New Zealand Society of Animal Production online archive

This paper is from the New Zealand Society for Animal Production online archive. NZSAP holds a regular annual conference in June or July each year for the presentation of technical and applied topics in animal production. NZSAP plays an important role as a forum fostering research in all areas of animal production including production systems, nutrition, meat science, animal welfare, wool science, animal breeding and genetics.

An invitation is extended to all those involved in the field of animal production to apply for membership of the New Zealand Society of Animal Production at our website www.nzsap.org.nz

The New Zealand Society of Animal Production in publishing the conference proceedings is engaged in disseminating information, not rendering professional advice or services. The views expressed herein do not necessarily represent the views of the New Zealand Society of Animal Production and the New Zealand Society of Animal Production expressly disclaims any form of liability with respect to anything done or omitted to be done in reliance upon the contents of these proceedings.

This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.

You are free to:

Share — copy and redistribute the material in any medium or format

Under the following terms:

Attribution — You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.

NonCommercial — You may not use the material for commercial purposes.

NoDerivatives — If you remix, transform, or build upon the material, you may not distribute the modified material.

http://creativecommons.org.nz/licences/licences-explained/
A modelling study of the productivity and profitability of unmated and mated ewes on North Island hill country

W.J. PARKER, D.I. GRAY, S.T. MORRIS\(^1\) AND S.N. McCUTCHEON\(^1\)

Department of Agricultural and Horticultural Systems Management, Massey University, Palmerston North, New Zealand.

**ABSTRACT**

Feed intake and wool production data on unmated, single- and twin-bearing/rearing ewes from a year-long field trial were incorporated into feed budget models of a hill country farm. Increasing the basal liveweight of an unmated ewe from an average of 45 to 55 kg increased greasy wool production from 4.15 to 5.10 kg/ewe. Relative to the annual feed requirements (614 kg DM/ewe) of a typical breeding ewe (1 sheep stock unit (ssu) on the case farm, the annual feed requirements of unmated 45, 50 and 55 kg ewes were estimated to be 0.58, 0.66 and 0.72 ssu. At 1991 costs and prices the gross margins (GM) were $15.50/ewe for breeding ewes (100% lambs weaned) and, depending on liveweight, from $7.12 to $8.11/ssu for the all-wool options. The breeding ewe policy remained more profitable even if low lamb prices or a poor lambing percentage were achieved.

**Keywords**: Feed budget model, wool production, unmated ewes, hill country, profitability.

**INTRODUCTION**

High wool prices compared to returns from lambs during the period 1985-1990 created a demand for information on the profitability of all-wool systems and generated a need for improved data on feed intake and wool production of unmated ewes relative to that of pregnant/lactating ewes. The evaluation of all-wool policies can be undertaken using farm feed budget models which quantify the temporal relationship between feed supply (pasture production) and animal feed demand, in conjunction with a financial analysis such as gross margins (GM). This approach is less expensive than carrying out farmlet studies, but depends on the availability of data which quantify relationships between inputs and outputs in the farm system. The present study compared unmated and breeding ewe policies (for crossbred ewes) by generating experimental data not previously available in the literature (Parker et al. 1991) and, as described in this paper, incorporating these findings into a model for a lower North Island hill country farm.

**METHODS**

**Feed budget models**

A simulation model (all-wool) was developed to investigate the effect of liveweight (LW) on the feed requirements and wool production of unmated ewes. This model was a modification of the McCall (1984) sheep farm model which had been adapted to a spreadsheet (VP Planner Plus) format by Gray (1987) to study hill country breeding ewe policies. Model outputs (monthly and per annum) included pasture cover, ewe LW and liveweight change (LWC), and ewe fleeceweight and wool growth rate (on a greasy and clean basis). Clean wool yield, which could be varied each month, was set at 70%. Feed requirements for unmated ewes (Table 1) were developed with the all-wool model from the associated field study (Parker et al. 1991) and the data of Rattray (1986) for fleecefree LWs of 45, 50 and 55 kg on July 1. For each LW the opening (July 1 19XX) and the closing (June 30 19(XX+1)) pasture covers were set at 1,500 kg DM/ha, and within year upper and lower pasture cover bounds were set at 2,700 and 700 kg DM/ha, respectively. Ewes were shorn twice-yearly in October and March. Replacements were purchased in October (as wet dry ewes from breeding flocks) and in February (as cast for age ewes) to maintain a fixed monthly number of ewes. Ewe intakes were altered to match pasture supply with feed demand within the specified pasture cover bounds, but were constrained to be a maximum of 3.5% of LW at the beginning of each month and to achieve no net change in LW by the end of the year. The feed intake data was transferred to a spreadsheet (Multiplan) "farm" model of feed supply (kg DM/ha) and feed requirements (kg DM/hd; Table 1) to study the effect of alternative all-wool policies on a case study property. Flock replacement feed requirements were derived by Gray (1987) for a 20 kg ewe lamb at weaning reaching 55 kg by two tooth mating.

**Case study farm**

Massey University’s hill country sheep farm, Tuapaka, was used as a case study property. The farm comprises 341 effective hectares of easy to steep hill land and is typical of lower North Island summer moist hill country. Net herbage accumulation averages 7,184 kg DM/ha/y (Table 1). The annual rainfall average is 1,132 mm. Pasture and animal performance data have been recorded since 1981.

A feed budget of the sheep and cattle policy at Tuapaka, simplified to monthly data inputs, was prepared using the farm model. Winter stock numbers included 2,350 ewes, 605 ewe hoggets, 42 other sheep, and 145 yearlings and 40 rising two-year Friesian bulls. This represented 3,588 su (10.5 su/eff. ha), and a 22% cattle to sheep ratio. Ewes lambed from early-September and weaned 100% lambs in late December. Except for 650 ewe replacements all lambs were sold as stores (woolly) at weaning. The bulls, purchased as weaners in November, were sold at 18 months (two thirds) and 30 months of age. Other details of sheep...
TABLE 1 Monthly feed requirements (kg DM/hd/d) of unmated and single- and twin-bearing/rearing ewes and flock replacements, and net herbage accumulation rates (NHA; kg DM/ha/d) for the Tuapaka hill country farm.

<table>
<thead>
<tr>
<th>Ewe classes</th>
<th>Unmated 45kg</th>
<th>50kg</th>
<th>55kg</th>
<th>Single (55 kg)</th>
<th>Twin (55 kg)</th>
<th>Flock replacements</th>
<th>Lamb</th>
<th>Hogget</th>
<th>NHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jul</td>
<td>0.7</td>
<td>0.8</td>
<td>0.8</td>
<td>1.0</td>
<td>1.1</td>
<td>1.0</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aug</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td>1.1</td>
<td>1.2</td>
<td>1.3</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sep</td>
<td>1.0</td>
<td>1.4</td>
<td>1.6</td>
<td>2.5</td>
<td>2.6</td>
<td>1.6</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oct</td>
<td>1.2</td>
<td>1.8</td>
<td>2.0</td>
<td>2.8</td>
<td>3.0</td>
<td>2.0</td>
<td>28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nov</td>
<td>1.4</td>
<td>1.4</td>
<td>1.9</td>
<td>2.7</td>
<td>2.9</td>
<td>2.1</td>
<td>43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dec</td>
<td>1.1</td>
<td>1.1</td>
<td>1.5</td>
<td>2.3</td>
<td>2.4</td>
<td>2.4</td>
<td>31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jan</td>
<td>1.0</td>
<td>1.0</td>
<td>1.2</td>
<td>1.5</td>
<td>1.5</td>
<td>1.0</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feb</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.2</td>
<td>1.2</td>
<td>1.1</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mar</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.5</td>
<td>1.5</td>
<td>1.3</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apr</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td>1.7</td>
<td>1.7</td>
<td>1.4</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>0.8</td>
<td>0.8</td>
<td>0.9</td>
<td>1.0</td>
<td>1.0</td>
<td>1.5</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jun</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual</td>
<td>359</td>
<td>408</td>
<td>441</td>
<td>603</td>
<td>630</td>
<td>7184</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a Derived from Parker et al. (1991); Ratnay (1986) and Gray (1987).
b Derived by Gray (1987) for a 20 kg lamb reaching 55 kg at two tooth mating.

RESULTS AND DISCUSSION

The fleece-tree LW profiles for the unmated ewe policies are presented in Fig. 1. Ewe LW increased rapidly from September to December in a pattern similar to that recorded in the field trial (Parker et al. 1991) and decreased through the late summer-winter period as feed intakes were reduced to a maintenance (or lower) level to transfer pasture forward to the late winter. The end-of-year fleece-free LW was within 0.5 kg of the basal LW for each LW option. Wool production (greasy) was predicted to be 5.10, 4.13 and 4.15 kg for the 45, 50 and 55 kg LW ewes, respectively. Thus, for these LW profiles, increased wool production by heavier ewes could be compensated for by running lighter ewes with lower wool production at a higher stocking rate.

The difference in annual wool production of unmated and mated 55 kg ewes of 6% compares with a 6 and 12% difference in wool weights between dry and single- and twin-rearing ewes of similar LW recorded by Sumner and McCall (1989). The need to reduce LW over the winter months, to prevent excessive accumulation of body condition, restricted the opportunity to maximise wool growth during the period when unmated ewes have their greatest advantage over pregnant ewes (Sumner and Squire 1989, Sumner and McCall 1989, Parker et al. 1991). In addition the greater average age of the unmated flock (due to the purchase of wet dry and cast-for-age ewes as replacements) limits the wool production advantage of unmated ewes (Sumner and Squire 1989) and the flexibility to revert to a breeding policy. The production targets for the bull beef policy, which generated more than twice the returns of either of the sheep systems, restricted the 1 July level of pasture cover to around 1,500 kg DM/ha. Annual feed consumption, rounded to monthly intervals, was 441, 408 and 359 kg DM/ewe for the 45, 50 and 55 kg ewes, respectively (i.e. 0.72, 0.66 and 0.58 of the annual feed requirement estimate of 614 kg DM for a typical ewe in the Tuapaka flock weaning 100% lambs). These estimates are similar to those of Coop (1965) of 594 kg DM/ewe for a 54 kg ewe weaning a single lamb at 14 weeks of age and 417 kg DM/ewe for a wether (a proxy for an unmated ewe) of a similar live weight (i.e. 0.70 ssu). Sumner and Squire (1989) estimated lower annual requirements of 520 kg DM/ewe for a 55 kg breeding ewe rearing a single lamb to weaning at 12
at 12 weeks, and 3.45 kg DM/y (i.e. 0.66 ssu) for an unmated ewe of the same weight.

The simulated monthly pasture cover for the Tuapaka breeding ewe and bull system and the 50 kg ewe all-wool policy are shown in Fig. 2. Unmated ewes were increased to a fixed monthly number of 3,950, 4,270 or 4,850 depending on the ewe size selected (55, 50 or 45 kg), or 1.68 to 2.06 the number of breeding ewes (2,350).

Within-year changes in monthly pasture cover for each all-wool policy were similar to those predicted for the breeding ewe system. The total feed consumption by the all-wool ewe policies (ewe numbers x kg DM/ewe/y = 1.74 x 106 kg DM) was equivalent to an annual average feed intake by the 2,350 breeding ewes plus their replacements of c. 740 kg/DM/y.

The GM for the breeding ewe policy was $15.50/ssu, while those for the all-wool policies were: $8.11/ssu (55 kg; $5.84/ewe); $7.95/ssu (50 kg; $5.25/ewe) and $7.12/ssu (45 kg; $4.13/ewe). Capital requirements for sheep wintered, which reflected ewe LW (Table 2), were $52,523 for the breeding ewe policy and $59,250 (55 kg), $55,510 (50 kg) or $53,350 (45 kg) for the all-wool policies. The minimum opportunity cost of an all-wool policy at Tuapaka in 1991 was $7.39/ssu or $20,499 for the 2,774 breeding ewe and ewe hogget su on the farm. Lamb returns could fall to $2.70/hd (at 100% lambs weaned) or lambs weaned to 39% (at $15/lamb) before the returns from the 55 kg ewe all-wool policy were equivalent to those from the breeding flock. These returns indicate that a higher stocking rate all-wool system with lower pasture cover levels (i.e. without bull beef) and greater within-year variation in LW would not improve overall farm returns. Some small savings for casual labour may be realised with the all-wool options (e.g. no docking), but no change in the cost of permanent staff would be achieved on the case farm.

The ratio between unmated ewes and a breeding ewe plus her replacement is dependent on ewe LW (which is a function of stocking rate), the flock replacement rate and the management system adopted (e.g. an earlier lambing date with the same December 1 weaning date, or the retention of lambs for finishing would both increase annual feed demand of the breeding policy relative to that of unmated ewes). It is therefore difficult to provide a common set of conversion factors for farmers considering a change to an all-wool system, and a farm feed budget should be prepared to assess the change in ewe numbers for each situation. The feed intake data presented here can be used for this purpose, and local costs and price data can then be used to derive comparative GMs. All-wool farming of Romney ewes on the case farm would be less profitable, and more exposed to price risk because of a larger dependence on wool prices, than breeding ewes and might be considered only if sheep breeds with significant wool premiums (e.g. Drysdale and Merino) were farmed (Sumner and Squire 1989) or if permanent labour requirements were able to be reduced.

ACKNOWLEDGEMENT

Financial support for this research was provided by the New Zealand Wool Board.

REFERENCES


