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A STUDY OF THE EFFECTS OF POST-MATING PROGESTERONE SUPPLEMENTATION ON THE REPRODUCTIVE PERFORMANCE IN THE EWE

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ABSTRACT

The aim of this study was to investigate the effects of post-mating progesterone supplementation, in the form of CIDRs, on the reproductive performance in recently mated ewes. The effect of two nutrition treatments were also examined by feeding two different pasture allowances to these ewes during a two week period immediately following a synchronized mating.

Two hundred and thirty four Border Leicester X Romney first cross ewes, comprised of 130 mixed-age ewes (3-8 years) and 104 two-tooth (maiden) ewes were flushed on increasing pasture allowances prior to joining. These ewes were naturally mated at a synchronized oestrus following a 13 day CIDR treatment period. During the three days following CIDR withdrawal, 88.0% of the ewes were mated. The mixed-age ewes came into oestrus significantly earlier than the two-tooth ewes ($P < 0.001$). There was a significant linear relationship between liveweight and onset of oestrus ($P < 0.05$), with the heavier two-tooth ewes coming on oestrus earlier than the lighter two-tooth ewes. This was not apparent in the mixed-age ewes.

On Day 2 following mating, ewes were randomly divided into either the high or low pasture allowance levels. Pasture allowance levels were monitored using an Ellinbank Pasture Meter (EPM). Levels of feed intake were estimated for a random sample of 20 ewes both before and after mating through the use of intraruminal chromium releasing devices (CRDs). Sward heights (representing quantity), botanical compositions and *in vitro* digestibilities (representing quality) were recorded for both the flushing and the post-mating period. This information led to the estimation of voluntary herbage intakes during the flushing period (Period I) of 1.2 M, while the intake levels of the ewes following mating (Period II) were calculated to be approximately 1.6 M and 1.0 M for the high and low pasture allowance levels, respectively.

Liveweight changes during Period I indicated that the ewes gained weight. During the differential feeding (Period II) the high fed ewes in Period II tended to continue to gain body weight (4.1% of initial liveweight at mating), while ewes on the low feeding level lost weight over the same period (2.8% of initial liveweight).

Ovulation rates were determined on Days 4 and 5 after mating. The mixed-age ewes had a higher ovulation rate (1.87 ± 0.04) than the two-tooth ewes (1.55 ± 0.06). Both age ($P < 0.001$) and liveweight ($P < 0.01$) of the ewes had significant effects on the ovulation rates.

Post-mating CIDR treatment was randomly administered to half the ewes in each of the two differential pasture allowance levels during Days 8-15 following mating. Forty five animals representing both age groups, feeding levels, ovulation rates and CIDR treatment, chosen at random, were blood sampled over the luteal phase of the oestrous cycle (Days 9 to 14 after mating). The blood samples were collected twice daily both at AM and PM over a six day period. The blood samples were then assayed on a pooled individual basis for progesterone concentration determination.

Analysis of the pooled progesterone data revealed that there were no statistically significant differences between two-tooth versus mixed-age ewes, nor pregnant versus non-pregnant ewes, with respect to peripheral plasma progesterone levels ($P > 0.10$). Progesterone levels however were found to differ significantly ($P < 0.001$) between ewes treated with CIDRs and unsupplemented ewes (1.88 ± 0.10 versus 1.34 ± 0.10 ng/ml), as well as between ewes having a single ovulation and those having twin ovulations (1.49 ± 0.10 versus 1.73 ± 0.09 ng/ml). When the effect of liveweight was corrected for, there was also a significant difference ($P < 0.05$) in pooled progesterone levels between ewes on the high (1.49 ± 0.11 ng/ml) and low pasture allowance levels (1.73 ± 0.09 ng/ml). A significant relationship ($P < 0.001$) was found between ewe liveweight and pooled progesterone concentrations for the two post-mating nutritional levels. The ewes on the high feed level had a constant relationship, while the low fed ewes had a positive relationship between liveweight and pooled progesterone concentrations.

Reproductive performance, as measured by the pregnancy rate, embryo survival rate and lambing percentage, all expressed to the first service, were not significantly affected by either age, feed level or CIDR treatment. The high feeding level (1.6 M) and CIDR treatment were found to slightly improve reproductive performance. The effect of age also appeared to slightly favour the two-tooth ewes

compared to the mixed-age ewes, although this was not found to be statistically significant ($P > 0.10$). There was however a significant effect ($P < 0.05$) of ovulation rate on the resulting pregnancy rate (50.8% for a single CL versus 68.3% for ewes having multiple CLs). The lambing percentage was also significantly affected by the ovulation rate of the ewes ($P < 0.001$), with single ovulating ewes having a lambing percentage of 56.0 ± 11.1%, while those with multiple ovulations had a lambing percentage to the first service of 115.3 ± 6.7%. The mixed-age ewes also had a slightly better percentage of multiple births to the first mating (72.4%) than did the two-tooth ewes (61.6%), although this difference was not statistically significant ($P > 0.10$).

There was a significant interaction between the post-mating feeding level and the CIDR treatment ($P < 0.05$) in the pregnancy and embryo survival rates, as well as for the lambing percentage to the first mating. The post-mating CIDR supplementation had a beneficial effect for the ewes on the 1.0 M pasture allowance level, while the same CIDR treatment for the ewes on the 1.6 M level either had no effect or reduced reproductive performance slightly. The mechanism responsible for the interaction between CIDR treatment and feeding level is not known. It is possible that it a somewhat more complex mechanism than simply a luteal deficiency of progesterone caused by increases in the nutritional level is responsible. An insensitivity to progesterone may be involved, as the low fed ewe tended to respond to post-mating CIDR treatment, while the high fed ewes did not.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure — Page

LIST OF ABBREVIATIONS

1	Single
≥2	Multiple
AI	Artificial insemination
BPR	Blood production rate
CIDR	Controlled internal drug releaser
CL	Corpus lutea
cm	Centimeter
-C	No CIDR treatment
+C	CIDR treatment
°C	Degree Celcius
CO_2	Carbon dioxide
CPM	Counts per minute
Cr	Chromium
CRD	Controlled releasing device
CV	Coefficient of variation
d	Day
D	Day of oestrous cycle
DM	Dry matter
DMD	Dry matter digestibility
DOMD	Digestibility of the organic matter in the dry matter
DOMI	Digestible organic matter intake
EPM	Ellinbank pasture meter
FO	Faecal output
FSH	Follicle-stimulating hormone
g	Gram
GnRH	Gonadotrophin releasing hormone
H	High feeding or pasture allowance level
ha	Hectare
hCG	Human chorionic gonadotrophin
IM	Intra-muscular
IU	International units
kg	Kilogram
km	Kilometer
L	Low feeding or pasture allowance level
LH	Luteinizing hormone
LSM	Least squares mean
M	Maintenance
MA (>2)	Mixed age ewes

MCR	Metabolic clearance rate
ME	Metabolizable energy
mg	Milligram
MJME	Mega joules of metabolizable energy
ml	Milliliter
m^2	Square meters
n	Number
NA	Non-applicable
ng	Nanogram
NP	Non-pregnant
OM	Organic matter
OMD	Organic matter digestibility
OR	Ovulation rate
P	Pregnant
P-1	Period I
P-2	Period II
PGF 2α	Prostaglandin F 2α
PMSG	Pregnant mare serum gonadotrophin
ppm	Parts per million
SC	Sub-cutaneous
SEM	Standard error of the mean
2T (2)	Two-tooth ewes
ug	Micrograms
ul	Microliter
wt	Weight