A STUDY OF REPRODUCTIVE WASTAGE AMONG COMMERCIAL SHEEP FLOCKS GRAZING NON-OESTROGENIC PASTURES IN SOUTH WESTERN AUSTRALIA

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Summary

Reproductive wastage was investigated over two seasons among sheep grazing non-oestrogenic pastures. The results show that approximately 25 percent of the ewes were not cycling when the rams were joined. Ovulation rates were consistently low, averaging 1.09, and fertilization rates consistently high, averaging 93 percent. Embryonic mortality varied widely between properties and years, but averaged 22 percent. The likely gains in ewe fertility as a result of minimising each wastage parameter are discussed.

I. INTRODUCTION

Recent extensive "on farm" studies in south Western Australia have shown that ewes which mate but fail to lamb represent a major cause of infertility (Knight et al., 1975b) and that ovulation rates are low (Lindsay et al., 1975). Despite this advance, information was lacking on the reasons why ewes fail to conceive and the extent to which non-oestrogenic pastures are involved. The work reported here, together with a concurrent study by Wroth and Lightfoot (1976), was conducted to investigate these aspects.

II. MATERIALS AND METHODS

Seven properties with Merino flocks that had never grazed oestrogenic subterranean clover were selected in an area of the eastern wheatbelt (305 mm mean annual rainfall) centred 260 km east of Perth for study in the 1971 season. Five of these flocks were studied again in 1972. The numbers of ewes studied on each property were: property 1 - 399, 403; 2 - 395, 386; 3 - 313; 4 - 379, 181; 5 - 399, 420; 6 - 396, 245; 7 - 399 for 1971 and 1972 respectively. Ideally, half of each flock were 2% year old ewes (young ewes) while the rest were the oldest after normal age culling (old ewes). However, young ewes could not be included on property 1 in 1971, nor on properties 2 and 5 in 1972. On each property the ewes were individually ear tagged and joined as one flock on cereal stubbles to rams fitted with Sire Sine harnesses for a six week period. Apart from property 1 where joining commenced in early December, all other properties joined between mid February and early March. Ram percentages varied between 2 and 4 percent. The mean number of ewes examined by laparotomy for estimations of ovulation and fertilization was 36 ± 3 (SE) per property per year. The procedures followed were identical to those described by Wroth and Lightfoot (1976).

III. RESULTS

The data collected from each flock are summarised in Table 1. In each year the number of ewes served by day 16 of joining was significantly less (P < .001) than the 94% expected if all ewes had commenced regular cyclic oestrus activity. However, most ewes were served by day 28 of joining.

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Apart from property 7 in 1971, ovulation rates measured during the first 16 days of joining were consistently low. There were no significant effects of age or year on ovulation rate.

Fertilization rates, calculated on a ewe basis, ranged from 83 to 100 percent with no significant effects of age or year. Ewes served on day 5, however, tended to yield lower fertilization rates than those served on day 12 (89 ± 94%, P = 0.1). Overall the proportions of fertilized ova with either 0, 1-5, 6-25, 26-100 or >100 sperm attached were 2, 8, 31, 27 and 33 percent respectively. Young and old ewes did not differ in this respect.

The estimates of embryo mortality (loss of pregnancy on a ewe basis) varied widely between properties and years. Young ewes tended to have higher rates of embryo mortality than old ewes (30 ± 3% v 22 ± 3%), but the differences failed to achieve statistical significance.

Less ewes lambed (P < 0.01) to first service during days 1-4 of joining (61 ± 4%) than between days 5-11 (74 ± 2%) and days 12-17 (74 ± 3%). Lambing to service from days 17 to 42 were 84 ± 2 and 75 ± 2 percent for ewes not served previously and returns to first cycle service respectively.

IV. DISCUSSION

The study has quantitated a number of areas of wastage that limit flock fertility. These are the low proportion of ewes served in the first cycle of joining, low ovulation rates, sub-maximal ewe fertilization rates and high levels of embryonic mortality. In an attempt to rank these areas of wastage as to their level of importance a model was constructed and a series of calculations performed in which the effects of each wastage parameter was minimised in turn. In the model the proportions of ewes lambing from service during days 1-16, 17-42 and returns to service were calculated by multiplying the percent ewes served in each category by the ewe fertilization rate and the embryo survival rate (100 - % embryonic mortality). In the calculations it was assumed that either (i) percent ewes served during days 1-16 = 94, (ii) percent ewes fertilized = 100, or (iii) percent embryonic mortality = 0. The results of these calculations predicted likely increases in the proportions of ewes lambing of 4, 2 and 10 percent for each of the above situations respectively. These comparatively small gains indicated that although measured levels of wastage can seem high their contribution to the final lambing percentage is reduced because most ewes have one or more chances to return to service should they fail to conceive early in the joining period. Most improvement in ewe lambing rate could come from reducing embryo mortality in zero but in practice, this potential is reduced as a significant proportion of the total embryonic losses may be caused by unavoidable genetic anomalies (Bishop 1964).

The low ovulation rate found both here and in other studies (Lindsay et al. 1975; Wroth and Lightfoot 1976) is an area where major gains in fertility seem possible. The data of Lindsay et al. (1975) suggest that for every 10 percent increase in ovulation rate about six extra lambs are born. Extrapolation of the data presented by Lightfoot and Marshall (1975) suggests a similar relationship. Thus, an increase in ovulation rate from 1.09 (as reported here) to say 1.40, such as has been achieved by feeding lupin grain (Lightfoot and Marshall 1974, 1975; Marshall and Lightfoot 1974; Knight, Oldham and Lindsay 1975), should result in 11 more ewes lambing and 18 extra lambs per 100 ewes joined.
<table>
<thead>
<tr>
<th>Property</th>
<th>Per cent of all ewes served by day</th>
<th>% ewes returning to service*</th>
<th>Ovulation rate**</th>
<th>% ewes fertilized***</th>
<th>% embryonic mortality†</th>
<th>% ewes lambing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16 28</td>
<td>1.04 1.03</td>
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<tr>
<td>2</td>
<td>57 78</td>
<td>86 88</td>
<td>99 93</td>
<td>16 28</td>
<td>1.04 1.03</td>
<td>95 89</td>
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<tr>
<td>3</td>
<td>76 90</td>
<td>90 93</td>
<td>24</td>
<td>1.05 93</td>
<td>31 83</td>
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<tr>
<td>4</td>
<td>75 33</td>
<td>88 91</td>
<td>90 95</td>
<td>22 20</td>
<td>1.08 1.08</td>
<td>100 100</td>
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<tr>
<td>5</td>
<td>91 79</td>
<td>100 93</td>
<td>100 97</td>
<td>12 16</td>
<td>1.09 1.22</td>
<td>89 91</td>
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<tr>
<td>6</td>
<td>75 73</td>
<td>97 93</td>
<td>99 94</td>
<td>18 15</td>
<td>1.02 1.10</td>
<td>98 94</td>
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<tr>
<td>7</td>
<td>69 92</td>
<td>92 96</td>
<td>12</td>
<td>1.31 83</td>
<td>6 91</td>
<td></td>
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<td>All properties (Means ± SE)</td>
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<tr>
<td>Young ewes</td>
<td>74±3 52±12</td>
<td>94±1 85±3</td>
<td>97±1 90±2</td>
<td>21±3 22±2</td>
<td>1.08 1.00</td>
<td>96±2 96±3</td>
</tr>
<tr>
<td>Old ewes</td>
<td>73±4 67±8</td>
<td>93±2 92±1</td>
<td>96±1 95±1</td>
<td>18±3 21±3</td>
<td>1.10 1.11</td>
<td>92±3 94±2</td>
</tr>
<tr>
<td>All ewes (1971 &amp; 1972)</td>
<td>69±4</td>
<td>92±1</td>
<td>95±1</td>
<td>19±2</td>
<td>1.09±.02</td>
<td>93±2</td>
</tr>
</tbody>
</table>

* To service days 1-16
** No. of corpora lutea/No. of ewes examined
*** 100 (No. ewes yielding fertilized ova/No. ewes yielding ova)
† 100 (% ewes fertilized - % ewes lambing to service days 1 to 16)/% ewes fertilized
A feature of this, and the concurrent study of Wroth and Lightfoot (1976), was the variation in fertility within the first 16 days of joining. The relative infertility was confined to ewes served in the first week and in this respect differed to the finding of Knight et al. (1975a) who reported reduced fertility during the first 14 days of joining.

Despite high ambient temperatures during joining (mean maximum for Dec., Jan., Feb. and Mar. were 32, 34, 33 and 30°C respectively) ram fertility did not appear to be a problem in the flocks studied. Fertilization rates were high and most fertilized eggs had large numbers of sperm attached.

In conclusion, substantial gains in fertility in the environment under study appear more likely to result from increases in ovulation rate than from reducing the other sources of wastage discussed above. It is therefore the authors' view that future research programmes should be planned accordingly.

v. ACKNOWLEDGMENTS

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VI. REFERENCES


