that CIDRs are at least as effective as sponges in achieving synchronised pregnancies in hoggets.

MATERIALS AND METHODS

Six hundred hoggets aged 7 or 8 months were used in one of 3 trials. The design in each trial was a 2^3 factorial. Half of the hoggets in each trial were shorn 1 month prior to mating with entire rams and half received either a 9 mm diameter CIDR containing 9% progesterone (0.34 g) or a sponge containing 70 mg of the progestagen MAP (6-methyl-17-acetoxy-progesterone) for 12 days during mid-late May 1985. Sponges and CIDRs were inserted into the anterior vagina using 12 mm diameter hollow applicators.

In trial 1, the 150 hoggets were from 2 strains (Marshall Romney and Waihora Romney). The 250 hoggets in Trial 2 were Romney or Coopworth. The hoggets in these trials received 200 IU of PMSG. In Trial 3, 190 Coopworth x Romney hoggets were treated with 0 or 300 IU PMSG at sponge and CIDR withdrawal.

Matings were recorded daily for the 4 days of entire joining following sponge and CIDR withdrawal. The number of *corpora lutea* were counted 7 to 10 days after mating (Trials 1 and 3), returns to vasectomised rams were recorded 21 days after the end of entire joining and numbers of lambs born were recorded during lambing. GGT levels (gamma glutamyl transferase) in early May were used as an index of sporidesmin poisoning in Trial 2 (Towers and Stratton, 1978). Live weights were recorded in early May.

Tests of significance were carried out using GENSTAT analysis of deviance or variance procedures and fitting live weight and GGT values as covariates where appropriate.

RESULTS

The mean live weight in each trial was 27, 31 and 33 kg respectively. The mean level of GGT was 318 IU/litre in Trial 2.

Overall the loss rate of sponges and CIDRs between insertion and withdrawal was low (1 *v* 3%) and was not affected by shearing or genotype.

Between 70 and 80% of the hoggets were mated by

entire rams. The pattern of mating was similar in the 3 trials: namely no hoggets mated within 24 hours of withdrawal, the peak of mating occurred during the second day (Table 1) and few hoggets mated during the fourth day. Matings were well synchronised in Trial 1. Within each trial, heavier hoggets were more likely to mate ($P<0.001$). Conversely, increasing GGT levels were associated with poorer mating performances ($P<0.01$). Furthermore, this effect remained after accounting for GGT associated reductions in live weight.

Although fewer CIDR treated hoggets mated at the peak in Trial 1 (28 *v* 44 $P<0.01$), the effect was not apparent in the other trials (Table 1). By the end of entire joining, a similar proportion of CIDR and sponge treated hoggets had mated (74 *v* 79%). By coincidence, the mating pattern for shorn and unshorn hoggets was similar to CIDR and sponge treated hoggets respectively (Table 1). The mating pattern was similar for Marshall and Waihora Romney, but more of the Waihora hoggets mated when compared at the same live weight (91 *v* 74% $P<0.01$). The main reason that more Coopworths mated in Trial 2 (78 *v* 60% $P<0.05$) was their higher live weight and lower GGT values. PMSG in Trial 3 was associated with a higher peak of mating (68 *v* 41% $P<0.01$) and a higher total of hoggets mated (89 *v* 71% $P<0.05$). The effects of method of synchronisation, shearing, genotype and PMSG on mating performance were additive.

More hoggets ovulated in Trial 1 than in Trial 3 (99 *v* 90% $P<0.01$). Treatment with CIDRs or sponges did not affect the proportion ovulating (93 *v* 96%), mating and ovulating (99 *v* 98%) or ovulating multiples (22 *v* 24%). Similarly, shearing and genotype effects were small. PMSG induced more hoggets to ovulate (98 *v* 83% $P<0.05$) but did not alter the incidence of ovulation in mated hoggets (99 *v* 97%). Multiple ovulation rate tended to be increased by PMSG (31 *v* 14%).

About 10 and 25% of mated hoggets returned to service in Trials 1 and 2 respectively and these rates were independent of method of synchronisation (Table 2). In Trial 3, CIDR treatment increased return rates ($P<0.05$). Shearing increased the return rate in Trial 2 only ($P<0.05$). Strain and PMSG had no effect. Coopworth hoggets were more likely to recycle than Romney (30 *v* 14% $P<0.05$). Furthermore, increasing GGT levels were associated with a reducing proportion of hoggets recycling.

Overall, 30% of the hoggets lambed. Within flocks, increased live weight was associated with increased fertility ($P<0.001$). The fertility of those hoggets that mated was independent of weight. Increasing GGT levels were associated with reduced fertility ($P<0.01$).

In Trial 1, more CIDR treated hoggets lambed ($P<0.01$ (Table 3)). This was the result of more mated hoggets lambing ($P<0.05$). Fertility and multiple birth rate were independent of method of synchronisation in Trials 2 and 3. Very few hoggets had multiple births. Shearing did not affect fertility except in Trial 2 where the lower fertility of joined hoggets ($P<0.01$) was the result of fewer mating. Strain of Romney differences were small. Coopworths had higher levels of fertility than Romneys, but only because they were heavier. PMSG did not affect fertility but multiple birth rate was increased (25 *v* 6% $P<0.05$).

DISCUSSION

This study confirmed that CIDRs are an effective substitute for sponges in achieving synchronised pregnancies in hoggets. Furthermore, this outcome was consistent for shorn and unshorn hoggets, the 4 genotypes examined and whether or not PMSG was administered.

The pattern of oestrus was generally similar following the use of CIDRs or sponges although sponges resulted in a more consistent pattern between trials mainly because of a more consistent peak. The synchronisation of matings in this study was better than achieved in Romney hoggets treated earlier in the breeding season (Ch'ang *et al.*, 1968). While PMSG improved oestrous responses in this study, the advantage would be expected to increase as treatment moved further into prepubertal anoestrus (Keane, 1974). The degree of oestrus synchronisation achieved in this study would not be sufficient for fixed time AI

TABLE 1 Mating performance (hoggets mated as % of hoggets joined) of shorn and unshorn hoggets treated with CIDR or sponges. Significance levels apply to within-trial comparisons.

	Mated day 2			Mated day 3			Total Mated		
	Trial			Trial			Trial		
	1	2	3	1	2	3	1	2	3
CIDR	77	28	57	2	25	14	79	66	76
Sponge	69	44**	51	6	19	29	82	72	84
Shorn	79	27	56	4	23	18	86	60	78
Unshorn	66	44**	52	4	22	24	75	77*	82

but would allow oestrous hoggets to be inseminated over 2 days.

The retention rate of CIDRs and sponges for 12 days was excellent. In contrast, failure to lodge the sponge in the anterior region of the vagina was the likely cause of the high loss rate (26%) in Romney hoggets in other work (Ch'ang *et al.*, 1968).

The incidence of oestrus without ovulation can be high (6 to 33%) in untreated pubertal hoggets (Edey *et al.*, 1977). The low incidence in this study compares favourably with the 7% in hoggets following sponge and PMSG treatment (Quirke, 1979). The ability of hoggets to produce multiple ovulations was independent of method of synchronisation. Collectively, these findings suggest that the oestrus-ovulation relationships in hoggets treated with sponges or CIDRs are similar to those in spontaneously cycling hoggets.

The proportion of hoggets lambing in this study was similar to some Romney and Coopworth flocks following natural oestrus (Allison *et al.*, 1975). The low pregnancy rate in the sponge group in Trial 1 is difficult to explain. Although pregnancy rates were low in comparison with adult ewes, they are consistent with the high level of post-fertilisation loss apparent in hoggets cycling naturally (McMillan and McDonald, 1985) or following hormonal synchronisation (Quirke, 1979). It is clear from Trial 3 that PMSG increased the number of hoggets mating and multiple birth rate, but did not improve the characteristically low fertility of these immature ewes. Return to service rates were independent of method of synchronisation in 2 of the trials. These return rates were not reliable indicators of barrenness as many barren hoggets failed to recycle.

In general, shearing prior to mating had no effect on reproductive performance. This contrasts with other reports in naturally cyclic hoggets (McMillan and Wilson, 1983) and 2-tooths (McMillan and Knight, 1982) where pregnancy rates have been improved. This suggests that the synchronised hogget may be inappropriate for evaluating shearing effects on hogget fertility.

The hoggets in Trial 2 experienced moderately severe liver damage. The negative association between GGT levels and reproductive performance agrees with other reports in hoggets (Moore *et al.*, 1983) and ewes (Smeaton *et al.*, 1985).

TABLE 2 Return to service rates (as % of hoggets mated) in shorn and unshorn hoggets treated with CIDR or sponges. Significance levels apply to within-trial comparisons.

	Trial		
	1	2	3
CIDR	8	21	23
Sponge	12	28	8*
Shorn	11	34	18
Unshorn	9	17*	13

TABLE 3 Lambing performance (hoggets lambing as % of hoggets joined (HJ) or of hoggets mated (HM)) in shorn and unshorn hoggets treated with CIDR or sponges. Significance levels apply to within-trial comparisons.

	HJ			HM		
	Trial			Trial		
	1	2	3	1	2	3
CIDR	29	26	36	38	40	48
Sponge	15*	31	41	20*	44	51
Shorn	25	21	37	31	37	50
Unshorn	19	36**	40	26	46	49

In conclusion, the 9 mm diameter CIDR has been demonstrated to be an effective substitute for sponges in achieving synchronised pregnancies in hoggets. Therefore, the decision to use CIDRs or sponges should involve considerations other than reproductive performance. These include price, availability, extent of accumulation of vaginal debris and ease of insertion and removal. The cost effectiveness of synchronising hoggets would be improved if high fertility levels could be achieved (e.g. McEwan *et al.*, 1985) and the requirement for PMSG treatment eliminated.

ACKNOWLEDGEMENTS

I thank D.R.H. Hall, P.R. Lynch, I.W. Kitney and I.M. Cameron for technical assistance.

REFERENCES

Allison A.J.; Kelly R.W.; Lewis J.S.; Binnie D.B. 1975. Preliminary studies on the efficiency of mating of ewe hoggets. *Proceedings of the New Zealand Society of Animal Production* **35:** 83-90.

Ch'ang T.S.; McDonald M.F.; Wong E.D. 1968. Induction of oestrus and ovulation in Romney ewe hoggets with a progestagen. *New Zealand journal of agricultural research* **11:** 525-532.

Edey T.N.; Chu T.T.; Kilgour R.; Smith J.F.; Tervit H.R. 1977. Oestrus without ovulation in pubertal ewes. *Theriogenology* **7:** 11-15.

Keane M.G. 1974. Effect of progestagen-PMSG hormone treatment on reproduction in ewe lambs. *Irish journal of agricultural research* **13:** 39-48.

McEwan J.C.; Mathieson C.D.; Hawker H. 1985. Effect of herbage allowance on the productive performance of lactating and non-lactating hoggets. *Proceedings of the New Zealand Society of Animal Production* **45:** 147-150.

McMillan W.H.; Knight T.W. 1982. Shearing and time of joining effects on reproduction in two-tooth ewes. *Proceedings of the New Zealand Society of Animal Production* **42:** 45-56.

McMillan W.H.; McDonald M.F. 1985. Survival of fertilised ova from ewe lambs and adult ewes in the uteri of ewe lambs. *Animal reproduction science* **8:** 235-240.

McMillan W.H.; Wilson L.D. 1983. Hogget reproduction responses to shearing and rearing level. Annual Report

of Agricultural Research Division, New Zealand Ministry of Agriculture and Fisheries 1982/83 p.142.

Moore R.W.; Sumner R.M.W.; Bass J.J.; Hockey H-U.P. 1983. Hogget lambing and its effect on the subsequent two-tooth performance of three breeds. *Proceedings of the New Zealand Society of Animal Production* **43:** 21-24.

Smeaton D.C.; Hockey H-U.P.; Towers N.R. 1985. Effects of facial eczema on ewe reproduction and ewe and lamb liveweights. *Proceedings of the New Zealand Society of Animal Production* **45:** 133-135.

Tervit H.R. 1983. Synchronisation of oestrus in sheep. *Proceedings of the Sheep and Beef Cattle Society of the New Zealand Veterinary Association* **13:** 53-63.

Towers N.R.; Stratton G.C. 1978. Serum gamma glutamyl-transferase as a measure of sporidesmin induced liver damage in sheep. *New Zealand veterinary journal* **26:** 109-112.

Quirke J.F. 1979. Control of reproduction in adult ewes and ewe lambs, and estimation of reproductive wastage in ewe lambs following treatment with progestagen impregnated sponges and PMSG. *Livestock production science* **6:** 295-305.

Welch R.A.S. 1983. Fertility of ewes treated with CIDR dispensers incorporating different levels of progesterone. Annual Report of Agricultural Research Division, New Zealand Ministry of Agriculture and Fisheries 1982/83 p.64.

Welch R.A.S. 1984. Development of CIDR dispensers for use in nulliparous ewes. Annual Report of Agricultural Research Division, New Zealand Ministry of Agriculture and Fisheries, 1983/84, p.58.