ON FARM EVALUATION OF A TURNIP CROP AND A MAIZE CROP FOR AUTUMN/WINTER FINISHING OF JAPANESE TRADE HEAVY STEERS

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SUMMARY

Economic analysis of an on-farm feeding system showed that a turnip crop can be profitable for fattening Japanese trade heavy steers but that returns would be sensitive to crop yield and winter price premium. Maize silage was not profitable with the yields achieved in this study.

A 10 t/ha turnip crop and an 8.3 t/ha maize crop were grown on a property in South Gippsland, Victoria. In autumn, 48 Hereford x Simmental 2 year-old steers were allocated to 4 treatments; pasture only (PP), pasture then maize silage (PM), turnips only (T), turnips then maize silage (TM).

During the period March-May turnips were grazed and produced steer liveweight gain significantly faster (0.67 kg/day) than did steers on pasture (0.22 kg/day). Most of this difference occurred in the second half of the period when steers on turnips gained 1.22 kg/day compared with 0.52 kg/day for steers on pasture.

During the period June-August maize crop residue was grazed, then maize silage was self fed resulting in an estimated mean carcass gain of 0.38 kg/day for both TM and PM steers. TM steers had significantly higher cold P8 fat depth, cold 10/11th rib fat and marbling score than PM steers. Both maize groups had significantly more liveweight gain than the pasture only group, which lost weight.

Keywords: turnips, maize, fodder crops, steers, model.

INTRODUCTION

Abattoirs in Victoria wishing to supply a consistent product to Japan are faced with a shortage of suitable steers in late autumn and winter. To supply suitable steers at this time requires summer and autumn feed supplementation because steers grazing dry summer pasture usually have insufficient fat cover to meet Japanese market specifications (12 to 20 mm P8 fat).

The profitability of alternative strategies for a specific steer fattening enterprise was examined using a simulation model (Beef-n-omics, NSW Dept Agric) and South Gippsland pasture growth rate data (McRae and Earnst 1989). One promising strategy involved growing a turnip crop on 3% of the grazing area, increasing steer purchases by 4% and fattening 10% of steers (which otherwise would have to go through a second winter) by grazing the turnips and selling at a winter premium of 15% over summer price. A turnip yield of 10 t/ha was estimated to increase the gross margin over the whole grazing area by approximately $10/ha, equivalent to $330 per hectare of crop. A simulation with a maize crop of 15 t/ha on 2% of the land and made into silage was estimated to have similar profitability. Steers were assumed to gain 0.7 kg/day on turnips and 0.8 kg/day on maize silage.

The aim of this trial was to test the assumptions of crop yield and animal performance used in the model.

MATERIALS AND METHODS

crops

On 21 November 1990, 8 ha of turnips (4 ha Mammoth Purple Top (MPT) and 4 ha of Barkant) were sown. Due to poor germination 1.2 ha of the MPT area was resown to Barkant on 2 January 1991. Two ha of maize (1 ha cv. SR73, 1 ha cv. SR103) were sown on 30 November 1990. Crop yields are shown in Table 1. Maize was harvested for silage on 14 May 1991. Additives during the ensiling process were 1.4% urea, 0.5% limestone, 0.25% common salt and 0.01% sulfur. Maize crop yield was assessed from the volume of the silage stack and a density measurement. In vitro digestible dry matter (DDM) and nitrogen (N) % was determined for the turnip crop and standing maize on 18 July 1991, and for the maize silage on 8 July 1991 (Table 1).

Animals

On 28 February 1991, 48 Hereford x Simmental steers, selected from a larger group of 65 (heaviest and lightest removed) were weighed and assessed for fatness by a ‘CALM’ assessor. Steers were allocated to a ‘lean’ or ‘medium’ fat group, ranked on liveweight, then randomly assigned to 4 treatments. These were: pasture only (PP), pasture then maize silage (PM), turnips only (T), turnips then maize silage (TM).
During period 1 (28 February-28 May) TM and T steers (total number 24), together with 39 other steers, had access to pasture and turnips for 1 week and then grazed on turnips alone at a stocking rate of 7.9 steers/ha. Stock were controlled by an electric fence which was shifted every 6 days. For the last 40 days on turnips steers also received hay at 2 kg/head/day. During period 1, PP and PM steers grazed pasture at approximately 1.6 steers/ha, the usual stocking rate for heavy steers on the property. At the end of period 1 the fattest 5 T and 5 PP steers on ‘CALM’ assessment were slaughtered to ascertain carcass characteristics.

During period 2 (28 May-15 August) TM and PM steers grazed maize crop residues for 17 days, then had access to a self fed maize silage stack and pasture for 62 days. A feeding barrier was moved at 3 day intervals to provide ad libitum intake. All carcass measurements were made by Ausmeat trained staff using the official Ausmeat chiller assessment method.

RESULTS

Crop yields and feed analyses are shown in Table 1.

<table>
<thead>
<tr>
<th>Date measured</th>
<th>Crop</th>
<th>Leaf DM (t/ha)</th>
<th>Bulb DM (t/ha)</th>
<th>Mean DM (t/ha)</th>
<th>Mean DDM (%)</th>
<th>Mean N (%)</th>
<th>Crop costs c/kg DMV</th>
<th>Crop costs A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.ii.91</td>
<td>Barkant</td>
<td>6.7</td>
<td>8.8</td>
<td>17.7</td>
<td>15.5</td>
<td>—</td>
<td>—</td>
<td>1.9</td>
<td>4.4</td>
</tr>
<tr>
<td>22.ii.91</td>
<td>MPT</td>
<td>5.4</td>
<td>7.0</td>
<td>17.5</td>
<td>12.4</td>
<td>—</td>
<td>—</td>
<td>(1.0)</td>
<td>(3.3)</td>
</tr>
<tr>
<td>18.iv.91</td>
<td>Resown Barkant</td>
<td>3.2</td>
<td>4.4</td>
<td>10.1</td>
<td>7.6</td>
<td>92.4</td>
<td>2.1</td>
<td>13.6</td>
<td>16.7</td>
</tr>
<tr>
<td>18.iv.91</td>
<td>MPT</td>
<td>1.2</td>
<td>4.5</td>
<td>10.8</td>
<td>5.7</td>
<td>94.1</td>
<td>1.8</td>
<td>(11.3)</td>
<td>(14.0)</td>
</tr>
<tr>
<td>8.vii.91</td>
<td>Maize silage</td>
<td>—</td>
<td>—</td>
<td>25.5</td>
<td>8.3</td>
<td>69.0</td>
<td>1.8</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

*Costs based on a mean turnip yield of 10 t/ha. Cost A includes all tractor sowing, harvesting and silage making. Cost B includes cost A + pasture resowing. Values in brackets exclude tractor overhead costs.*

During period 1 steers on turnips had significantly ($P < 0.05$) greater mean liveweight gain (0.67 kg/day) than steers on pasture (0.22 kg/day). Most of the difference occurred in the second half of the period when steers on turnips gained 1.29 and 1.16 kg/day and steers on pasture gained 0.57 and 0.48 kg/day (Fig. 1).

Steers grazing on turnips in period 1 tended to have more P8 fat (Table 2) but the difference was not significant ($P > 0.05$).

During period 2, steers on maize silage had significantly ($P < 0.05$) higher liveweight gain (TM 0.42 kg/day, PM 0.63 kg/day) than steers on pasture (PP) which had lost 0.50 kg/day. Most of the gain occurred during the last 38 days on maize silage (TM 0.54 kg/day, PM 0.88 kg/day). The estimated carcass gain for both silage groups was approximately the same at about 30 kg or 0.38 kg/day. TM steers had significantly higher cold P8 fat depth (+2.8 mm), cold 10/11th rib fat (+3.7 mm), and marbling score (+0.58) than PM steers. Eighty per cent of TM and 60% of PM steers met the minimum Japanese trade requirement for P8 fat of 12 mm. All carcass measurements used Ausmeat chiller assessment standard, mean values are shown in Table 2.

DISCUSSION

Turnip yield and steer performance on turnip and maize silage was very similar to the figures initially used in the model, but maize yield was much lower. A partial budget using actual stock performance and prices achieved, and using the Beef-n-omits model prediction of an overall increase of 4% carrying capacity, indicated an increase in gross margin of $1270 per 100 ha of grazing containing 3 ha of turnips. The extra income was $895 from 20 steers fattened on turnips and sold in May at 129 c/kg rather than November at 114 c/kg; plus $1670 gross margin from 8 extra steers carried. The extra costs were $555 for turnip sowing and $760 for pasture resowing. However, the gross margin is very sensitive to crop yield, the winter price premium received and the model prediction of extra stock sold. For example, the simulation model suggests that a crop yield of only 6.5 t/ha would halve the benefit.
Table 2. Carcass attributes at the end of period 1 of the 5 fattest steers from each treatment of pasture (PP), turnips (T), and at the end of period 2 of all steers from treatments of pasture then maize silage (PM) or turnips then maize silage (TM)

<table>
<thead>
<tr>
<th></th>
<th>End of period 1 (28 May)</th>
<th>1.s.d. (P&lt;0.05)</th>
<th>End of period 2 (15 August)</th>
<th>1.s.d. (P&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dressing out percentage</td>
<td>55.5</td>
<td>56.2</td>
<td>6.0 n.s.</td>
<td>56.2</td>
</tr>
<tr>
<td>Carcass weight (kg)</td>
<td>347.0</td>
<td>384.1</td>
<td>32.4*</td>
<td>370.5</td>
</tr>
<tr>
<td>P8 fat depth mm (hot)</td>
<td>8.8</td>
<td>121.4</td>
<td>3.6 n.s.</td>
<td>12.2</td>
</tr>
<tr>
<td>P8 fat depth mm (cold)</td>
<td>8.6</td>
<td>11.6</td>
<td>3.2 n.s.</td>
<td>11.2</td>
</tr>
<tr>
<td>10/11th rib fat</td>
<td></td>
<td></td>
<td>8.5</td>
<td>12.5</td>
</tr>
<tr>
<td>Fat colour (O-9)</td>
<td>4.8</td>
<td>4.2</td>
<td>1.6 n.s.</td>
<td>4.7</td>
</tr>
<tr>
<td>Meat colour (1-9)</td>
<td>2.4</td>
<td>2.2</td>
<td>0.8 n.s.</td>
<td>1.5</td>
</tr>
<tr>
<td>Marbling (1-6)</td>
<td>1.0</td>
<td>1.0</td>
<td>0 n.s.</td>
<td>1.46</td>
</tr>
</tbody>
</table>

*P = 0.05; n.s., not significant.

The budget also assumes that the turnip area is successfully resown to pasture before winter, and is equal in production to the original pasture by the following year.

The substantial decline in turnip crop yield from 22 February to 18 April was probably due to leaf deterioration and bulb rot. The mean yield of 10 t/ha was similar to district yields in 1991 previously reported (P. Notman pers. comm.).

It was calculated that 20.8 kg of turnip dry matter was offered per kilogram of liveweight gain achieved. Since there was little crop residue, greater animal performance would have been expected, based on feeding standards (Anon. 1975) and the high feeding value of the turnips (Table 2). The lower performance of stock may have been due to poor initial adaptation to the crop. In a number of experiments sheep and cattle have taken 4 weeks or more to adapt when transferred from pastures to brassica crops (Scott et al. 1984). Techniques to minimise this problem need investigation.

The Hereford x Simmental steers on turnips did not quite reach Japanese trade requirements for P8 fat depth in this study, although an earlier maturing steer genotype is likely to do so.
Further fattening on maize silage gave significant improvements in fat depth and, for the TM group in particular, marbling. However, the cost per kilogram of maize silage dry matter in this study was high (Table 1). Higher yields, as initially used in the model, would be needed to make maize silage an economic proposition.

This trial suggests that the growing of a turnip crop as a feed source for the supply of steers out of season can be profitable, particularly if the crop is part of a pasture improvement program. Grazing turnips should also result in improved fat depth and marbling in steers destined for further fattening.

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