

SYNCHRONIZATION OF OESTRUS IN CATTLE, SHEEP AND GOATS
USING A PROSTAGLANDIN ANALOGUE

H. HEARNshaw*, B.J. RESTALL*, C.D. NANCARROW+, and P.E. MATTNER+

Summary

The prostaglandin analogue ICI 79939 can induce luteolysis and synchronize oestrus in sheep, goats (effective dose 30 µg s/c) and cattle (effective dose 250 µg s/c). Fertility following mating or insemination in the three species was within acceptable limits. No gross failure of the reproductive system after treatment with the analogue was experienced.

I. INTRODUCTION

Prostaglandin F_{2α} (PGF_{2α}) causes luteolysis in several species of animals including cattle and sheep. This has led to investigations with PGF_{2α} as an agent for the control of oestrus and ovulation in domestic animals (Inskeep 1973) and to comparison of PGF_{2α} and progestins as practical methods of synchronizing oestrus in cattle (Smith 1973). This paper reports preliminary studies of the use of a synthetic prostaglandin analogue (ICI 79939) in synchronizing oestrus and ovulation in sheep, cattle and goats.

II. MATERIALS AND METHODS

Trials with sheep and goats were conducted at the NSW Department of Agriculture Research Station, Condobolin during April and May, 1973 and those with cattle at the Agricultural Research Station, Leeton, during May and July, 1973.

(a) Sheep

(i) Dose Response

Four groups of ten mature Merino ewes were injected i.m. with either 125, 62.5, 31.2 or 15.6 µg ICI 79939 in 0.5 ml saline on Day 8 of the oestrous cycle. Thereafter ewes were run continuously with harnessed vasectomised rams (10% of ewe flock) and were examined several times daily for the occurrence of oestrus. Raddled (oestrous) ewes were removed soon after first marking and were returned to the rams on the evening of the same day. Ovarian examinations were carried out 5 days after oestrus on five ewes from each dose group. Raddle colours were changed five days after oestrus and subsequent cycle lengths were recorded.

(ii) Fertility

One hundred and four Merino ewes at unknown stages of the cycle were injected with 32 µg ICI 79939 (i.m. in 0.5 ml saline). Fourteen rams fitted with marking harnesses were placed with the ewes. On the ninth day after the injection, ewes that had not been marked received a second injection of ICI 79939 at the same dose rate as used previously. The ewes were lambed under supervision in order to detect any abnormalities or behaviour patterns.

(b) Goats

Eighteen feral does at unknown stages of the cycle, were injected i.m. with either 32 µg (9 does) or 16 µg (9 does) ICI 79939. A buck, with harness and

* NSW Dept. of Agriculture, C/- CSIRO, P.O. Box 239, Blacktown, NSW, 2148.

+ CSIRO, Division of Animal Physiology, P.O. Box 239, Blacktown, NSW, 2148.

raddle, was then placed with the does and markings recorded several times daily for 3 days. Thereafter returns to service were checked daily.

(c) Cattle

(i) Dose Response

Prior to the trial, heifers of mixed breed had run continuously with a testosterone-treated steer fitted with a chin ball harness, and Kamar heat mount detectors were used to assist in obtaining records of oestrus. In addition, heifers were observed for oestrus several times a day. Heifers within each of the following bodyweight classes - 220-250 kg (9 heifers); 250-300 kg (10 heifers); 300-450 kg (10 heifers) - were randomly allocated to 3 groups that received a dose of either 250, 500 or 1000 µg ICI 79939. The heifers were injected s/c between days 4 and 15 of the oestrous cycle.

(ii) Fertility

Nineteen parous Hereford cows were injected s/c with 500 µg ICI 79939. Rectal palpations of the ovaries of all cows were performed prior to treatment. Any cow showing an induced oestrus or regression of a palpable corpus luteum following treatment was artificially inseminated between 72 and 90 hours after treatment. Jugular blood samples, for progesterone determination, were collected before and after insemination. Cows were fitted with Kamar heat mount detectors to detect return to service, and pregnancies were confirmed by palpation 15 weeks after insemination.

III. RESULTS

(a) Sheep

(i) Dose Response

All doses of ICI 79939 except 15.6 µg induced oestrus in all animals (Table 1). Induced oestrus was observed 38-48 hours after injection. A fresh ovulation had occurred in all the animals examined and subsequent cycle lengths were within the normal range. Ewes exhibited highly individualistic behaviour, nervousness and excitability and were extremely difficult to move through yards or handle normally.

TABLE1

Effect of dose of ICI 79939 on reproductive activity in sheep

Dose ICI 79939 (µg)	15.6	31.2	62.5	125.0
No. of ewes	10	10	10	10
No. with induced oestrus	8	10	10	10
No. ewes with fresh ovulation	5/5	5/5	5/5	5/5
Days to next oestrus (mean + S/D)	19.6* \pm 2.7	17.4 [†] \pm 0.5	18.2 \pm 1.4	18.2 \pm 1.7

* 8 ewes only - 2 ewes did not respond to ICI 79939 and did not have a fresh ovulation.

[†] 9 ewes only - 1 ewe has not recycled.

(ii) Fertility

Some 61% of the 104 ewes mated on Days 3 and 4 after the first injection of

ICI 79939 (Table 2). A further 22.1% mated 3-4 days after the second injection given on Day 9. Thus 83% of ewes mated over the two 2-day periods. A further 8.7% of ewes, considered to have not responded, mated during the 12 day period. Of the ewes that mated after either the first or the second injection, 71% and 52% **respectively, lambed**. Overall, the lambing figure was 67%. The lambs had an average birth weight of 4.5 kg and there were no obvious abnormalities.

TABLE 2
Synchronization of oestrus and fertility in sheep treated with ICI 79939

Days after 1st treatment	2	3	4	5,6,7,	8	9	10	11	12	13
No. of ewes showing oestrus	6*	40	24	-,-,-,	3*	2nd injection (31 ewes)	-	16	7	-
Percent of total ewes treated	5.8	38.5	23.1	2.9				15.4	6.7	
Ewes returning - number to service		13	5					8		
- percent		25.7						34.8		
Ewes lambing - number			47						12	
- percent			67						52	

* These ewes are considered not to have responded to the ICI 79939.

(b) Coats

All 18 does exhibited oestrus within 48 hours of injection of ICI 79939. Three exhibited oestrus within 7 hours of treatment. Ten does (56%) subsequently kidded, The remaining eight does returned to service 19-22 days after the **synchronized** oestrus.

(c) Cattle

(i) Dose Response

Table 3 is a summary of the results. Luteolysis occurred in all heifers. All but two animals showed induced oestrus from **46-120** hours after ICI 79939 injection and had a subsequent increase in progesterone concentration, indicating a fresh ovulation.

TABLE 3
Effect of dose of ICI 79939 on reproductive activity in cattle

Dose ICI 79939 (µg)	250	500	1000
No. of heifers	9	11	9
No. with induced oestrus	9	9	9
No. heifers with a palpable fresh ovulation	8	9	8
Days to next oestrus (Mean \pm S/D)	18 \pm 5.5	21 \pm 1.6	19 \pm 5.0

(ii) Fertility

After treatment of the heifers with ICI 79939, all functional corpora lutea underwent luteolysis as indicated by a decrease in the level of progesterone in peripheral blood. Six of the 19 cows came into oestrus within 65 hours of treatment. These were inseminated at 72 hours and also at 90 hours after treatment. Five other heifers received a single insemination 90 hours after treatment. One of these came into oestrus just prior to that time; the other 4 had either a large

follicle, a fresh ovulation ora corpus luteum of reduced size at palpation performed immediately before the insemination. Pregnancy diagnosis (per rectum) carried out 15 weeks later indicated that 7 of the 11 inseminated heifers were pregnant.

IV. DISCUSSION

The results indicate that ICI 79939 can induce luteolysis and synchronize oestrus in sheep, cattle and goats. In the latter case introduction of the buck may have induced oestrus, particularly in the case of the does exhibiting oestrus behaviour within 7 hours of treatment. Fertility following mating or artificial insemination in the 3 species was within acceptable limits and does not indicate gross malfunction of the reproductive system following-treatment. The interval between treatment and oestrus was more variable in cows than in sheep. In addition, oestrus was not always detected in cows even when luteolysis occurred. Similar variations in time to induced oestrus have been reported by workers administering PGF₂ α via the uterus (Elsden *et al.* 1973; Smith 1973). The detection of oestrus in cow herds is difficult and it would be an advantage to inseminate at a predetermined time after injection and still obtain normal fertility.

The minimum effective dose of the analogue for cattle has not been determined but it is considerably lower than effective levels of PGF₂ α given *s.c.* or *i.m.* (Lauderdale 1972; Hearnshaw *et al.* 1973). The reported lack of response at certain stages of the cycle has important managerial implications (Inskeep 1973). Further studies are needed to develop compounds and methods of administration that will result in high fertility following insemination at a set time.

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