FINNSHEEP IN FINLAND

Report on a two-month study tour in Finland, summer 1973

By

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December 1973
Lambing
Tagging and weighing lambs
Supplementary feeding
Weaning, castration, vaccination
Drenching and Dipping
Grazing
Shearing
Culling and selection
Fattening
Manure

MARKETING, PRICES AND PROFITABILITY
Meat
Wool
Feedstuff costs
Profitability

PRODUCTION RECORDING
Stud-Book
Sheep Improvement Programme
Progress

EXPORT OF FINNSHEEP

ACKNOWLEDGMENTS

REFERENCES AND PERSONAL COMMUNICATIONS
INTRODUCTION

Among the domestic ruminants, the sheep is the most efficient converter of feed into meat. Because overall efficiency of meat production (i.e., feed units required for dam's maintenance and for production of a kilogram of live weight in her offspring) under intensive systems depends primarily on the litter size, a sheep's potential for meat production is formidable: ten lambs per ewe per year (42). Perhaps less than 10% of the potential is at present developed!

With the rapid growth of the world's population and improved nutritional standards, the danger of too little food for too many mouths has arisen. Although the danger of hunger has been decreasing with the progress of agriculture and the "green revolution," the problem of malnutrition, particularly that due to shortage of animal proteins, is becoming very serious. The world is looking for additional sources of proteins: from rabbit to deer, from yeast grown on petroleum to meat substitutes.

Although sheep have traditionally been looked upon as wool rather than meat producers, some scientists and progressive farmers decided, during the last decade, to have another look at sheep as a meat producer. Around 1960, there was widespread discussion in Great Britain about the need for work on sheep fertility. There was also an official group, the Committee on Sheep Recording and Progeny Testing, which published a report in 1971 (11). During its deliberations there was some discussion on the benefit to be obtained from higher ewe fertility, and on the lack of research on the subject. Prof. H.P. Donald, Director of the Animal Breeding Research Organisation (ABRO), Edinburgh, Scotland, was a member of this Committee and ultimately responsible for importing the Finnsheep to Britain. He and some of his staff were keen to start such work, and that is where our story begins.

In the winter of 1961, Prof. Kalle Maijala, present Director of the Animal Breeding Department, Agricultural Research Centre, Tikkurila, Finland, spent two months at the Institute of Animal Genetics, University of Edinburgh. During a visit to ABRO, he mentioned the high fertility of the Finnsheep and his remarks aroused considerable interest.

On his return home he analyzed the production recording of the Finnish Sheep Breeders' Association (FSEA), and supplied the data to Dr. G. Wiener of ABRO. In summer 1962, Mr. J.L. Read, formerly of ABRO and at present Head, Sheep Improvement Services, Meat and Livestock Commission, Bletchley, came to Finland to select five Finnsheep ram-lambs and ten ewe-lambs, which were air-lifted to ABRO.

In 1966 Prof. K. Maijala delivered a paper "Causes of variation in litter size in Finnsheep ewes" (29) at the 9th International Congress of Animal Production, Edinburgh, and the first results of Finnsheep performance as purebreds and crossbreds in Scotland were published by Donald and Read in 1967 (12) and by Donald, Read and Russell in 1968 (13). However, even before these publications appeared, word of the Finnsheep's remarkable fertility reached several countries and since 1965 the Finnsheep have been the most sought after breed of sheep: 24 countries imported them directly from Finland, and others from Ireland and Great Britain.
During the summer of 1973, I spent two months at the Animal Breeding Department of the Agricultural Research Centre in Tikkurila, Finland, to study the Finnsheep in its native country. During that time I studied production recordings and the Stud-Book of FSBA in Helsinki, and journals and books with the help of a translator. I talked to a number of research workers, saw results of some of their unpublished work, and stayed on a number of sheep-breeding farms; I also visited the LSO meat works at Turku and the Wool Centre in Tampere.

As the literature on Finnsheep in English is very limited (30, 41) it was suggested that the information collected should be made available to others interested in this breed. For a broader description of agriculture in Finland, Maijala’s work (30) should be consulted.

**TERMINOLOGY AND ABBREVIATIONS**

- **ewe-lamb** = less than one year old, but particularly at tupping – 6-9 months old.
- **ewe-hogget** = less than two years old, but particularly at lambing – 12-14 months old.
- **ewe** = two or more years old.
- **A** = monthly mean temperature
- **B** = means of monthly absolute maximum temperature
- **b** = means of monthly absolute minimum temperature
- **FM** = Finnish Mark
- **F.U.** = Scandinavian feed unit
- **FSBA** = Finnish Sheep Breeders’ Association
- **FSPR** = Finnish Sheep Production Recording
- **K** = weight or size of sheep in FSPR
- **Kt** = weight of litter in FSPR
- **M** = means of daily maximum temperature
- **m** = means of daily minimum temperature
- **P** = average precipitation per month, in mm
- **R** = conformation in FSPR
- **S** = fertility or litter size in FSPR
- **SIP** = Sheep Improvement Programme
- **V** = wool in FSPR
ECONOMIC BACKGROUND

Finland, with her 337,034 km\(^2\), is as big as Italy, and her population of over 4.6 million, or 15.1 inhabitants per km\(^2\) of land, is evenly divided into urban (51\%) and rural (49\%) population. Out of 2.2 million employed persons in 1970, 20.3\% were working in agriculture and forestry, 25.0\% in industry, and 15.5\% in trade. However, agriculture and forestry accounted for only 11.9\% of the net national products in 1972 (10).

The farmland consists of 15,150,200 ha, classified as follows (10):

<table>
<thead>
<tr>
<th>Type</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gardens</td>
<td>0.1</td>
</tr>
<tr>
<td>Arable land</td>
<td>17.6</td>
</tr>
<tr>
<td>Meadows</td>
<td>0.5</td>
</tr>
<tr>
<td>Improved pasture</td>
<td>0.5</td>
</tr>
<tr>
<td>Forest land</td>
<td>64.7</td>
</tr>
<tr>
<td>Waste land</td>
<td>15.5</td>
</tr>
<tr>
<td>Plots, etc.</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Excluding 'gardens' and 'plots, etc.', distribution according to size, of the type of land farmed, is given in Table 1. Between 1959 and 1969 the number of farms decreased by 34,000; during the same period, the proportion of farms with up to 10 ha of arable land was reduced from 75\% to 68\%, and that of farms with more than 10 ha increased from 25\% to 32\% (10). The type of land farmed was also calculated (Table 2), to give a fuller picture of the grazing potential.

The area and yields of field crops are given in Table 3. The main crop is hay (30\%), followed by oats and barley. The tendency is to grow less hay and more grain — barley, in particular. In 1959, nearly 44\% of the arable land was used for hay and 35\% for grains, whereas in 1972 the proportion was 30\% and 49\%, respectively, and barley fields increased from 9\% to 19\%. There was also a substantial increase in yields since 1959: barley from 1.42 to 2.45, oats from 1.51 to 2.49, and hay from 2.88 to 3.57 tons per ha.

The number of farm animals is given in Table 4. In comparison with 1959 (30) the number of horses, sheep and cattle decreased and that of mink, pigs and poultry increased. On the other hand, the proportion of farms keeping farm animals, except for pigs, decreased, even between 1969 and 1971 (Table 5). In 1971, nearly 31\% of all farms kept no farm animals at all (18).

An average of 80\% and 20\% of a farmer's income is derived from agriculture and forestry, respectively (30). In 1969, the average gross returns and farm expenses per ha (on book — keeping farms) were as follows (10):

<table>
<thead>
<tr>
<th>Farm income (1,934 FM)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>livestock</td>
<td>75.0</td>
</tr>
<tr>
<td>crops</td>
<td>17.9</td>
</tr>
<tr>
<td>other</td>
<td>7.1</td>
</tr>
</tbody>
</table>
Farm expenses (2,105 FM) %
fodder, fertilizers and seeds 23.7
buildings 10.9
implements 12.4
labor: wages 3.6
own labor 37.4
other 12.0

The production, consumption, export and import of meat are given in Table 6 (6). The per capita consumption, 31.5 kg in 1959, has been rising by over 1 kg per year, mostly through increased consumption of pork (by 9.5 kg), beef (by 5.8 kg), and poultry (by 1.3 kg).

The degree of self-sufficiency in 1972 was (6):

<table>
<thead>
<tr>
<th>Item</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>bread grains</td>
<td>114</td>
</tr>
<tr>
<td>dairy products</td>
<td>122</td>
</tr>
<tr>
<td>meat</td>
<td>111</td>
</tr>
<tr>
<td>eggs</td>
<td>147</td>
</tr>
<tr>
<td>sugar</td>
<td>29</td>
</tr>
</tbody>
</table>

In 1972, import amounted to 13,114 million FM and export to 12,082 million FM. Most of Finland's goods are imported from, and exported to, Western Europe; only about 16% of her trade, in both directions, is with Eastern Europe.

GEOGRAPHICAL DISTRIBUTION OF SHEEP

Fig. 1 shows the distribution of some 100,000 sheep in 1972 according to the 12 countries into which Finland is divided. It was prepared by Mr. E. Hautakangas, the Managing Director of FSBA, Helsinki. Generally, the highest concentration of sheep is in mid- and West Finland, followed by the north; the southeast area has a much smaller density. Sheep are also kept above the Arctic Circle, but their density may be somewhat reduced there, because it is difficult during the short summer to grow enough fodder for the long winter months (20, 24).

Climate

As there is a world-wide demand for Finnsheep (see Table 22), the question of adaptation under various climatic conditions is of paramount importance. As Finland is about 1,000 km long, lying between the latitudes 60° and 70°N., with about a third of its length beyond the Arctic Circle, the data selected (14, 15, 17) pertain to typical "sheep" areas: latitudes 64° - 65° for the north, 62° for mid-Finland and 60° for the south. Occasionally the data pertain to more than one locality per latitude:

* where 100% = no import - no export, and
114% = 14% surplus for export.
Fig. 1. Distribution of sheep in 12 counties of Finland in 1972 (p. 23).
Table 1. Distribution of farms and type of land farmed in 1969, according to size of farms (in 1,000 - ha)

<table>
<thead>
<tr>
<th>Size of farm (ha arable land)</th>
<th>No. of farms</th>
<th>Arable land</th>
<th>Meadows and improved pasture</th>
<th>Waste land</th>
<th>Forest</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 2</td>
<td>11.3</td>
<td>1.8</td>
<td>4.0</td>
<td>4.5</td>
<td>3.4</td>
<td>3.2</td>
</tr>
<tr>
<td>2 - 5</td>
<td>25.3</td>
<td>9.6</td>
<td>17.0</td>
<td>22.5</td>
<td>17.1</td>
<td>16.6</td>
</tr>
<tr>
<td>5 - 10</td>
<td>35.0</td>
<td>26.6</td>
<td>31.0</td>
<td>37.2</td>
<td>34.1</td>
<td>33.2</td>
</tr>
<tr>
<td>10 - 15</td>
<td>15.9</td>
<td>21.7</td>
<td>18.8</td>
<td>16.9</td>
<td>19.1</td>
<td>19.2</td>
</tr>
<tr>
<td>15 - 25</td>
<td>10.2</td>
<td>21.3</td>
<td>15.9</td>
<td>11.4</td>
<td>14.9</td>
<td>15.5</td>
</tr>
<tr>
<td>25 - 50</td>
<td>3.7</td>
<td>13.4</td>
<td>9.1</td>
<td>5.3</td>
<td>7.9</td>
<td>8.5</td>
</tr>
<tr>
<td>50 and over</td>
<td>0.6</td>
<td>5.6</td>
<td>4.1</td>
<td>2.2</td>
<td>3.6</td>
<td>3.8</td>
</tr>
<tr>
<td>Total</td>
<td>297,257</td>
<td>2,669.1</td>
<td>153.4</td>
<td>2,348.3</td>
<td>9,795.0</td>
<td>14,966.8</td>
</tr>
</tbody>
</table>

Table 2. Distribution of farms in 1969 according to type of land (all figures in hectares)

<table>
<thead>
<tr>
<th>Size of farm (ha arable land)</th>
<th>Arable land</th>
<th>Meadows and improved pasture</th>
<th>Waste land</th>
<th>Forest</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 2</td>
<td>1.4</td>
<td>0.2</td>
<td>3.1</td>
<td>9.8</td>
<td>14.5</td>
</tr>
<tr>
<td>2 - 5</td>
<td>3.4</td>
<td>0.4</td>
<td>7.0</td>
<td>22.2</td>
<td>33.0</td>
</tr>
<tr>
<td>5 - 10</td>
<td>7.3</td>
<td>0.5</td>
<td>8.9</td>
<td>34.1</td>
<td>50.8</td>
</tr>
<tr>
<td>10 - 15</td>
<td>12.2</td>
<td>0.6</td>
<td>8.4</td>
<td>39.5</td>
<td>60.7</td>
</tr>
<tr>
<td>15 - 25</td>
<td>18.8</td>
<td>0.8</td>
<td>8.8</td>
<td>48.2</td>
<td>76.6</td>
</tr>
<tr>
<td>25 - 50</td>
<td>32.5</td>
<td>1.3</td>
<td>11.2</td>
<td>69.9</td>
<td>114.9</td>
</tr>
<tr>
<td>50 and over</td>
<td>78.7</td>
<td>3.3</td>
<td>27.6</td>
<td>185.4</td>
<td>295.0</td>
</tr>
<tr>
<td>Average</td>
<td>9.0</td>
<td>0.5</td>
<td>7.9</td>
<td>33.0</td>
<td>50.4</td>
</tr>
</tbody>
</table>
Table 3. Area of field crops and average yields obtained in 1972

<table>
<thead>
<tr>
<th>Crop</th>
<th>Area (%)</th>
<th>Yield per ha (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>7.3</td>
<td>2,590</td>
</tr>
<tr>
<td>Rye</td>
<td>2.4</td>
<td>2,000</td>
</tr>
<tr>
<td>Barley</td>
<td>18.9</td>
<td>2,450</td>
</tr>
<tr>
<td>Oats</td>
<td>20.3</td>
<td>2,490</td>
</tr>
<tr>
<td>Potatoes</td>
<td>1.9</td>
<td>18,900*</td>
</tr>
<tr>
<td>Sugarbeet</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>Grassland for hay</td>
<td>29.8</td>
<td>3,570 (of hay)</td>
</tr>
<tr>
<td>Others</td>
<td>18.6</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>in 1,000 - ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivated area</td>
<td>2,463.7</td>
</tr>
<tr>
<td>Out of production</td>
<td>201.3</td>
</tr>
<tr>
<td>Total arable land</td>
<td>2,665.0</td>
</tr>
</tbody>
</table>

*1970

Table 4. Number of farm animals (in 1,000-head) on Dec. 15, 1972 (Data from refs. 6 and 14)

<table>
<thead>
<tr>
<th>Animal</th>
<th>Females of breeding age</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horses</td>
<td>10.7</td>
<td>52.2</td>
</tr>
<tr>
<td>Cattle</td>
<td>804.1</td>
<td>1,712.1</td>
</tr>
<tr>
<td>Sheep</td>
<td>99.9</td>
<td>99.9</td>
</tr>
<tr>
<td>Reindeer</td>
<td></td>
<td>236.0</td>
</tr>
<tr>
<td>Pigs</td>
<td>102.3</td>
<td>1,020.6</td>
</tr>
<tr>
<td>Poultry</td>
<td>6,349.4</td>
<td>6,961.8</td>
</tr>
<tr>
<td>Mink kids</td>
<td></td>
<td>3,050.0</td>
</tr>
</tbody>
</table>

* Including approximately 2.5-3.0% rams.
Table 5. Distribution of domestic animals on farms in 1969 and 1971 (15)

<table>
<thead>
<tr>
<th>Animal</th>
<th>1969 (%)</th>
<th>1971 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horses</td>
<td>31.8</td>
<td>20.2</td>
</tr>
<tr>
<td>Dairy cows</td>
<td>72.9</td>
<td>58.9</td>
</tr>
<tr>
<td>Sheep</td>
<td>7.9</td>
<td>5.1</td>
</tr>
<tr>
<td>Pigs</td>
<td>15.2</td>
<td>15.0</td>
</tr>
<tr>
<td>Poultry</td>
<td>29.9</td>
<td>20.4</td>
</tr>
<tr>
<td>Fur animals</td>
<td>1.1</td>
<td>0.5</td>
</tr>
<tr>
<td>None</td>
<td></td>
<td>30.8</td>
</tr>
</tbody>
</table>

Table 6. Production, consumption, export and import of meat in 1972

<table>
<thead>
<tr>
<th>Type of meat</th>
<th>Production (in million kg)</th>
<th>Consumption</th>
<th>Export</th>
<th>Import</th>
<th>Consumption per capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef and veal</td>
<td>106.5</td>
<td>101.8</td>
<td>6.0</td>
<td>1.3</td>
<td>22.0 45.9</td>
</tr>
<tr>
<td>Pork</td>
<td>127.5</td>
<td>107.6</td>
<td>20.0</td>
<td>0.1</td>
<td>23.3 48.6</td>
</tr>
<tr>
<td>Mutton and lamb</td>
<td></td>
<td>1.4</td>
<td>1.4</td>
<td>0.3</td>
<td>0.3 0.6</td>
</tr>
<tr>
<td>Poultry</td>
<td></td>
<td>6.9</td>
<td>6.9</td>
<td>1.5</td>
<td>1.5 3.1</td>
</tr>
<tr>
<td>Horse flesh</td>
<td></td>
<td>3.9</td>
<td>3.9</td>
<td>0.2</td>
<td>0.8 1.7</td>
</tr>
<tr>
<td>Reindeer meat</td>
<td>1.6</td>
<td>0.5</td>
<td>0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>326.5</td>
<td>213.8</td>
<td>34.2</td>
<td>2.3</td>
<td><strong>47.9</strong></td>
</tr>
</tbody>
</table>
The differences in temperature among these three latitudes were relatively small, and therefore Mikkeli was chosen as typical (Fig. 2). The differences between Mikkeli and Kajaani, in the north, were much smaller than between Mikkeli and Helsinki, in the south for A and m in November - March, and for b in all months; Helsinki’s temperatures were higher. However, sheep are housed in winter and therefore the difference in minimum air temperatures between localities is considered of secondary importance.

Summer temperatures can be relatively high; means of monthly absolute maximum temperatures (B) and absolute maximum temperature (a.m.t.) were as follows (°C):

<table>
<thead>
<tr>
<th>Locality</th>
<th>B</th>
<th>a.m.t.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June</td>
<td>July</td>
</tr>
<tr>
<td>Kajaani</td>
<td>26.3</td>
<td>27.6</td>
</tr>
<tr>
<td>Mikkeli</td>
<td>27.6</td>
<td>28.3</td>
</tr>
<tr>
<td>Helsinki</td>
<td>25.7</td>
<td>27.9</td>
</tr>
</tbody>
</table>

The means of annual absolute maximum (M) and minimum (m) temperature and the annual range are given below (°C):

<table>
<thead>
<tr>
<th>Locality</th>
<th>M</th>
<th>m</th>
<th>range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kajaani</td>
<td>28.6</td>
<td>-31.8</td>
<td>50.4</td>
</tr>
<tr>
<td>Mikkeli</td>
<td>29.1</td>
<td>-32.4</td>
<td>61.5</td>
</tr>
<tr>
<td>Helsinki</td>
<td>28.8</td>
<td>-23.7</td>
<td>52.5</td>
</tr>
</tbody>
</table>

The dates of the four seasons and the duration of the growing season are given in Tables 7 and 8.

Precipitation (Fig. 2) increases from north to south; the average precipitation for Kajaani, Mikkeli and Helsinki is 564,585 and 688 mm and the number of days with precipitation 0.1 mm is 116,118 and 199, respectively. The driest months
Fig. 2. Temperature and precipitation at Mikkeli, 61°40'N, 27°18'E, 107 m above sea level, 1931 - 1960.
Monthly mean temperature (A); Means of monthly absolute maximum (B) and minimum (m) temperatures; Means of daily maximum (M) and minimum (m) temperatures (15); Average precipitation (P) in mm/month (15).
are February, March and April, with 7-9 precipitation days each (17).

Relative humidity. Monthly relative humidity varies between 64 and 95% (18); examples are given in Table 9. During summer (June, July and August), out of 92 days there were 56 days with a relative humidity between 20 and 50%.

Day length was calculated from sunrise to sunset, as well as including civil twilight, for the 62°N (8), and is given in Fig. 3. If twilight is taken into account it will be seen that day length varies from 7.24 hours in mid-December to 24 hours in June and part of July.

Table 7. Onset and duration (in days) of thermal spring, summer, autumn and winter (14).

<table>
<thead>
<tr>
<th>Season</th>
<th>KAJAANI</th>
<th></th>
<th>MIKKELI</th>
<th></th>
<th>HELSINKI</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Date</td>
<td>Duration</td>
<td>Date</td>
<td>Duration</td>
<td>Date</td>
<td>Duration</td>
</tr>
<tr>
<td>Spring</td>
<td>14.IV</td>
<td>46</td>
<td>9.IV</td>
<td>45</td>
<td>4.IV</td>
<td>48</td>
</tr>
<tr>
<td>Autumn</td>
<td>8.IX</td>
<td>50</td>
<td>12.IX</td>
<td>57</td>
<td>21.IX</td>
<td>64</td>
</tr>
<tr>
<td>Winter</td>
<td>30.X</td>
<td>166</td>
<td>8.XI</td>
<td>151</td>
<td>24.XI</td>
<td>131</td>
</tr>
</tbody>
</table>

Table 8. Growing season and the sum of effective temperature, S (ref.16)

<table>
<thead>
<tr>
<th>Locality</th>
<th>From - To</th>
<th>Number of days</th>
<th>Mean temp. (°C)</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>KAJAANI</td>
<td>6.V - 2.X</td>
<td>149</td>
<td>11.9</td>
<td>1,033</td>
</tr>
<tr>
<td>MIKKELI</td>
<td>28.IV - 8.X</td>
<td>163</td>
<td>12.2</td>
<td>1,178</td>
</tr>
<tr>
<td>HELSINKI</td>
<td>27.IV - 18.X</td>
<td>174</td>
<td>12.6</td>
<td>1,324</td>
</tr>
</tbody>
</table>
Fig. 3. Day length at 62°N.
Table 9. Relative humidity at 14\textdegree{} hours in 1970 (ref. 18)

<table>
<thead>
<tr>
<th>Month</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan.</td>
<td>1</td>
<td>18</td>
<td>12</td>
<td>2</td>
<td>23</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feb.</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>11</td>
<td>3</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>March</td>
<td>8</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>14</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>13</td>
<td>7</td>
<td>12</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>July</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aug.</td>
<td>2</td>
<td>7</td>
<td>12</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sept.</td>
<td>6</td>
<td>5</td>
<td>8</td>
<td>4</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oct.</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>14</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nov.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>16</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Instead of Mikkeli.

**ORGANIZATION AND EXTENSION SERVICES**

The Finnish Ministry of Agriculture has no extension services (20), and the extension work is carried out by instructors employed by various agricultural associations. Thus, the sheep instructors are staff-members of FSEA, which has its head office in Helsinki.

The country is divided into seven sheep districts with a resident sheep instructor in each one. Her or his (at present, five out of the seven are females) main duties are: advising on professional matters, selection and culling of breeding stock, supervising recording, weighing, etc.

The head office in Helsinki keeps records, archives, pedigrees and the Stud Book; it publishes a quarterly, 'Lammastalous', deals with export of breeding stock, and buying and selling of stock on behalf of its members. Through its subsidiaries it sells wire netting for fencing and wool yarns for knitting, made from pure Finn-sheep wool. It also has its own experiment farm near Mikkeli with a flock of about 60 ewes, where experiments and trials on grazing, nutrition, meat, performance test-
ing and crossing are being conducted.

The governing body of FSBA is a Council consisting of a President and five to eight members chosen at the annual general meeting of the Association. The position of the Managing Director is permanent.

The Association receives an annual grant from the Ministry of Agriculture. The membership fee is at present 10 FM per member, irrespective of the flock size.

THE BREED

For all practical purposes there is only one breed in Finland: the Finn- sheep. The Rygja, imported in 1958 and 1959 (30) from Norway, did not make any headway; it gives nearly one lamb less per year than the Finnsheep. Very recently a few Texel and Suffolk rams were imported for crossing to improve fat-lamb carcasses. One farm is trying F₁, ⅛ Finn and ⅝ Texel ewes; another farm is using a Suffolk ram for fat-lamb production.

Origin

According to Inkovaara (22), the Finnsheep is descended from Mouflon, still living in the wild state on Sardinia and Corsica, and is related to other Scandinavian short-tailed sheep. Owen (35) quotes earlier writers who classified it as belonging to northern short-tail sheep 'whose ancestors were once widespread in Northern Europe'. He and Ryder (41) state that the Finnsheep is related to the Romanov of the USSR, but no work on such a relationship is known.

Development

At first, attempts were made to improve the native Finnish sheep by crossing with larger, and heavier-wooled foreign breeds. These trials were not successful and the breeders started to develop the native sheep.

Roughly speaking, there were two types of sheep in Finland: In the southwest there was a small, and often inbred, sheep; its mature weight was 20-40 kg, with 7-8-month-old lambs weighing 10-18 kg. In eastern Finland the local sheep were much bigger, the ewes weighing 40-50 kg, rams 50-70 kg, and 7-8-month-old lambs 25-30 kg. These sheep were taken as the foundation stock, and in the 1940s flocks around Kajaani were very much in vogue (22).

Description

Head: narrow, covered with hair; nose straight, although in the past some rams had a slightly Roman nose; ears: narrow and rather short, horizontal but often pointing upwards. Horns: usually polled, and some rams have knobs; legs: fine, covered with hair; tail: short, 10-12 vertebrae, and covered with hair; the tail is rather wide at its base but tapering towards its end (22). Color: white, some are black, occasionally gray, brown and even piebald. Black and gray sheep often have white spots on head and legs. Lambs black at birth often turn gray
later on (22). Some farmers keep black sheep as the lambs' black pelts are used for prams and car-seats (9). Black is recessive to white. In former days, grey wool for knitting sweaters was preferred to white (24).

Some of the ewes have four functional teats (31, 45).

The conformation is not of mutton type and the bones tend to be too fine, a point which has to be watched when selecting for heavy mature weight. The Finn-sheep is one of the most prolific, if not the most prolific, breeds; it matures sexually very early, is a relatively deep milker, hardy, and of friendly disposition.

**Flock structure**

In 1969 there were 23,491 sheep-keeping farms, or 7.9% of all farms. In 1971 the percentage dropped to 5.1 (Table 5). Comparative statistics for Tables 10 and 11 were available for 1969 only (14). The highest percentage of sheep-keeping farms was of those with five or more ha of arable land; approx. one in ten such farms kept sheep. The lowest percentage of sheep-keeping farms was those with 1-2 ha of arable land: 0.4 in ten such farms kept sheep. Three-quarters of all flocks were on farms with five or more ha of arable land. Flocks of 1-4 and 5-19 sheep were not very much influenced by the size of farms: 91% and 95%, respectively, were on farms with 2-25 ha of arable land. On the other hand, 93% of the flocks numbering 20 or more sheep were on farms with 5 to over 50 ha of arable land.

Out of 23,491 flocks in 1969, 85% comprised one to four fully grown sheep, 13.5% - 5-19, and 1.5% - 20 or more sheep. Their distribution according to farm size is given in Table 11. At present, there are about ten flocks with 100 or more breeding ewes, and the biggest flock has approximately 350 breeding ewes (20).

The flock structure is not pyramidal, like in Australia and New Zealand; most of the rams are selected from the best flocks, which number about 40 (20).

**Table 10. Percentage of farms keeping sheep, and flock distribution according to flock size and farm size in 1969 (ref. 14)**

<table>
<thead>
<tr>
<th>Size of farm (ha arable land)</th>
<th>Sheep-keeping farms</th>
<th>Fully-grown sheep</th>
<th>Total flocks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 - 4</td>
<td>5 - 19</td>
<td>20 and over</td>
</tr>
<tr>
<td>1 - 2</td>
<td>3.7</td>
<td>5.5</td>
<td>4.0</td>
</tr>
<tr>
<td>2 - 5</td>
<td>5.6</td>
<td>18.6</td>
<td>14.5</td>
</tr>
<tr>
<td>5 - 10</td>
<td>8.8</td>
<td>38.1</td>
<td>31.5</td>
</tr>
<tr>
<td>10 - 15</td>
<td>10.5</td>
<td>21.3</td>
<td>20.2</td>
</tr>
<tr>
<td>15 - 25</td>
<td>10.5</td>
<td>12.6</td>
<td>18.7</td>
</tr>
<tr>
<td>25 - 50</td>
<td>9.8</td>
<td>3.5</td>
<td>9.6</td>
</tr>
<tr>
<td>50 and over</td>
<td>9.4</td>
<td>0.4</td>
<td>1.6</td>
</tr>
<tr>
<td>Avg.</td>
<td>7.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Number of farms 23,491
Table 11. Size of flocks within a given farm size in 1969 (ref. 14)

<table>
<thead>
<tr>
<th>Farm size (ha arable land)</th>
<th>Fully-grown sheep</th>
<th>Number of flocks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 - 4</td>
<td>5 - 19</td>
</tr>
<tr>
<td>1 - 2</td>
<td>89.4</td>
<td>10.3</td>
</tr>
<tr>
<td>2 - 5</td>
<td>88.5</td>
<td>11.0</td>
</tr>
<tr>
<td>5 - 10</td>
<td>87.7</td>
<td>11.5</td>
</tr>
<tr>
<td>10 - 15</td>
<td>85.9</td>
<td>13.0</td>
</tr>
<tr>
<td>15 - 25</td>
<td>78.8</td>
<td>18.7</td>
</tr>
<tr>
<td>25 - 50</td>
<td>65.6</td>
<td>28.2</td>
</tr>
<tr>
<td>50 and over</td>
<td>47.2</td>
<td>28.0</td>
</tr>
<tr>
<td>Average</td>
<td>85.0</td>
<td>13.5</td>
</tr>
<tr>
<td>Total number of flocks</td>
<td>19,970</td>
<td>3,180</td>
</tr>
</tbody>
</table>

REPRODUCTION

Tupping season

There is very little information available on the sexual season in Finn- sheep and therefore tupping season will be defined as the time the farmer allows the rams to run with the ewes; generally September, October and November. Rams are withdrawn after 1 1/2 - 2 1/2 months. According to Inkovaara (22), the most suitable time for tupping is October - November, so that the lambs will be 1 1/2 months old at the beginning of the grazing season. Most of the tupping takes place indoors; no hand-service or artificial insemination is practised; some of the bigger flocks use crayons and tupping marks are recorded every day or two. About 90% of ewes are settled to the first mating (20, 22). Tupping of ewe-lambs usually starts 2-3 weeks later than that of ewes.

With so many small flocks tupping can be a problem, as keeping a ram for a few ewes is hardly worth while. Therefore, there are 'Station' rams available, at present some 120 in number, which can be borrowed from the FSBA. No fee is paid for this, but the farmer can charge (about 5 FM) for service when neighbors' ewes are brought in, as well as for upkeep of such ewes, e.g. 1 FM per day per ewe.

Bigger flocks use one ram for 50 ewes.

Oestrus

The duration of oestrus was calculated by Kangasniemi (28) in 1972 on 24
sponge-synchronized ewes, using a vasectomized ram every four hours; mean = 2 days \((1 - 2\frac{3}{4})\). According to Inkovaara (22), the sign of heat is wagging of the tail.

Remes (38) calculated the oestrous cycle on sponge-synchronized ewes; mean = 15.2 days, with a range of 13-17 days \((n = 22)\).

**Gestation length**

The length of gestation was calculated on pooled data of Remes and of Kangasniemi and pertains to sponge-synchronized ewes during in-season tappings in 1969 on 17 farms (38) and in 1971 and 1972 on an experimental farm near Mikkeli (28):

<table>
<thead>
<tr>
<th>gestation length (days)</th>
<th>n</th>
<th>(\bar{x})±S.D.</th>
<th>C.V.</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>276</td>
<td>143.5±2.3</td>
<td>1.6</td>
<td>136-150</td>
</tr>
</tbody>
</table>

**Lambing season**

Maijala (29) published graphs on lambing season for 3-7-year-old ewes in 61 flocks during 1948-63; the actual figures (31) are given in Table 12. Eighty-three percent of the ewes lambed in March and April, and 99% within the first 6 months, January-June. It is possible that around 50 years ago ewes lambed earlier, as Rosio (40) in 1919 advocated January as the best month for lambing.

In addition to Maijala's data (29) on the lambing season, Table 12 contains some preliminary data on out-of-season lambing, calculated from published and unpublished data of Maijala and Kangasniemi (32) and Goot and Maijala (unpublished). The ewes lambed throughout the year, but the proportion of ewes lambing in any given month varied, so that the frequency curve consists of two peaks, one in April and the other in September; the troughs were in November-December and in June-July. This corresponds to peaks of fertile tappings occurring in October and April and troughs in June-July and January-February. However, more information is needed because on one farm (c) lambing was planned not to take place in June-July, i.e., rams were not put in in January-February (36) and as for the second troughs, the owner was of the opinion that very few ewes come on heat in June-July.

Maijala and Kangasniemi (32) concluded that at least one-half of Finnish ewes are capable of lambing out of season. Further results available would indicate a still higher proportion (Goot & Maijala, unpublished).

Preliminary results from flock (c) for 5 years (1968-1972) on twice-yearly lambing (between Jan. 1 and Dec. 31) were as follows (Goot & Maijala, unpublished):

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lambed once per year</td>
<td>148</td>
<td>54</td>
</tr>
<tr>
<td>Lambed twice per year</td>
<td>125</td>
<td>46</td>
</tr>
<tr>
<td>Total</td>
<td>273</td>
<td></td>
</tr>
<tr>
<td>Dry</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
Table 12. Lambing season: Frequency of monthly lambing

<table>
<thead>
<tr>
<th>Lambing month</th>
<th>Once-yearly lambing (%)</th>
<th>More than once-yearly lambing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>Jan.</td>
<td>4.2</td>
<td>24.1</td>
</tr>
<tr>
<td>Feb.</td>
<td>6.0</td>
<td>3.7</td>
</tr>
<tr>
<td>March</td>
<td>41.4</td>
<td>5.6</td>
</tr>
<tr>
<td>April</td>
<td>41.8</td>
<td>13.0</td>
</tr>
<tr>
<td>May</td>
<td>4.7</td>
<td>13.0</td>
</tr>
<tr>
<td>June</td>
<td>1.0</td>
<td>3.7</td>
</tr>
<tr>
<td>July</td>
<td>0.2</td>
<td>0.6</td>
</tr>
<tr>
<td>Aug.</td>
<td>0.2</td>
<td>3.7</td>
</tr>
<tr>
<td>Sept.</td>
<td>0.2</td>
<td>16.7</td>
</tr>
<tr>
<td>Oct.</td>
<td>0.1</td>
<td>5.7</td>
</tr>
<tr>
<td>Nov.</td>
<td>0.2</td>
<td>13.0</td>
</tr>
<tr>
<td>Dec.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>2,563</td>
<td>54</td>
</tr>
</tbody>
</table>

* 3-7-year-old ewes in 81 flocks in 1948-63 (ref. 29,31)
  a Rams in throughout the year, 1962-66 (ref. 32)
  b One year (1968), with twice-yearly lambing (ref. 32)
  c Planned twice-yearly lambing, 1968-72; hoggets excluded (Goot & Maijala, unpublished)

Age at first lambing

Although extensive data on the age at first lambing are available at the FSBA, they have not yet been analyzed and therefore it was decided to base the present calculation on the flock in which 97 hoggets, out of 99, lambed during 1968-71; one of the two hoggets was sold before lambing and the other one aborted. The hoggets came from litters with 3.7 lambs and they themselves gave birth to an average of 2.3 lambs at first lambing.

age at first lambing (days) \[ \bar{X} \pm S.D. \quad C.V. \]

\[ \frac{97}{x} = 378.1 \pm 15.9 \quad 4.2 \]

The range was 342 - 422 days. As the length of pregnancy is 143.5 days, they must have been tupped when 235 days old, on the average. Obviously the latter figure can not be taken as the average age at puberty. Tupping depends on the time the farmer decides to let the ram in; ewe-lambs born earlier are tupped at an older age than those born later. This is illustrated below.

<table>
<thead>
<tr>
<th>Date of birth</th>
<th>n</th>
<th>Average age at lambing (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.III - 31.III</td>
<td>65</td>
<td>383.7</td>
</tr>
<tr>
<td>1.IV - 3.V</td>
<td>32</td>
<td>366.7</td>
</tr>
<tr>
<td>Total</td>
<td>97</td>
<td></td>
</tr>
</tbody>
</table>

Difference 17.0
Donald and Read (12) give the age of, and weight at, puberty for 43 Finn-sheep ewe-lambs born in Scotland as 210 days and 32.7 kg, respectively. No comparable figures are available as these 97 hoggets were weighed when 150 days old, i.e., approximately 45 days before tupping. Their weight then was $32.5 \pm 9.2$ kg, C.V. = 28%. Five of them were 20-25 kg (mean = 22.8 kg) when 150 days old, all of them lambed when 374 days old (average), and all of them produced twins.

**VITAL STATISTICS**

**Age composition**

The age composition of flocks is described in Table 13 (29, 31). Assuming that the flocks are relatively static in number, the percentage of ewe-hoggets would represent the rate of replacement. Another set of figures (Table 14) shows a considerable higher proportion of hoggets. The latter data are based on the 1970 returns from ten bigger flocks participating in the Sheep Improvement Programme (SIP) (26); the average flock size was 41.5 ewes and only 24% of flocks had fewer than 20 ewes. In these flocks there was a tendency to increase their size and 86% of ewes were under 5 years old (28).

**Litter size**

Since 1968, data published by FSBA divide sheep into two groups: under, and over, 2 years old; these data will be analyzed further on. At present, data of Maijala (29) and Kangasniemi (26) are more suitable. Both are very similar, and the later are given in Table 14 (26). Statistics on lambs born per ewe were based on ewes lambing, but the percentage of dry ewes appears to be very small: 3.9% for hoggets and 1.3% for ewes (26). However, not all the ewe-lambs are put to ram in their first winter; some are judged too young physiologically to become satisfactory mothers as hoggets. The proportion of such ewe-lambs appears to be very small (20, 24, 28).

As seen in Table 14, the litter size increases with age, from 1.9 in hoggets and 2.6 in 2-year-olds, to 3.10 in 6-year-old ewes. According to Maijala (29), the age of ewes accounts for about 20% and 16% of variance in litter size at birth and at 2 weeks of age, respectively; differences between farms account for another 15%.

The size of litters according to the age of the dams was given, up to 1965, by Maijala (29). Data pertaining to 1970 are given in Table 15. The average percentage of multiple births was 63% for hoggets and 94% for ewes.

**Mortality**

Mortality in lambs, i.e., those stillborn or dying within the first fortnight, is affected by the age of their dams (Table 14). On the average, mortality reduces the effective litter size by 0.4 lambs, from 2.8 to 2.4 per ewe. Within hoggets and two-year-old ewes, the reduction in litter size is the smallest, 0.2 and 0.3 lambs per ewe, respectively; the biggest reduction, 0.6 lamb, occurs within 6-year-old and older ewes. It is likely that the present management in bigger flocks is not always adequate to cope with too many lambs, a point which is discussed.
Table 13. Average flock composition by ewe age, based on 81 flocks in 1948-1963 (refs. 29, 31)

<table>
<thead>
<tr>
<th>Age of ewes (years)</th>
<th>Ewes</th>
<th></th>
<th>%</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>845</td>
<td>19.2</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>957</td>
<td>21.7</td>
<td>26.9</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>784</td>
<td>17.8</td>
<td>22.0</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>585</td>
<td>13.3</td>
<td>16.4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>420</td>
<td>9.5</td>
<td>11.8</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>324</td>
<td>7.4</td>
<td>9.1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>243</td>
<td>5.5</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>158</td>
<td>3.6</td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>92</td>
<td>2.1</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4,408</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Ewe-hoggets excluded.

Table 14. Ewe fertility and lamb mortality in 1970, according to age of the ewes (ref. 26)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Ewes</th>
<th></th>
<th>Lambs</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td></td>
<td>Born¹</td>
<td>Alive²</td>
<td>Lamb mortality (%)³</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>836</td>
<td>50.1</td>
<td>1.86</td>
<td>1.67</td>
<td>10.2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>736</td>
<td>26.5</td>
<td>2.58</td>
<td>2.29</td>
<td>11.2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>506</td>
<td>18.2</td>
<td>2.80</td>
<td>2.49</td>
<td>11.1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>309</td>
<td>11.1</td>
<td>2.88</td>
<td>2.55</td>
<td>12.1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>172</td>
<td>6.2</td>
<td>2.83</td>
<td>2.51</td>
<td>11.3</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>122</td>
<td>4.4</td>
<td>3.10</td>
<td>2.51</td>
<td>19.0</td>
<td></td>
</tr>
<tr>
<td>7 - 9</td>
<td>100</td>
<td>3.6</td>
<td>2.96</td>
<td>2.40</td>
<td>22.3</td>
<td></td>
</tr>
<tr>
<td>Total:</td>
<td>2,781</td>
<td>Average:</td>
<td>2.76*</td>
<td>2.42*</td>
<td>12.5*</td>
<td></td>
</tr>
</tbody>
</table>

¹Per ewe lambing; about 3.9% and 1.5% of dry hoggets and ewes, respectively.
²At 2 weeks of age, per ewe lambing.
³At 2 weeks of age, per lambs born.
*Hoggets excluded.
later on.

Table 14 also shows mortality based on the number of lambs born: it was 10-12% for lambs out of ewes up to 5 years old, and nearly double in lambs out of 6-year-old and older ewes.

Figures on mortality according to the size of litter and age at death are given in Table 15. The figure increases with the increase in litter size, practically irrespective of the age of ewes, particularly in litters of three or more lambs. However, in lambs out of hoggets, the mortality in any given litter size was higher than in those out of ewes, although the overall averages point the other way round. This is so because there is a much higher proportion of singles in the hoggets (25.8%) than in the ewes (6.5%), and mortality in singles is low (Table 15).

The highest proportion of lambs which died were either stillborn or died at birth, followed by those dying within the first 3 days; very few died between the 4th and 14th day. There is hardly any mortality, save accidental, in older lambs (20, 24).

It is known that management plays a big factor in reducing losses. Kangasniemi (26) divided farms into two groups with the following results:

<table>
<thead>
<tr>
<th>Size of litter</th>
<th>Management good</th>
<th>Mortality, 0 - 14 days (%)</th>
<th>Management poor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.9</td>
<td>8.5</td>
<td>8.0</td>
</tr>
</tbody>
</table>

Table 16 shows that more males than females die, particularly at birth.

The following reasons were given by farmers for losses:

(i) not enough shepherding at night (9, 19, 36);
(ii) small, and often weak, lambs; in bigger flocks it is not always possible to give such lambs individual attention in time (19);
(iii) smothering by the dam; one farm managed to reduce this factor considerably, by building larger pens, 1.5 x 1.5 m² (19).

Low winter temperatures very seldom cause losses of lambs; on one farm where water indoors freezes at night, there have been no losses, but weak lambs are put under an infrared lamp, if required.

No statistics could be found on mortality in ewes. It is estimated to be low, less than 1%, and the period when the ewes are likely to die is before lambing, and occasionally from bloating (9, 19, 20, 24, 36).
Table 15. Mortality of lambs according to litter size (ref. 26)

<table>
<thead>
<tr>
<th>Litter size</th>
<th>Lambs born</th>
<th>Lamb mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>%</td>
</tr>
<tr>
<td>HOGGETS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>216</td>
<td>25.8</td>
</tr>
<tr>
<td>2</td>
<td>524</td>
<td>62.7</td>
</tr>
<tr>
<td>3</td>
<td>91</td>
<td>10.9</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>.6</td>
</tr>
<tr>
<td>Total</td>
<td>836</td>
<td>Avg.: 4.8</td>
</tr>
</tbody>
</table>

| EWES        |            |                    |          |            |            |       |
| 1           | 120        | 6.3                | 0.8      | 1.7        | -          | 2.5   |
| 2           | 620        | 31.8               | 2.7      | 1.9        | 0.8        | 5.4   |
| 3           | 876        | 45.1               | 6.4      | 3.2        | 1.5        | 11.1  |
| 4           | 278        | 14.2               | 10.7     | 7.6        | 2.0        | 20.2  |
| 5           | 43         | 2.2                | 17.2     | 10.7       | 3.2        | 31.1  |
| 6           | 7          | 0.4                | 9.5      | 21.4       | 4.8        | 35.7  |
| 7           | 1          |                    |          |            |            |       |
| 8           |            |                    |          |            |            |       |
| Total       | 1,945      | Avg.: 6.7          |          | 4.2        | 1.5        | 12.5  |

*Four alive, out of eight born.

Table 16. Mortality (%) of lambs by sex (ref. 27)

<table>
<thead>
<tr>
<th>Hoggets</th>
<th>At birth</th>
<th>0 - 3 d</th>
<th>4 - 14 d</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>6.0</td>
<td>4.0</td>
<td>0.9</td>
<td>10.9</td>
</tr>
<tr>
<td>Females</td>
<td>3.6</td>
<td>4.4</td>
<td>1.5</td>
<td>9.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ewes</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>7.8</td>
<td>4.6</td>
<td>1.7</td>
<td>14.1</td>
</tr>
<tr>
<td>Females</td>
<td>5.6</td>
<td>3.9</td>
<td>1.4</td>
<td>10.9</td>
</tr>
</tbody>
</table>
PRODUCTION

3-day weight

There are no birth weights available as lambs are weighed routinely on the third day. The figures given below are from the Sheep Improvement Programme and refer to 1796 lambs born in 1971 (out of ewes only) in 29 flocks. Using the least squares method the weights were adjusted for farm, sex, and age of dam; however, they do not include lambs which were lost within the first 14 days of life. According to Kangasniemi (28), the weights were as follows:

<table>
<thead>
<tr>
<th>Litter size</th>
<th>3-day weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.84</td>
</tr>
<tr>
<td>2</td>
<td>5.96</td>
</tr>
<tr>
<td>3</td>
<td>3.34</td>
</tr>
<tr>
<td>4</td>
<td>3.02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex</th>
<th>3-day weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>male</td>
<td>3.92</td>
</tr>
<tr>
<td>female</td>
<td>3.66</td>
</tr>
</tbody>
</table>

Rate of growth

No figures are available, but calculations based on the official production recordings would indicate the rate of growth, from birth to 150 days of age, to average under 200 g/d.

In a small experiment to raise ram-lambs to 50 kg slaughter weight on ad lib. feeding, Pertila (37) weaned the 16 lambs when 72 days old and weighing 19.7 kg; they were slaughtered when 186 days old and weighing an average of 48.1 kg. Allowing 3 kg for the birth weight, the rate of growth up till weaning would average 252 g/d, and that from weaning to slaughter about 250 g/d. During the third year of the experiment, the after-weaning gains of the eight ram-lambs were 318, 129 and 307 g/d during the first 5 weeks, next 4 weeks and final 7 weeks, respectively; the poor gains during the middle 4 weeks were attributed to inadequate provision of drinking water.

The conversion ratios from weaning to slaughter during those 3 years were 5.3, 6.2 and 5.3 F.U./kg liveweight for 4, 4 and 8 ram-lambs, respectively.

Body weight

As part of Sheep Production Recording, sheep are weighed every autumn and yearly averages have been published—since 1968, separately for hoggets and ewes. The 1971 returns of autumn body weight from 650 flocks were as follows (27):

<table>
<thead>
<tr>
<th></th>
<th>under 2 years</th>
<th>over 2 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n  kg</td>
<td>n  kg</td>
</tr>
<tr>
<td>Rams</td>
<td>118 75</td>
<td>312 88</td>
</tr>
<tr>
<td>Ewes</td>
<td>3,944 52</td>
<td>7,857 62</td>
</tr>
</tbody>
</table>
In another set of data (4), the average weight of 268 ewes in seven flocks ranging in size from 18–55 ewes, was 69.8 kg, with a range of 53 – 91 kg. At present, the larger flocks use rams weighing, as 3-4 year-olds, 100 kg or more. The heaviest ram weight recorded so far was 139 kg.

Inkovaara (23) studied the relationship between the autumn body weight of ewes and the weights of their litters at 5 months of age. Abridged data are given in Table 17. In the five-lamb litters, allowance should be made for smaller numbers and the artificial rearing of some lambs (23, 24).

**Fertility**

Based on the same statistics (7) as the body weights above, the number of lambs born and alive at 2 weeks were:

<table>
<thead>
<tr>
<th></th>
<th>Born</th>
<th>Alive at 14 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoggets</td>
<td>1.9</td>
<td>1.7</td>
</tr>
<tr>
<td>Ewes</td>
<td>2.7</td>
<td>2.4</td>
</tr>
</tbody>
</table>

These figures are in very close agreement with those given in Table 14. In the latter, there is considerable variation in flock averages: about one-third of the flocks (12-70 ewes per flock) had a litter size of 3.0 - 3.5 lambs at birth, and 2.5 - 3.2 lambs alive two weeks later. Similarly, within hoggets the figures were 2.4 - 2.7 and 2.0 and 2.5, respectively (28).

**Litter weight**

The national averages in 1971 for 5-month weight of a lamb and of a litter were 31 and 72 kg, respectively, out of ewes, and 31 and 51 kg, respectively, out of hoggets (7). Slightly higher figures were obtained through the S.I.P. (28) and are reproduced in Table 18. Here again, one-third of the flocks were higher than the average for 150 d and total litter weights and one-third were lower. The best flocks were smaller (49-55 lambs per flock) and the worst were bigger (79-100 lambs per flock).

**Best production**

There are numerous examples of lamb production per flock or individual ewe (4). The record production of individual sheep, up to 1973, is given below:

<table>
<thead>
<tr>
<th>Lambs born per litter or year</th>
<th>Lambs surviving per litter or year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lambs born per lifetime (11 lambings)</td>
<td>Lambs surviving per lifetime (11 lambings)</td>
</tr>
<tr>
<td>Highest average litter size per ewe (9 lambings)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lambs born per litter or year</th>
<th>Lambs surviving per litter or year</th>
<th>Lambs born per lifetime (11 lambings)</th>
<th>Lambs surviving per lifetime (11 lambings)</th>
<th>Highest average litter size per ewe (9 lambings)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lambs born per litter or year</td>
<td>Lambs surviving per litter or year</td>
<td>Lambs born per lifetime (11 lambings)</td>
<td>Lambs surviving per lifetime (11 lambings)</td>
<td>Highest average litter size per ewe (9 lambings)</td>
</tr>
<tr>
<td>9 (30)</td>
<td>11 (20)</td>
<td>49 (20)</td>
<td>46 (20)</td>
<td>4.9 (4)</td>
</tr>
</tbody>
</table>

*Numbers in parentheses are references to the literature.*
Highest litter(s) weight at 5 months (kg) 271 (5) 312*
Highest ram weight (kg) 139 (20)
Highest ewe weight (kg) 107 (20)

Table 17. Weight of litter at 5 months, according to weight of dam (data abridged from ref. 23)

<table>
<thead>
<tr>
<th>Weight of dam (kg)</th>
<th>Litter size (lambs born and reared)</th>
<th>Total weight at 5 months (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 - 49</td>
<td>2 3 4 5</td>
<td>132 146 175 232</td>
</tr>
<tr>
<td>55 - 59</td>
<td>58 61 68 77</td>
<td>75 86 97 109</td>
</tr>
<tr>
<td>65 - 69</td>
<td>68 77</td>
<td>97 109 116 138</td>
</tr>
<tr>
<td>75</td>
<td></td>
<td>109 138 232</td>
</tr>
</tbody>
</table>

Table 18. Birth weight, average age at "5-month" weighing, and weights of lambs and litters at 5 months of age (based on 37 flocks and 2,397 lambs born in 1971 (ref. 28)

<table>
<thead>
<tr>
<th>3-day weight (kg)</th>
<th>Flock average</th>
<th>Between-flock range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lambs per flock</td>
<td>64.8</td>
<td>12 - 217</td>
</tr>
<tr>
<td>Age at weighing (days)</td>
<td>149.2</td>
<td>127 - 192</td>
</tr>
<tr>
<td>Weight at 5 mo. (kg)</td>
<td>32.5</td>
<td>23.0 - 38.4</td>
</tr>
<tr>
<td>Weight at 150 d_1 (kg)</td>
<td>33.0</td>
<td>24.3 - 39.1</td>
</tr>
<tr>
<td>Weight at 150 d_2 (kg)</td>
<td>36.0</td>
<td>27.4 - 42.9</td>
</tr>
<tr>
<td>Weight of litter^1 (kg)</td>
<td>83.1</td>
<td>49.0 - 112</td>
</tr>
</tbody>
</table>

^1Sex and age corrected.
^2Sex, age, type of birth and rearing corrected and adjusted to 3-year-old ewes.

*Goot, H. & Maijala, K. unpublished data.
Details regarding the record 270.5 kg 5-month weight of the litter might be of interest (5). The litter of six was born on 29. III. 72 to a 4-year-old ewe. Lambing lasted 50 min. Three males and three females were born, with a total weight of 13.5 kg at birth. The smallest lamb was reared artificially; the others were left with the ewe and were receiving supplementary milk, first five times daily and later four times, plus ad lib. concentrates. The ewe was receiving 2 F.U. per day plus vitamins. On July 15 the "family" went to grazing but the lambs were losing condition and therefore returned indoors and fed on Chou moellier. The litter was weighed every fortnight and the birth weights and final weights are given below (5):

<table>
<thead>
<tr>
<th>Ram-lambs</th>
<th>Birth weight (kg)</th>
<th>5-mo. weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>no. 17</td>
<td>1.5</td>
<td>45.0</td>
</tr>
<tr>
<td>18</td>
<td>2.5</td>
<td>51.0</td>
</tr>
<tr>
<td>19</td>
<td>2.7</td>
<td>51.0</td>
</tr>
<tr>
<td>Ewe lambs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no. 328</td>
<td>2.2</td>
<td>38.0</td>
</tr>
<tr>
<td>329</td>
<td>2.8</td>
<td>45.5</td>
</tr>
<tr>
<td>330</td>
<td>1.8</td>
<td>42.0</td>
</tr>
<tr>
<td>Total</td>
<td>13.5</td>
<td>270.5</td>
</tr>
</tbody>
</table>

Data on lambing twice yearly refer to one farm, the year being defined as from January 1 to December 31.

Milk suckled

In 1972, Kangasniemi (28) conducted a trial to test the technique for estimating milk suckled. The trial started 5-7 days after lambing, on 16 mature ewes. For 9 weeks lambs were weighed at 4-hour intervals for two consecutive days each week. The daily averages per ewe were 2.44, 2.44, 2.19, 1.83, and 1.77 kg milk per 24 h in the 1st to 5th weeks of the trial, respectively.

In another trial nine ewes, three of each with singles, twins and triplets, were tested once only - 7-9 days post partum, using again lamb weights. The 24-hour averages were 1.32, 2.51 and 2.30 kg per ewe with singles, twins and triplets, respectively (28).

It is generally reckoned that a ewe has enough milk for 2-3 lambs (20, 24).

Meat

There is very little factual information available on meat production and carcass composition of Finnsheep. About 30 years ago Inkovaara (22) criticized the small carcass weights. 6-8 kg. According to him, the optimum carcass weight should be 15-25 kg; over 30 kg is not desirable, and under 10 kg the little meat which there is, is too dry.

At present the bulk of lambs is sold late in summer and autumn to coincide with the cabbage season; there is a special and very popular dish consisting of
lamb and cabbage. Lambs are 4-6 months old at slaughter and carcasses range in weight from 6 - 26 kg (37). The average carcass weights in 1972 and 1973 at Turku's abattoir were 15.5 and 15.8 kg, respectively. Carcasses do not include kidneys or kidney fat. No commercial figures for dressing percentage were available but it was estimated to be about 40%.

Inkovaara (22) reported dressing percentages of 30-35% for 20-kg lambs and of 45% for 30-kg lambs. Varo's figures (47) refer to 133 ram-lambs weighing 35.0 ± 4.5 kg, and their carcasses: 13.6 ± 1.9 kg. In other data (43) based on 40 ram-lambs, the "slaughter percentage" was given as 37.92 ± 2.76%. Perttila (37) reported data based on 16 ram-lambs slaughtered when 186 days old and weighing 48.1 kg; the carcasses weighed 21.1 kg, on the average; hence, dressing out was 45.9%. These percentages seem low and might be due either to low fat content in the carcasses, or to taking the pre-slaughter weight without a 24-hour fast, or both. Commercially, the dressing out percentage is not important, as payment is made on carcass weight.

**Body and carcass fat**

In Finland there are no data available on body fat distribution. Inkovaara (14, 22) stated that the fat is deposited as kidney, subcutaneous, and inter-muscular fat, in that order. There is very little marbling, or intra-muscular, fat in lamb carcasses. Varo (47), in the previously quoted work, gives the weight of kidney fat as 21.4 ± 93 g, or 1.3 ± 0.5% of the carcass weight. In Scotland, McCleland and Russell (35) slaughtered seven Finnsheep wethers over a weight range of 26 - 41 kg (mean 34.6 kg) and found the following percentages of fat, based on a fleece-free empty body weight of 30.1 kg:

% of chemical fat in the fleece-free empty body: 14.24 ± 0.81%

<table>
<thead>
<tr>
<th>Fat deposit (%)</th>
<th>x ± S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fat in muscular tissue</td>
<td>3.88 ± 0.14</td>
</tr>
<tr>
<td>2. Subcutaneous fat</td>
<td>1.30 ± 0.22</td>
</tr>
<tr>
<td>3. Omental and mesentering fat</td>
<td>4.18 ± 0.72</td>
</tr>
<tr>
<td>4. Perirenal fat</td>
<td>1.38 ± 0.29</td>
</tr>
<tr>
<td>5. Bone fat</td>
<td>0.76 ± 0.08</td>
</tr>
<tr>
<td>6. Fat in remainder</td>
<td>2.74 ± 0.13</td>
</tr>
</tbody>
</table>

The authors also compared Finnsheep with Scottish Blackface wethers of similar age and weight. With increased body weight the percentage of fat deposited in various parts of the body in the two breeds was as follows:

- **Finnsheep**
  - no change: deposit nos. 1, 5, 6
  - increase: deposit nos. 2, 3, 4

- **Blackface**
  - no change: deposit nos. 3, 5, 6
  - increase: deposit nos. 1, 2, 4

Thus, the Finnsheep wethers appear to deposit more of the body fat than muscular fat, whereas the Blackface wethers appear to put on more carcass fat than body fat. Perttila (37) stated that wethers had more fat than ram-lambs.
The author inspected about 50 carcasses in the LSO abattoirs, Turku. The weights ranged from approximately 8-15 kg. The carcasses did not have many characteristics of mutton breeds; they were rather leggy, sharp at the withers, and very deficient in fat. Leg and shoulders were without any fat cover; some carcasses had a thin layer of fat on the rump. One carcass, grade I, was cut into two sides: again, absolutely no fat was visible.

**Wool**

Inkovaara (22) stated that the wool on the native sheep was primitive, viz., consisting of a mixture of fine and coarse fibers. The character (crimp) was poor, but some sheep had good wool.

As described in 1938 (44) and 1943 (22), the Finnsheep wool has been used for three main purposes:

1. Homecraft: 46's - 50's, plain but with luster;
2. Pelt production (with the skin): 50's - 56's; 2.5-3.0 cm in length, with broad but well-defined crimp; and
3. Textiles: mainly 56's - 60's, but also finer than 60's, with good crimp, length and staple formation.

The wide range in wool types is of great interest and merits further investigation. For instance, type 1 can be described as 'unimproved', i.e., "obtained from sheep without Merino or English blood" (2). On the other hand, type 3 is not only within the range of Merino fineness, but it has a very well-defined crimp, which even in a Finnsheep x Mutton Merino cross improves the wool character very considerably in comparison with pure Mutton Merino wool (Goot, H. unpublished).

Autumn-shorn wool is better than spring-shorn wool (21, 24). This is, no doubt, due to the fact that the latter is grown during pregnancy, lambing and lactation, rather than to in-wintering. The length of autumn-shorn wool is 8-10 cm for 6-7-month growth, and that of spring-shorn wool is 4-5 cm for 5-6-month growth (21).

The average shrinkage is 34 - 36% (21), giving a yield of 64-66%.

The wool inspected at the Wool Store, Tampere, consisted of lamb and ewe wool. Most of it was well grown but the fleece wool was rather short for count, being grown for a half year only. The wool was practically free of vegetable and possibly mineral matter; it had luster even at counts which in other wools do not show any luster. The wool could be easily sorted into two main types; type 1 (homecraft), which was plain (without crimp), and type 3 (textile), with a rather broad but well-defined crimp and staple formation and with very good handle. The color was medium to poor. The moisture content appeared to be rather high. It was well shorn, with very few second cuts and skin bits.

**Hairiness and kemp:** About 30-40 years ago hairiness was quite widespread, but vigorous selection reduced the incidence of hairy fleeces to the present level of less than 3% and it is confined to the britch (21, 24).
Cott and yellow stain: Occasionally, some parts of the fleece can be slightly cotted and stained after in-wintering.

'Sikkara villa' (screw-type wool) appears to be peculiar to Finn sheep and possibly Romanov. It refers to staple formation and crimp. Instead of staple there is a lock or frill, very thin, and the crimp goes screw-wise. With poor 'body', the frills bend in all directions thus making shearing and later carding or combing very difficult (20, 21, 24). It has been strongly selected against and at present 'sikkara villa' can be found occasionally on withers, shoulders and points.

Black and gray is not considered a fault; black pelts either for children's cot or car-seats, have been in demand, and gray homecraft wool is preferred for making sweaters and underwear. As far as could be ascertained, these are no pigmented fibers in white wool.

**Fleece weight**

The official Sheep Recording returns for 1971 (7) give the following fleece weights (sum of two shearings per year):

<table>
<thead>
<tr>
<th>Sheep age</th>
<th>under 2 years</th>
<th>over 2 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>kg</td>
</tr>
<tr>
<td>Rams</td>
<td>118</td>
<td>3.5</td>
</tr>
<tr>
<td>Ewes</td>
<td>3,944</td>
<td>2.8</td>
</tr>
</tbody>
</table>

Table 19. Examples of stock feeding of ewes (all data are given in kg)

<table>
<thead>
<tr>
<th>Ration</th>
<th>A</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hay</td>
<td>Concentrate</td>
</tr>
<tr>
<td>Flushing</td>
<td>1.5</td>
<td>0.3</td>
</tr>
<tr>
<td>First 3 mo. of pregnancy</td>
<td>1.5</td>
<td>-</td>
</tr>
<tr>
<td>Fourth month of pregnancy</td>
<td>1.5</td>
<td>0.3</td>
</tr>
<tr>
<td>Fifth month of pregnancy</td>
<td>1.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Ewe suckling: 1 lamb</td>
<td>1.5</td>
<td>0.5</td>
</tr>
<tr>
<td>2 lambs</td>
<td>1.5</td>
<td>0.9</td>
</tr>
<tr>
<td>3 lambs</td>
<td>1.5</td>
<td>1.3</td>
</tr>
<tr>
<td>4 lambs</td>
<td>1.3</td>
<td>1.8</td>
</tr>
</tbody>
</table>
NUTRITION

Grazing

No data on grazing natural pastures, waste lands and forest were obtained. The practice of grazing stock in forest, although decreasing, is still appreciable, especially in the central and eastern parts of Finland (25). The remarks that follow pertain to grazing arable land, and the yields recorded were obtained with cattle.

There are two main grazing systems: grazing leys sown for hay and silage, and those sown for pasture. The first type is included in the field rotational system; during the first 1-3 years the sward is cut once a year only, for hay or silage making (and when hay is removed the stock is grazed during September-October) and after about 3 years it is grazed for one to two extra years before being plowed under. In 1965, 60% of arable grazing consisted of this type of ley. As red clover disappears within the first 2 years and is replaced by weeds, and the regrowth of timothy is slow, the grazing yields are poor under this system.

The most common seed mixtures for the second type of ley consist of meadow fescue, with timothy, perennial ryegrass and red clover; on clay soils, some of the fescue is replaced by cocksfoot. In 1965, 72% of this type of ley contained either meadow fescue or cocksfoot as the dominant grass, and approximately 8% and 10% were from 0-4 and 5-7-year-old leys, respectively. According to the same author (25), the average annual yield during the 125 days of grazing (with cows) was 2,960 F.U. per ha, with an average regrowth of 23 F.U. per ha per day.

Ewes

As the grazing season is short (5 months in the north and 6 months in the south) sheep are stall-fed for 6-7 months. The feed values are calculated in Scandinavian feed units and the recommended feeding standards have been given by Maijala (30). Two examples of in-wintering rations are to be found in Table 19 (20). Hay is still the basic feedstuff (30), but there is a strong tendency to increase the use of silage and reduce hay and concentrates in the ration. Hay and silage are usually made from timothy (Phleum pratense), meadow fescue (Festuca pratensis) and red clover (Trifolium pratense), but on peat soils only timothy is grown (46). The relative composition of hay in 1966-68 was as follows (34):

<table>
<thead>
<tr>
<th></th>
<th>Yield* (kg/ha)</th>
<th>Grass (%)</th>
<th>Clover (%)</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lapland</td>
<td>3520</td>
<td>55</td>
<td>1</td>
<td>44</td>
</tr>
<tr>
<td>North Finland</td>
<td>3610</td>
<td>59</td>
<td>2</td>
<td>39</td>
</tr>
<tr>
<td>Mid Finland</td>
<td>3550</td>
<td>65</td>
<td>8</td>
<td>27</td>
</tr>
<tr>
<td>South Finland</td>
<td>3350</td>
<td>67</td>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>Average</td>
<td>3720</td>
<td>64</td>
<td>10</td>
<td>26</td>
</tr>
</tbody>
</table>

*one cut per year
The most important legume is red clover but its wider use is limited by three factors: (i) difficulty in obtaining seed due to wet weather at harvesting time; that is why seed mixtures sown contain less clover than recommended; (ii) damages caused by clover rot (Sclerotina trifoliorum), which is prevalent everywhere in Finland; and (iii) rather high proportion of peat soils, especially in the north, on which clover will not grow (46).

The chemical composition (in %) of hay and silage was given by Ring (39) as:

<table>
<thead>
<tr>
<th></th>
<th>Hay</th>
<th>Silage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter</td>
<td>80.0</td>
<td>20.5</td>
</tr>
<tr>
<td>Crude proteins</td>
<td>7.8</td>
<td>18.4</td>
</tr>
<tr>
<td>Dig. proteins</td>
<td>-</td>
<td>8.8</td>
</tr>
<tr>
<td>N-free extract</td>
<td>37.6</td>
<td>40.6</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>27.7</td>
<td>27.5</td>
</tr>
</tbody>
</table>

In addition to hay, oats and barley straw - but not rye - is used especially for maintenance and for supplementing grazing at the end of the grazing season.

There are a number of feedstuffs specific to Finland and, no doubt, neighboring countries. Their use is on the decline because of labor costs (20, 22, 24): (i) pine-needles and bark, (ii) dry forest leaves: 2 kg per F.U., with 140 g proteins; leaves can replace ½ of the ration; (iii) during and after the Second World War, lignin or cellulose was also used, 300-500 g per ewe, although it was not consumed by ewes as readily as by cows and horses.

Whole grains of oats and barley are fed to sheep, supplemented with bought-in protein-vitamin-mineral supplements, like 'Tuku', whenever required. The following concentrates are manufactured (for current prices, see p. 37):

- Tuku: loose proteins supplement containing 30% dig. proteins, 0.8 kg per F.U.;
- Lamma Sampo 1: pellets containing 17% dig. proteins, 1.05 kg per F.U.;
- Lamma Sampo 2: containing 13% dig. proteins, 1.09 kg per F.U.;
- Milk replacer: containing 22% dig. proteins and 24% fat, 0.7 kg per F.U.

All these supplements contain minerals and vitamins but not antibiotics, with the exception of the milk replacer.

Some farmers grow rape and especially Chou moellier for flushing and finishing lambs. A few examples from farms visited might be of interest.

**Example 1.** 10-ha farm, 32 ewes, near Lahti. In-wintering: October-May (7 mos.). During the first 3 months of pregnancy ewes get 1.5 kg hay + 0.3 kg oats; oats are gradually increased during the latter part of pregnancy to 0.8 kg per ewe. During lactation: 0.5 kg oats, 0.3 kg Tuku and hay ad lib. Outdoors: only grazing and straw at the end of the grazing season.

**Example 2.** 9-ha farm, 24 ewes, near Turku. Flushing on Ruhukaali (Chou moellier); otherwise as above.

**Example 3.** 60-ha farm, 70 ewes, near Helsinki. First 3 months of pregnancy: hay,
straw and onions, later supplemented with home-made concentrates consisting of barley, oats, molasses, 1.5% urea, minerals and vitamins: 1.22 kg per P.U. Outdoors: only grazing.

Example 4. 60-ha farm, 90 ewes, near Turku. First 3 months of pregnancy: hay (after harvesting Fencuc seeds), silage (sugar-beet leaves) and whole barley; as the pregnancy advances better quality hay is given (timothy, Dactilis and red clover), plus whole barley, plus pelleted sugar-beet pulp containing molasses and 3% urea. During lactation the feedstuffs are the same except that (a) the sugar-beet pulp is urea-free, and (b) Lamma sampo 1 is added. During grazing, mineral and vitamin supplements are added.

Example 5. 100-ha farm, 350 ewes, near Turku. Maintenance mostly on hay and ad lib. pine-needles and bark. Flushing on rape, either grazed or cut, and molasses. Steaming up, for 6 weeks, on barley, oats, grass silage and hay. During lactation some bought-in concentrates are added. Outdoors: grazing only.

Rams

About 30 years ago the standard was 1.0-1.2 P.U. per 100 kg live weight and 70-84 dig. proteins, or 1.5 kg hay and 0.5 kg dry leaves per day, with additional 0.5 kg of oats during tupping (22). Nowadays, rams get a ration similar to that of ewes.

Lambs

Generally, ram-lambs are weaned when 3-3½ months old, but ewe-lambs are not weaned and they graze with their dams. During the first 3 - 3½ months of suckling, lambs are creep- or hand-fed on concentrates. The weaned ram-lambs either graze on separate paddocks or are stall-fed on concentrates and hay. Those on pasture usually receive some concentrates, or oats, during the initial grazing period. On some farms the supplement is continued throughout grazing; on others no supplement is given at all and on still others, a mineral-vitamin supplement only is given.

During grazing, the unweaned ewe-lambs are usually managed like ewes.

Artificial rearing

Artificial rearing is either complete or partial. The latter is more popular, as it is claimed that lambs thrive better when left with the mother, and besides, there is less labor involved. Partial artificial rearing appears to be specific to Finnsheep. Lambs can be trained, apparently with very little difficulty, to take the bottle when much older than the customary 1 - 3 days, to supplement mother's milk.

The milk replacer contains 24% fat (12.5% animal fat, the rest cocoa and soya) and 22% dig. proteins. It is fed at a ratio of 130 g powder to 1 liter of water. Beer or soda bottles with ordinary 'baby' teats are used. For complete artificial rearing, lambs are fed five times daily, or even more often, during the first 3 days, then three times daily and during the last 3 weeks, twice daily only. They are 'weaned' at 12 kg. The 'milk' is given warm, and ad lib. concentrates and water are available.
There are two types of plastic lamb-bars on the market: the usual 12-teat bucket and a 6-teat bucket cut on one side to hang flush on a hurdle. The 'baby' teats are connected to transparent plastic pipes through an inner-tube air-valve. It is claimed that cleaning is very easy, as they clean themselves automatically.

HEALTH

There are few, if any, health problems in the Finnsheep. Some sheep and lambs are vaccinated against Clostridia spp. and drenched against internal parasites. Liver fluke, once the most serious of all, gives very little trouble. As for other internal parasites, the most common appears to be Haemoncus, Trichostrongylus and Ostertagia; there is very little lungworms (1).

Sheep lice is seldom encountered or any other external parasites or skin and wool diseases, and therefore dipping is almost never practised (1, 9, 19, 20).

Judging by the reports from the State Vet. Med. Institute, Helsinki, Coccidia and E. coli are seldom found; white muscle disease is more prevalent in some years than in others (1).

Mortality in ewes is very low and that which occurs is due mostly to bloat, mastitis and pregnancy toxemia (9, 19, 20, 36). Some farmers claim (9, 19) that mastitis is brought about by tiny wounds inflicted by lambs' teeth, especially when there is too little milk to satisfy all the lambs. The incidence of pregnancy toxemia is remarkably low, in view of the big litter size in Finnsheep.

The Veterinary Department of the Ministry of Agriculture and Forestry publishes a monthly report on epizootics in Finland, which is also submitted to the OIE in Paris.

HOUSING

For housing, Inkovaara (22) prefers timber to stone and bricks, as wooden houses are less damp. A good sheep house should have enough light and dry and fresh air but no drafts, and provide 1.5-1.6 m² per pregnant ewe and 2-3 m² per ram. However, there are very few houses built specifically for sheep. They are usually in-wintered in unused horse-stables and cow-sheds. A high proportion of farms seems to have switched over from dairying to sheep keeping. The sheds and stables are solidly built brick or stone structures, but some are wooden with an earthen floor. At present, concrete floors are favored because they do not freeze in the winter and mechanical scraping of manure is easy.

Straw is used for bedding and manure is removed late in the summer.

Windows and doors are left open whenever possible. One big farm uses an electric fan, but otherwise there are no special provisions made for ventilation.

No exact figures could be obtained with regard to indoor temperatures and humidity, particularly during the lambing season. Some farmers reckon the humidi-
ty to be 85-90% and temperatures to range from 0° to +10°C. In some sheds, water freezes at night.

**MANAGEMENT**

With so many small flocks and such a big range in flock sizes (see Tables 10, 11), it is difficult to generalize. On some farms sheep are treated as pets, whereas on others they may be neglected, too few to be bothered about. With medium and bigger flocks the extra labor cost might be too high for a given flock size, or labor may not always be available because of the pressure of other farm work. Therefore, the description offered here is based on Inkovaara's handbook (22) — which, although written over 30 years ago, is not too outdated — and on conversations with a number of leading sheep farmers, in particular Mr. E. Hautakangas, the Managing Director of FSBA in Helsinki.

One cannot help being impressed with the high caliber of the people working with sheep in Finland. Surprisingly, a high proportion of them are women who, in addition to household chores, look after sheep, often single-handed; they even shear them! One can find on bigger farms that both husband and wife, or father and son, have degrees in agriculture.

**In-wintering**

Sheep are brought in when the snow covers the ground for the winter proper (see Tables 8, 9). The shed will then be cleaned and often disinfected, and in good repair. Flushing of ewes may start before or during in-wintering. It is done either by giving whole grains or concentrates, or by feeding Chou moellier or rape. Topping may start a week after taking the ewes in, and ewe-lambs a few weeks later. In flocks with one ram only, in-breeding is avoided by changing the ram from year to year. In flocks where more than one ram is used, the ewes are divided into groups of 25-50. Sisters are usually put to different rams. In such flocks crayon marks are read every day or two. Rams are usually withdrawn after 1½-2 months, but occasionally they stay much longer.

During in-wintering and before lambing, ewes may or may not go out. On one farm, near Turku, they go out to graze Chou moellier from October until the beginning of December; but at lambing they usually stay indoors. There are no hard rules. One flock, near Tampere, was housed for several years in an old cow-shed in which the doors were covered with a canvas and both water and feeding troughs were outside. Neither sheep nor lambs suffered any ill effects, providing the lambing started about the beginning of April (3).

**Steaming up** usually starts 2 months before lambing.

**Lambing**

Lambing should be timed according to the start of grazing, so that the new lambs will then be 1½ months old and weighing 8-14 kg (14, 24). If the size of a flock warrants it, ewes are grouped according to (i) size of group 30-40 ewes per group, without any regard to the time of lambing; (ii) time of lambing; and (iii)
time of lambing and age of ewes. The different management practices are dictated by the shape of the shed, and by the facilities and labor available. Thus (i) it is more convenient to have a few lambing places in the shed as there is enough room, pens and labor available; (ii) it is more convenient to have ewes lambing at the same time grouped in one place; and (iii) ewe-hoggets and their lambs need more attention and therefore it is convenient to have them in a separate group.

On a well-run farm, about one-third of the ewes can be put into individual pens at a time. The pens are made from wooden hurdles tied together and which are light and low enough to facilitate handling. The biggest pens are 1.5 x 1.5 m², and a farmer questioned claimed that no smothering occurs. Usually, ewes are put into those pens after lambing, but at least on one farm ewes are put in about 3 days before lambing, i.e., on the 140th day of pregnancy. The time spent in individual pens is 3-7 days and depends on the litter size and vigour, age and individuality of the ewe, and availability of pens.

Once let out, the ewes—whenever possible—are grouped again, but this time according to their litter size, e.g. up to two or three lambs; ewes with four or more lambs are always kept as a group, as some of the lambs are bottle-fed. Ewe-lambs should also be kept as a group as they require a higher level of nutrition.

Ideally during lambing time shepherding should be available 24 hours per day. This was found on one farm only, where four people (the farmer, his wife and son, and a farm-hand) were available day and night for a flock of some 550 ewes producing over 1,000 lambs. Otherwise, there is no night shepherding except in the case of particularly valuable ewes. There are no statistics as to how many ewes are helped during lambing. As for lambs, it is clear from Tables 14 and 15 and conversations with farmers that the losses could be reduced with more intensive shepherding during lambing.

**Tagging and weighing lambs**

Lambs are weighed and notched on the third day of life. Ordinary spring milk scales are used. Some farmers have started using metal ear-tags. On the same day, the navel is sprayed with Terramycin, and on at least one farm each lamb is given, via an eyedropper, 1 cc Vit. A and D and 2 cc Vit. E.

**Supplementary feeding**

Lambs requiring supplementary milk are bottle-fed, preferably without being separated from their dams. Milk is either taken from other ewes or a milk substitute is used. Bottle feeding starts early, but even lambs older than a week take relatively easily to the bottle (9, 19). In this, as well as in the ability to suck and be bottle-fed at the same time, the Finn x Texel lambs are much easier to raise than Finn x Texel lambs (19).

**Weaning**

Because of early sexual maturity ram-lambs are weaned when 3-3½ months old, or they would tup ewes and ewe-lambs alike during summer grazing. Generally, ewe-
lambs are not weaned.

Castration

Occasionally, ram-lambs are castrated to avoid weaning.

Vaccination

The only vaccination routinely used on many farms is the 'seven-in-one' against Clostridium spp. Ewes are vaccinated 2-4 weeks before lambing and lambs when approximately 7 weeks old, or before the start of grazing.

Drenching against round-worms

Ewes are drenched once or twice yearly: either in the autumn and after lambing, or after lambing only, i.e., before turning them out to grazing; Lambs are drenched one month after being put on grass.

Dipping

Almost no dipping is practised.

Grazing

The flock is grazed in fenced paddocks, on sown or native pasture, waste land, and in the forest. Fences are made of lamb-proof wire netting. Grazing may be supplemented by straw, grains and/or mineral and vitamin supplements. Usually, part of a paddock is wooded, but other than that there are no shelters or wind-breaks. Water is provided or sheep drink from a lake or river.

During the grazing season there are hardly any losses from theft, wild animals or stray dogs.

Sheep in the smaller flocks are very docile and friendly; each one has a name and it is easy to catch them in a paddock as they flock in whenever the owner comes in; usually they are rewarded with a handful of oats. Lambs, too, especially those on the bottle, will run from the farthest corner of the paddock to get the bottle.

Shearing

Formerly, sheep were clipped three or even more times per year. At present they are shorn twice a year: spring shearing in April or May, before the start of grazing, and autumn or winter shearing in October-November, when the sheep are already indoors. Farmers, or farmers' wives, do the shearing with hand shears, although electric shearing machines are used in bigger flocks.

Traditionally, shearing is done on a table, with the sheep's head tied to it, and forelegs and hind legs tied separately. First, the extremities, neck, legs, belly and crutch, are shorn and later the fleece proper, starting from the belly, up the side and back; then the animal is turned on the other side and the operation is repeated (22). Some farmers put a large, old tire on the table and let the sheep
lie on it instead of tying the animal. Still others shear the sheep in a standing position, with its head tied to a post; some use the Australian shearing position.

The wool is then put into a small paper or jute sack for dispatch to the wool center. In the past, however, the wool was dried for a few days and then old newspapers were put under the fleece and it was rolled up.

Culling and selection

Selection of stud sheep is described in the section 'Production Recording'. Flock ewes and hoggets are selected or culled on age, weight (at least 40-45 kg autumn weight as a 2-year-old), fertility (dry ewes and young ewes with singles or ewes with high litter mortality are culled), conformation, and wool (density, uniformity and belly cover). In addition, the selection of ewes-hoggets is based on pedigree and dam performance in respect to litter size and uniform growth of all lambs within the litter (22).

Fattening

Intensive fattening of young animals is of relatively recent origin. In the past, both beef and sheep were fattened in the autumn when potatoes, beets and straw were plentiful; the taste, too, was for more mature beef and hogget or mutton. It is therefore of interest to cite what Inkovaara (22) wrote about 30 years ago on fattening of sheep. The best age for fattening is when sheep are 15-20 months old, although 7-9-month-old lambs are also suitable. The animal should be shorn to increase the appetite. Fattening can start on cabbage and potatoes and gradually be shifted to barley and oats. Hay should always be available. The daily ration should contain 2 P.U. and approximately 160 g of dig. proteins per 100 kg live weight.

Manure

Manure is carted late in summer and used on arable land.

MARKETING, PRICES AND PROFITABILITY

Meat

Sales of sheep generally start in June with culled ram-lambs, followed by culled ewes; most of the lambs are sold in August and September. Lambs are sold when 35-45 kg live weight and at 5-7 months of age. During the season, buyers come to a farm 2-3 times a week to fetch lambs. Payment, made within two weeks, is based on carcass weight and grade.

In 1971, approximately 1,330 tons of sheep meat were marketed.

Meat prices are controlled but not subsidized, except for three development districts where subsidies for all meat are 0.50, 1.00 or 1.50 FM, according to district.

The present (August 1973) prices paid to farmers in Turku, per kg carcass weight, are lamb, 10.25 FM; beef, 8.20 FM; and pig-meat, 5.10 FM. Lamb retails at
13-14 FM per kg. Beef prices are usually higher than lamb prices, except for 3 months in the year, viz. July, August and September, and a two-week period before Easter. Meat prices are steadily increasing: during 1972, prices paid to the producers increased from 6.31 FM to 7.28 FM for beef and from 5.35 to 6.65 FM for sheep meat.

The meat works visited in Turku, the LSO (Meat Cooperative of Southwest Finland), is a modern factory and abattoir dealing mostly with pigs and cattle. LSO handles approximately 80-90,000 sheep per year. Sheep skins are salted and sold. All offal, blood, bones, etc., are used - some for feeding mink.

Wool

As mentioned previously, there are two main types of wool: Homecraft (coarse and plain) and Textiles (finer and with crimp). About 200 tons reach the market annually, and the remainder is used for homecraft. Often, wool is given to small mills to be spun into knitting yarn for home knitting of sweaters, socks, underwear, etc. In the past, gray wool was preferred to white wool.

There are three Wool Centers in Finland; the largest is in Tampere, and handles about 100 tons of wool per year. Farmers send their wool, packed in either small paper bags or sacks, either directly to the Wool Center, or through a village store. At the Wool Center the wool is sorted and payment, made within 1-2 months, is according to the weight of wool per given grade.

Wool grading started in 1942 and was based on length and color:

Grade 1: white, autumn - shorn, at least 8 cm long;
Grade 2: white, spring - shorn, under 8 cm;
Grade 3: colored, black, gray and/or mixed.

However, the grades were changed to favor fineness; wool must be at least 2 cm in length. The present classification and current prices as of 15. IX. 73 per kg greasy wool, are as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>FM/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>white, fine to medium black, fine to medium</td>
<td>13.00</td>
</tr>
<tr>
<td>2</td>
<td>white coarse</td>
<td>10.30</td>
</tr>
<tr>
<td>3</td>
<td>black coarse</td>
<td>6.50</td>
</tr>
<tr>
<td></td>
<td>mixed colors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>shoddy, etc</td>
<td>0.50</td>
</tr>
</tbody>
</table>

The percentage breakdown according to type of wool handled by the Tampere Wool Center in 1972 was as follows (21):

- white, fine: 44.5
- white coarse: 51.3
- black: 0.6
- mixed colors: 1.5
- shoddy, etc.: 2.1

Note that at least 96% of the wool was white.
Table 20. Income and expenditures (Finnish Marks) in flocks of 10, 50 and 100 ewes in 1973 (20)

<table>
<thead>
<tr>
<th>Basic unit of 10 ewes producing 23 lambs, 21 for sale and 2 for replacement; 2.7 kg and 1.0 kg of wool per ewe and lamb, respectively</th>
<th>10 ewes</th>
<th>50 ewes</th>
<th>100 ewes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kg</td>
<td>FM</td>
<td>Total FM</td>
</tr>
<tr>
<td><strong>INCOME</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sale of 21 lambs, 38 kg l.w. and 40% dressing</td>
<td>320</td>
<td>9.00</td>
<td>2,800</td>
</tr>
<tr>
<td>Sale of 2 ewes, 60 kg l.w. and 40% dressing</td>
<td>48</td>
<td>8.00</td>
<td>384</td>
</tr>
<tr>
<td>Sale of wool: 10 ewes x 2.7 kg and 23 lambs x 1.0 kg</td>
<td>50</td>
<td>10.50</td>
<td>525</td>
</tr>
<tr>
<td><strong>Total income</strong></td>
<td></td>
<td>3,789</td>
<td>18,945</td>
</tr>
<tr>
<td><strong>EXPENDITURES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grazing, 10 ewes x 300 F.U. = 3,000 F.U.</td>
<td>0.30</td>
<td></td>
<td>900</td>
</tr>
<tr>
<td>Grain (barley and oats), 10 x 50 kg</td>
<td>500</td>
<td>0.45</td>
<td>225</td>
</tr>
<tr>
<td>Protein and vitamin supplement, 10 x 10 kg</td>
<td>100</td>
<td>0.90</td>
<td>90</td>
</tr>
<tr>
<td>Mineral supplement, 10 x 5 kg</td>
<td>50</td>
<td>0.65</td>
<td>33</td>
</tr>
<tr>
<td>Hay, 10 x 125 kg</td>
<td>1,250</td>
<td>0.20</td>
<td>250</td>
</tr>
<tr>
<td>Silage, 10 x 1100 kg</td>
<td>11,000</td>
<td>0.06</td>
<td>660</td>
</tr>
<tr>
<td>Interest, 8%, 10 x 200 = 2,000 FM</td>
<td></td>
<td></td>
<td>160</td>
</tr>
<tr>
<td>Cost of ram</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of fencing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Veterinary fees and medicine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straw for bedding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance and repairs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL EXPENDITURE</strong></td>
<td></td>
<td></td>
<td>2,703</td>
</tr>
<tr>
<td><strong>Gross return</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income-expenditures</td>
<td>1,086</td>
<td>6,065</td>
<td>12,260</td>
</tr>
<tr>
<td>per ewe</td>
<td>109</td>
<td>121</td>
<td>123</td>
</tr>
<tr>
<td>per ha (5 ewes/ha; 2,800 F.U./ha)</td>
<td>545</td>
<td>605</td>
<td>615</td>
</tr>
<tr>
<td><strong>Labor, 5 FM/h</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total expenditure + labor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>600&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2,000&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3,000&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>3,303</td>
<td>14,880</td>
<td>28,630</td>
</tr>
<tr>
<td><strong>Net income</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>per flock</td>
<td>486</td>
<td>4,065</td>
<td>9,260</td>
</tr>
<tr>
<td>per ewe</td>
<td>49</td>
<td>81</td>
<td>93</td>
</tr>
<tr>
<td>per ha (5 ewes/ha; 2,800 F.U./ha)</td>
<td>245</td>
<td>405</td>
<td>465</td>
</tr>
</tbody>
</table>

<sup>a</sup>12 h/ewe;  <sup>b</sup>8 h/ewe;  <sup>c</sup>6 h/ewe.
Feedstuff costs

The current prices (August 1973) of feedstuffs are as follows:

<table>
<thead>
<tr>
<th>Feedstuff</th>
<th>Price per kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barley</td>
<td>0.47</td>
</tr>
<tr>
<td>Oats</td>
<td>0.45</td>
</tr>
<tr>
<td>Hay</td>
<td>0.18</td>
</tr>
<tr>
<td>Silage</td>
<td>0.07</td>
</tr>
<tr>
<td>Concentrates</td>
<td></td>
</tr>
<tr>
<td>Tuku (30% dig. proteins)</td>
<td>0.85</td>
</tr>
<tr>
<td>Lemnas Sampo 1 (17% dig. proteins)</td>
<td>0.735</td>
</tr>
<tr>
<td>Lemnas Sampo 2 (13% dig. proteins)</td>
<td>0.695</td>
</tr>
<tr>
<td>Milk replacer</td>
<td>3.40</td>
</tr>
</tbody>
</table>

Profitability

In Table 20 a current balance sheet, prepared by Mr. E. Hautakangas of the FSEA, is reproduced. It is especially instructive as it gives full details of income and expenditure. Eighty-six percent of all income is derived from sales of stock and only 14% from wool. The expenditures can be grouped according to percentage of the total, as follows:

<table>
<thead>
<tr>
<th>Expenditure</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grazing</td>
<td>27.3%</td>
</tr>
<tr>
<td>Home-grown feeds</td>
<td>36.7%</td>
</tr>
<tr>
<td>Bought-in feeds</td>
<td>3.7%</td>
</tr>
<tr>
<td>Ram</td>
<td>3.6%</td>
</tr>
<tr>
<td>Interest on livestock</td>
<td>4.8%</td>
</tr>
<tr>
<td>Fencing and repairs</td>
<td>3.0%</td>
</tr>
<tr>
<td>Medicines</td>
<td>1.8%</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>0.9%</td>
</tr>
<tr>
<td>Labor</td>
<td>18.2%</td>
</tr>
</tbody>
</table>

Net income, both per ewe and per ha, increases with flock size.

PRODUCTION RECORDING

Stud-Book

The official production-recording scheme is run by the FSEA, which was founded in 1918. At present its statistics are based on returns from approximately 650 flocks, ranging in size from 3 - 350 breeding ewes and hoggets, with an average size of 18 ewes per flock, and representing ca. 16% of the sheep population (20).

The production-recording scheme was described by Inkovaara (22) and more recently by Owen (35). We are outlining here the up-dated requirements for entry in the Stud-Book.

It is convenient to divide sheep into flock sheep and stud sheep. Both are
pedigreed, but only the latter are registered in the Stud-Book (20). In order to qualify for inclusion in the Stud-Book, sheep have to reach one of the three classes in respect to Conformation (R), Wool (V), Weight (K), Fertility (S), and Litter weight at 5 months of age (Kt).

**Conformation.** Grades are subjective and special attention is paid to body length, back-line, legs, and fleshing (V- or U-shaped hindquarters).

**Wool.** Grades are subjective and attention is paid to fineness, density, luster or color, character, and uniformity over the body. Wool must be free of hairiness, kemp and so-called "screw-type" frills. Minimum fleece weights are 3.0 kg for rams and 2.0 kg for ewes, but allowance is made for litter size reared.

**Weight or size** is based on autumn weights, although occasionally certain measurements are also taken. The minimum weights (in kg) per class are as follows:

<table>
<thead>
<tr>
<th>Class</th>
<th>Under 2 years</th>
<th>Over 2 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>rams</td>
<td>ewes</td>
</tr>
<tr>
<td>I</td>
<td>65</td>
<td>50</td>
</tr>
<tr>
<td>II</td>
<td>60</td>
<td>45</td>
</tr>
<tr>
<td>III</td>
<td>50</td>
<td>40</td>
</tr>
</tbody>
</table>

Weight requirements were increased in 1958 and 1963. In comparison with the figures given by Inkovaara (22), the weights were raised in class I and II by 15 and 10 kg for rams and ewes, respectively.

**Fertility**

Class I. at least triplets born and reared at first lambing, or an average of 2.5 lambs per litter.

Class II. at least triplets born at first lambing, or an average of 2.0 lambs per litter.

Class III. at least twins born at first lambing, or an average of 1.5 lambs per litter.

**Litter weight adjusted to 5 months of age**

Class I. at least 75 kg per litter

Class II. at least 60 kg per litter

Class III. at least 45 kg per litter

**Color:** The sheep are to be of one color; white is preferred, but black, gray and brown are also accepted.

**Selection of young rams** is based on the performance of his dam and paternal grand-dam in respect to fertility and litter weight. Later the performance of his progeny is also taken into account.

In addition to the above three classes there are two special classes, Elite and Premium, to which entry standards are still higher. The minima for the highest class are given below:
Minima for Elite class

**Conformation**
- Class I
  - body length:
    - rams, 80 cm
    - ewes, 70 cm

**Wool**
- Wool count: 46's
- staples: uniform in length and fiber diameter limit, 6 μ
- run-out fleeces: must be covered with wool
- belly:

**Fleece weight (kg):**
- 46's-48's: Rams 4.0, Ewes 3.2
- 50's-56's: Rams 3.5, Ewes 2.8
- 58's-: Rams 3.0, Ewes 2.4

**Body weight**
- average of two consecutive years: rams, 80 kg; ewes 65 kg.

**Fertility**
- Rams: dam and paternal grand-dam must be class I; two sons must be class I and six daughters must be as good as their dams.
- Ewes: class I and must have two of her offspring in the Stud-Book.

**Litter weight**
- Rams: dam and paternal grand-dam must be flock average;
- Ewes: 60 kg in two consecutive years, but always above flock average.

Sheep Improvement Programme

In addition to the official Sheep Recording there is a Sheep Improvement Programme (SIP) devised and run by Mr. R. Kangasniemi, Animal Breeding Department, Agricultural Research Centre, Tikkurila. It started in 1970, with the full cooperation of the FSEA, and it is hoped that it will eventually cover all recording flocks. The aim of the SIP is twofold: to calculate breeding values for individual sheep, to be available to the breeder each year before the start of tupping; and to computerize the calculations and thus relieve the sheep instructors of unnecessary paper work.

The basic data for each flock are entered by sheep instructors onto three types of forms (see Appendix): Flock sheet, Ewes sheet and Lambs sheet. The forms are devised to have the data transferred directly onto a punch-card. The FSEA and sheep instructors receive full data for each flock, but the sheep farmer receives only (i) flock averages of his flock and all other flocks participating; and (ii) current individual performance of his ewes including each ewe’s deviation from the current averages of his flock in respect to: (a) total corrected weight of her litter at 5 months of age, (b) mean corrected weight of a lamb in her litter at 5 months of age, and (c) a selection index which includes age-corrected number of lambs born and of lambs alive at 2 weeks of age, together with adjusted mean weight of a lamb as under (ii b), weighted in favor of rate of growth.
The 5-month-weight corrections are for:
I. sex; within farm and year; mid-point between sexes; Note that 'sex' also includes nutritional and managerial factors specific to a given farm, such as post-weaning nutrition of ram-lambs and grazing of ewe-lambs;
II. type of birth and rearing: within-year, but pooled over all flocks;
III. age of lambs at 150 days: linear individual corrections;
IV. age of dam: within-year but pooled data over all flocks; 3-year-old dam.

It has been realized for some time that if more rapid progress is to be made, the size of flocks will have to be increased and more accurate parameters made available. The present official Sheep Recording is based on the total litter weight at 5 months of age; statistical analysis revealed (28) that it strongly favors selection for litter size but, as the emphasis is being shifted to selection for the rate of growth up to 5 months, it is considered that (ii b) is the best measurement of rate of growth, as it does not include the effect of litter size, and (ii c) is the best selection index (28). The SIP is still in the initial stages and will be developed more fully to include other factors, such as the milking ability of the ewe.

Progress

Because of changes in tabulating Sheep Recording returns, it is difficult to compare yearly averages. Thus, up to 1968 all returns were based on one age-group, viz. over one year old. Since 1968, two age-groups have been listed: under 2 years and over 2 years old. In the past, the litter weight was given at 6 months instead of at 5 months, as at present. In spite of these difficulties Mr. E. Hautakangas prepared a list, based on one age-group, and its abridged version (for 1948-1971) is given in Table 21. In spite of a 40% decrease in the number of flocks recorded, the number of rams and ewes increased by 34 and 184%, respectively. All production traits recorded improved by 16-44%. The highest yearly rates of improvement were in body weight (1.5-1.9%), followed by fleece weight (1.1-1.4%); the lowest were in litter size at birth and at 2 weeks of age (0.8-0.7% per year). Of course, it is impossible to know how much of this improvement was genotypic.

Table 21. Improvement in production between 1948 and 1971 (20)

<table>
<thead>
<tr>
<th></th>
<th>1948</th>
<th>1971</th>
<th>Difference</th>
<th>Per year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unit</td>
<td>(%)</td>
<td></td>
<td>(%)</td>
</tr>
<tr>
<td>Rams over 1 year old</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>320</td>
<td>430</td>
<td>+110</td>
<td>34</td>
</tr>
<tr>
<td>Average autumn weight</td>
<td>58.6</td>
<td>84.5</td>
<td>+25.9</td>
<td>44</td>
</tr>
<tr>
<td>Average fleece weight</td>
<td>2.7</td>
<td>3.6</td>
<td>+0.9</td>
<td>33</td>
</tr>
<tr>
<td>Ewes over 1 year old</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>4,150</td>
<td>11,801</td>
<td>+7,651</td>
<td>184</td>
</tr>
<tr>
<td>Average autumn weight</td>
<td>43.0</td>
<td>58.6</td>
<td>+15.6</td>
<td>36</td>
</tr>
<tr>
<td>Average fleece weight</td>
<td>2.1</td>
<td>2.7</td>
<td>+0.6</td>
<td>26</td>
</tr>
<tr>
<td>Average litter size</td>
<td>2.0</td>
<td>2.4</td>
<td>+0.4</td>
<td>20</td>
</tr>
<tr>
<td>Average litter size at 2 wks</td>
<td>1.9</td>
<td>2.2</td>
<td>+0.3</td>
<td>16</td>
</tr>
<tr>
<td>Average litter weight</td>
<td>48.6</td>
<td>65.3</td>
<td>+16.7</td>
<td>20</td>
</tr>
<tr>
<td>Average lamb weight</td>
<td>25.7</td>
<td>31.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of flocks</td>
<td>1,071</td>
<td>645</td>
<td>-426</td>
<td>-40</td>
</tr>
</tbody>
</table>

* at 6 months of age;
** at 5 months of age.
The weights of a litter cannot be compared as they are based on 6-month and 5-month weights; however, it is clear that here too there was a substantial improvement.

The figures for 1971 in Table 21 are based on one age-group and therefore they are not comparable with statistics given in previous tables.

**EXPORT OF FINNSHEEP**

The 24 countries which imported the Finnsheep directly from Finland since 1962 are listed in Table 22. In addition, the U.S.A. and New Zealand imported the Finnsheep from Ireland, Canada and Great Britain. There are still other countries which imported Finnsheep crosses, such as Cadzow Improvers. A glance at the list shows the variety of climatic, socio-economic and husbandry conditions under which the Finnsheep are being tested. Although the conditions differ greatly, the aim is common, viz. to increase the number of lambs reared per ewe so that meat production can be rapidly and economically intensified. As with any new development, it is natural that a number of problems will have to be solved before the new production methods can be put into commercial practice. Time is important and pooled experience should be of mutual benefit. Should not a special body be formed for this purpose?

The huge potential of sheep for meat production can be easily developed and therefore ought to be developed as rapidly as possible, so that the sheep can become one of the major animal protein producers in the world. The problem is international and should be tackled accordingly.

**ACKNOWLEDGMENTS**

It is a pleasure to thank all those who, by supplying information, unpublished data and records, made the study possible: my host Prof. Kalle Maijala, Director, Animal Breeding Department. Agricultural Research Centre, Tikkurila; Mr. R. Kangasniemi, B. Agr. Sc., Assistant at the above Department; Mr. N. Inkovaara, M. Agr. Sc., President, and Mr. E. Kautakangas, B. Agr. Sc., Managing Director, The Finnish Sheep Breeders' Association, Helsinki; Dr. Per Andersson, State Veterinary Medicine Institute; Miss Ulla Paaskunta, B. Agr. Sc., of Timari; Mrs. Pirikki Anttila, B. Agr. Sc., of Anttila; and Mr. and Mrs. B. Frisk of Peksala.

I am also indebted to Mrs. Liisa Lindberg for fluent translations from Finnish books and articles.

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For reading the manuscript or parts thereof, and valuable suggestions, I am much obliged to Prof. K. Maijala, Mr. R. Kangasniemi and Mr. E. Hautakangas.

To all others who in one way or another made my stay in Finland a pleasant and enjoyable experience, I express my sincere thanks.
Table 22. Export of Finnsheep, 1962 – 1972 (M = males, F = females)

<table>
<thead>
<tr>
<th>Country</th>
<th>First year</th>
<th>Subsequent years</th>
<th>Total number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year</td>
<td>M (number)</td>
<td>Years</td>
</tr>
<tr>
<td>Algeria</td>
<td>'69</td>
<td>2 25</td>
<td>69,70,71</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>70</td>
<td>3 5</td>
<td>69</td>
</tr>
<tr>
<td>Canada</td>
<td>68</td>
<td>53 177</td>
<td>69,70,71</td>
</tr>
<tr>
<td>Ceylon</td>
<td>69</td>
<td>2 2</td>
<td></td>
</tr>
<tr>
<td>Czechoslovakia</td>
<td>71</td>
<td>10 21</td>
<td></td>
</tr>
<tr>
<td>Cyprus</td>
<td>72</td>
<td>6 22</td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>65</td>
<td>1 7</td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td>72</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>64</td>
<td>2</td>
<td>66</td>
</tr>
<tr>
<td>Germany, East</td>
<td>67</td>
<td>3</td>
<td>68,71</td>
</tr>
<tr>
<td>Germany, West</td>
<td>65</td>
<td>4 15</td>
<td>68,69,70</td>
</tr>
<tr>
<td>Holland</td>
<td>67</td>
<td>2</td>
<td>70,71</td>
</tr>
<tr>
<td>Hungary</td>
<td>69</td>
<td>11 37</td>
<td>71,72</td>
</tr>
<tr>
<td>Ireland</td>
<td>65</td>
<td>25 52</td>
<td></td>
</tr>
<tr>
<td>Israel</td>
<td>70</td>
<td>6</td>
<td>71</td>
</tr>
<tr>
<td>Italy</td>
<td>72</td>
<td>1 2</td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>67</td>
<td>7</td>
<td>72</td>
</tr>
<tr>
<td>Portugal</td>
<td>69</td>
<td>4 12</td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td>68</td>
<td>5 20</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>64</td>
<td>2</td>
<td>65,66,68,69,70</td>
</tr>
<tr>
<td>Switzerland</td>
<td>68</td>
<td>1 9</td>
<td></td>
</tr>
<tr>
<td>United Kingdom</td>
<td>62</td>
<td>5 10</td>
<td>64,65,67</td>
</tr>
<tr>
<td>U.S.S.R.</td>
<td>71</td>
<td>5 10</td>
<td>72</td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>66</td>
<td>13 62</td>
<td></td>
</tr>
</tbody>
</table>

Total 380 1,471 1,851
REFERENCES AND PERSONAL COMMUNICATIONS

22. Inkovaara, N. (1943) [Sheep Husbandry] Pellervö-Seura, Helsinki. (in Finnish)
Form 1.

FLOCK SHEET

1. Recording year ____________
2. Flock’s Code Number ____________
3. Owner ____________
4. Address ____________
5. Agric. District Number ____________
6. Number of all ewes at mating ____________
7. Number of ewe-lambs ____________
8. Number of ewe-lambs not mated ____________
9. Number of rams used ____________

TUPPING

<table>
<thead>
<tr>
<th>Rams</th>
<th>Ear-tag No.</th>
<th>Pedigree No.</th>
<th>Name</th>
<th>No. of ewes per ram</th>
<th>From Day</th>
<th>Month</th>
<th>To Day</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
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Notes:

* On nutrition, condition of ewes at tupping, special problems, etc.
EWES SHEET (to be filled in, after lambing, by ram-group)

Flock No. and Owner

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<thead>
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<th>Identification data for a ram and ewes</th>
<th>LAMBING</th>
<th>RAM &amp; EWES</th>
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<td>DAM</td>
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<tr>
<td>d</td>
<td>m</td>
<td>kg</td>
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<td>← - SIRE OF LAMBS ← - →</td>
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<tr>
<th>LAMB'S NUMBER</th>
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<td>DATE OF BIRTH</td>
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<tr>
<td>$\sigma^2 = 1; \varphi = 2$ SEX</td>
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<td>6-WEEK WEIGHT</td>
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