PMSG RESPONSE IN EWES OF DIFFERENT BREEDING VALUE FOR
REPRODUCTIVE RATE AS AN AID TO SELECTION

L.G. BUTLER** and W.M.C. MAXWELL**

SUMMARY

One hundred and fifty ewes with lifetime records of ovulation rate and
lambing were divided into two groups on the basis of age, live weight and
reproduction index (calculated from reproductive performance data). Both groups
were synchronised in oestrus with progestagen sponges inserted for 14 days. At
sponge removal one group received no PMSG while the other group received 400
i.u. PMSG. Eight days after sponge removal, the ovaries of all ewes were
examined at laparoscopy.

Ovulation rate increased from 2.04 eggs shed per ewe ovulating in the
control group to 3.00 due to PMSG (P <0.001). There was a positive
relationship between ovulation rate and reproduction index (r = 0.18) but there
was no index x PMSG treatment interaction. Although this work does not support
the hypothesis that, within a flock, ewes of higher breeding value for
reproductive rate respond more to PMSG treatment than ewes of low breeding
value, further work with larger numbers of animals is needed.

Keywords: ovulation rate, PMSG, selection, reproductive rate

INTRODUCTION

There is evidence reviewed by Bindon (1984) that ewes of high breeding
value (genetic merit) for reproductive rate have a higher ovulatory response
to PMSG than ewes of low breeding value. Bindon et al. (1971) and Trounson and
Moore (1972) respectively found that the mean ovulatory response to PMSG of
Trangie 'High Fertility' ewes was 300% and 50% greater than that of ewes'
selected against multiple births. This evidence had been derived from
established flocks exhibiting a high reproductive rate as a result of selection
for this trait (Booroola, Trangie 'High Fertility, Romney High Fertility). This
genic association between prolificacy and sensitivity to PMSG has also been
oted in the Finn and D'Man breeds of sheep, and in mice and cattle (Bindon
1984).

Responsiveness to PMSG could be a valuable tool in a selection program
aimed at increasing reproductive rate, if the ovaries of ewes of high breeding
value for reproductive rate are most responsive to PMSG. That is, if in
comparison with ewes of low breeding value, ewes of higher breeding value for
reproductive rate were distinguished by expressing higher ovulation rates. under 
PMSG stimulation, then accuracy of selection would be increased. In effect this
procedure could increase the realised heritability of reproductive rate and
consequently the rate of genetic progress achieved. Any means of increasing 'the'
rate of genetic progress in reproductive rate would benefit the sheep industry.

This hypothesis has not been tested in a flock which has not been highly
selected for reproductive rate over many generations. The present experiment was
designed to determine the magnitude of response in ovulation rate following
treatment with PMSG of ewes of differing breeding value for reproductive rate .

* Animal Breeding and Research Institute, Katanning, W.A. 6317.
** Present Address: Dept. of Agriculture, P.O. Box 180, Launceston, Tas. 7250.
** Present Address: Dept. of Agriculture, P.O. Box 1671, Adelaide, S.A. 5001.
MATERIALS AND METHOD

Sheep

Ewes of mean live weight 59.5 kg (S.E.M. = 0.55 kg) and mean condition score 3.4 (S.E.M. = 0.07) with records of pedigree, annual ovulation, and lifetime reproduction were available from the Katanning Animal Breeding and Research Institute Fertility Flock (Butler and Morrow 1984). This flock had been selected and bred for reproductive rate (assessed by ovulation rate) for only 6 years from 1980 using ovulation rate as the major selection criterion. Most ewes were 6 years old and were the progeny of ewes initially screened into the flock and sired by unselected rams.

Design

Ewes were ranked on an index for reproductive performance by the method of Turner (1968). This method took account of the number of lamblings and the heritability and repeatability of lambs born. Effectively the ranking gave an index of 100 to a ewe which averaged one lamb per joining up to the age of observation. The ewes were then divided into two groups, A and B, balanced by using stratified lists for index, age, and liveweight.

Management

On February 18, 1986 progestagen sponges were inserted and removed 14 days later. At sponge removal, ewes in group A were injected with 400 i.u. PMSG and the ewes in group B received no PMSG. The ewes were then joined with 10% teaser wethers. Eight days after sponge removal, the ovaries of all ewes were examined by laparoscopy and ovulation rate was recorded.

An assay of the PMSG batch in unselected Merino sheep at Katanning indicated that in autumn, 400 i.u. would give a mean ovulation rate of 3.5 (range 1 - 8).

Ewes were weighed and condition score estimated each week and at laparoscopy.

Statistical analysis

A logit regression model with binomial errors was fitted to the ovulation rate data. When index, treatment and index x treatment effects were adjusted for live weight and live weight change, there was no effect and so live weight differences were ignored.

RESULTS...

During the 22 days of the experiment, average live weight and condition score decreased from 59.5 kg to 52.4 kg and from 3.41 to 3.28 respectively.

The regression of ovulation rate on index was significant (P < 0.05) for the data for PMSG treated and non-treated sheep combined (r = 0.18) and for the data for the non-treated, sheep alone (r = 0.29). These regressions suggest that the index was effective in identifying ewes of different genotype for ovulation rate.

The contingency table (Table 1) shows the number of animals in each cell for ovulation-rate x PMSG treatment x index range and the average ovulation rate for each index range. The analysis showed that ovulation rate increased
from 2.04 (S.E.M. = 0.09) eggs shed per ewe ovulating in the untreated group to
3.00 (S.E.M. = 0.17) due to PMSG treatment (P < 0.001). There was no effect on
response to PMSG due to index x treatment interaction.

Table 1 Number of animals in each cell (index range x PMSG treatment x
ovulation rate) and average ovulation rate for PMSG treatment x index
range.

<table>
<thead>
<tr>
<th>Ovulation rate</th>
<th>PMSG treatment (i.u.)</th>
<th>Index range</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;113</td>
<td>113 to 123</td>
<td>133 to 143</td>
</tr>
<tr>
<td>1</td>
<td>400</td>
<td>6 3 3 0</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>7 14 10 13 4</td>
<td>48</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>1 1 3 2 2 1</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0 0 1 1 0 2</td>
<td>2</td>
</tr>
<tr>
<td>&gt;4</td>
<td>0</td>
<td>0 0 0 0 1 0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>400</td>
<td>9 21 17 19 7</td>
<td>73</td>
</tr>
</tbody>
</table>

Mean ova(ion rate 400 (0.15) (0.12) (0.19) (0.19) (0.42) (0.09)
(SEM) (0.34) (0.26) (0.36) (0.42) (0.43) (0.17)

DISCUSSION

These data do not support the hypothesis that, within a flock, individual
animals of different estimated breeding value for reproductive rate vary in
their response to PMSG. It seems unlikely that the 12% and 4% reduction in live
weight and condition score respectively would be entirely responsible for the
lack of interaction of index with response to PMSG, because these reductions
would be expected to result in a depression of about 0.1 eggs shed per ewe
ovulating (Lindsay et al. 1975).

The mean ovulation rate of the PMSG treated group (3.0) was lower than we
expected (3.5). Therefore it is possible that greater stimulation of the
ovaries of higher index ewes if treated with a higher dose of PMSG may have
increased the proportion of ewes with high ovulation rates, sufficiently to
generate a significant difference. In this respect, a sensitivity analysis of
the contingency table suggested that, in order to achieve significance with 150
ewes, 90% of high index ewes would have had to exhibit 4 or more ovulations
under PMSG stimulation, compared to only 10% of untreated ewes.

Further work is required to elucidate the hypothesis:
ACKNOWLEDGMENTS

We are indebted to Dr G. Hood and Mr J. Hunton for assistance with the laparoscopies and to Mrs J. Speijers for statistical assistance.

REFERENCES


