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Development of a management system to intensify and increase beef production in a range suckler herd in Israel - "the Amaziah project"

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ABSTRACT

East-Mediterranean natural pastures are characterised by extreme seasonal variation in nutritional value. High quality green standing pasture is available only during the rainy season (Dec.-May), whereas during the rest of the year the standing pasture is dry and of low quality.

The main objective of this study was to investigate the potential of increasing weaning rates and weaning weights on a commercial beef suckler herd under the above conditions. The main 3 means to achieve this were: (i) Increased stocking rate, (ii) Intensive trough-feeding, during the dry pasture season, of rations based on recycled wastes, and (iii) short calving periods.

Main input/output data in the 1st and 10th year of the study, respectively, were as follows: herd size: 424, 624 cows; stocking rate: 0.19, 0.29 cow/ha of pasture; trough-fed ration: 1, 2 metric tons DM/cow/year; energy in trough-fed ration: 7.5, 8.8-9.6 MJ/kg DM; percent cows calving in the first 2 months of the calving season (Aug. + Sept.): 35, 89; percent cows weaning (of exposed to mating bulls): 73, 86; avg. calf weaning weight 206, 259 kg LW; total weaned calf crop: 64, 138 metric ton LW/year. These data present a potential model for improving the efficiency and increasing the volume of range beef production under Mediterranean-type pasture conditions.

Studies are in progress on intensive beef production (i) by suckler herds in full confinement - fed year-round on rations composed mainly of recycled wastes, (ii) by dual-purpose cattle - in dairy herds under milk quotas, and (iii) under desert conditions based on grazing or trough-feeding forage irrigated with saline water and/or purified recycled sewage water.

Keywords: Beef production; suckler herds; feeding recycled wastes; reproductive management; grazing management; feeding management.

INTRODUCTION

Annual beef consumption in Israel is close to 60,000 metric tons of boneless carcass. About 60% of it is imported frozen and only 40% is produced domestically. About 75% of domestic production originates from the dairy herds - ca 110,000 high yielding Israeli-Holstein dairy cows in full confinement. The other 25% is from range herds - ca 45,000 suckler cows of mixed beef breeds. The overall number of range cows is limited by the relatively small area presently available for grazing - ca 130,000 ha of natural pastures.

The objective of saving foreign-currency on beef imports, and the need to diversify and add income sources from agriculture, led to the initiation of a comprehensive long term research and development programme to increase domestic beef production in Israel. Intensive production in range suckler herds, grazing on natural pastures, is one of the systems investigated.

The semi-arid east-Mediterranean region is characterised by strictly seasonal rainfall confined to only 5-7 autumn and winter months. The long dry season results in a long period of low quality dry standing pasture containing ≤7.2 MJ of metabolisable energy (ME) and 60g of crude protein (CP) per kg of dry matter (DM). Abundance of high quality green standing pasture (≥10.5 MJ and 140 g CP per kg DM) is available only during ca 4 winter and spring months (mid-January through mid-May). (Gutman, 1978; Weitz, 1981; Bruckental et al., 1984; A. Perevolotzki, unpublished data).

The long season of low quality pasture impaired production of beef herds despite some protein and energy supplementation, low calving rates and weaning weights, and extended calving periods - characteristic of suboptimally fed beef herds - were common in Israel during the 1970’s (Lehrer and Schindler, 1984). Adopting Wiltbank’s (1971, 1972) concept under Israeli beef herd conditions, Lehrer and Schindler (1984) demonstrated the increase in pregnancy rates and weaning weights as a result of short calving periods which were attained by improved nutrition. The subsequent stage of the work was aimed at testing a further intensified management system which integrated the following 3 main components: (i) a short, late summer/early autumn calving period, (ii) increased stocking rate, (iii) trough-feeding, during the dry pasture season, of total mixed rations (TMRs) composed mainly of recycled wastes. The specific objectives of the work were: to implement the intensified reproductive management (Lehrer and Schindler, 1984) in another commercial herd, by gradual shortening of the calving period over several years; to test intensified grazing and trough-feeding management systems which would cater for the nutritional requirements of the dams, under the intensified reproductive management; and to determine the changes in production and economic variables as a result of implementing the overall intensified management system. Results obtained over a 10 year work period are presented in this report.

MATERIALS AND METHODS

Most of the work was conducted on a commercial beef herd at Moshav Amaziah, a co-operative village about 40 km

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south-west of Jerusalem. The herd of ca 400-600 head, subdivided into groups of ca 150-250 head/group were rotationally grazed on ca 2,200 ha of natural pastures, mainly hill slopes at elevations ranging from ca 200-350 m above sea level.

During the dry pasture season - when dams were in last trimester of pregnancy through to mating - trough-fed TMRs were provided ad lib. Examples of TMRs, for late pregnant non-lactating and for nursing cows, are presented in Table 1. Freshly prepared TMRs were provided either daily or once in 2 days. No trough feeding took place during the green pasture season.

Dams were of mixed breeds, predominantly varying ratios of Simmental X Hereford crosses. Maiden heifers and first calves were mated naturally with Simmental X Hereford bulls; Heifers born to these matings were used as replacements. Second and subsequent calves were mated naturally with pure-bred or cross-bred Charolais bulls to produce terminal offspring.

Weaning of 6-10 month old calves was timed to coincide with withering of the green pasture. Weaning date varied among years (between the end of April through the beginning of June) depending mainly on pasture quality.

Data were collected and analysed on amounts, composition, and the nutritional value of TMRs in the daily fed groups, calving dates, cow/calf affiliations, and weaning liveweights (LW). In addition, one of the herd subgroups was used to determine the annual pattern of LW changes of the cows and calf crop, cow body-condition score (BCS in a scale of 1-5), and luteal ovarian cyclicity of the suckling dams at the start of the mating period (based on plasma progesterone concentrations in 3 consecutive once weekly plasma samples). All details of costs, expenses and income were collected and analysed.

Additional subjects investigated, beyond the scope of this report, were post-weaning management of replacement heifers to first calving at ca 2 years of age, feed lotting of the weaned calf crop to slaughter LW of 400-450 kg at 14-16 months of age, and seasonal changes in pasture quantity, nutritional value and estimated intake.

The multidisciplinary approach, professional involvement, data collection and analysis methods, and procedures of team decision making, were similar to those practised by the "Farm Monitor Groups" in New Zealand (Webby and Sheath, 1991).

RESULTS AND DISCUSSION

Annual profiles of dam net maternal LW and BCS relative to pasture condition, and to weaning, calving, and subsequent mating periods, are presented in Figure 1. Net maternal LW and BCS declined simultaneously with the decline in pasture quality, throughout the last trimester of pregnancy and the subsequent postpartum and mating periods, not withstanding the trough-feeding of TMRs. Live weight and BCS were gained during the green pasture season, reaching their annual peaks at the end of this season (Kahn et al., 1987 and unpublished data).

Despite the LW and BCS losses, post-partum ovarian cyclicity by the start of the mating period was resumed in >80% of the suckling cows, and pregnancy rates after 90-100 d mating periods were >90%. These high rates of ovarian activity and pregnancy were achieved provided that, on average, LW at the beginning of the mating period was ≥85%

FIGURE 1: Annual profiles of mean liveweight and body condition score of beef cows, relative to pasture condition, and to weaning, calving, and to weaning and subsequent mating periods at Moshav Anaziah beef herd, Israel.

TABLE 1: Examples of daily TMRs for a late pregnant, non-lactating (A), and a suckling (B) beef cow.

<table>
<thead>
<tr>
<th>Component</th>
<th>kg as fed</th>
<th>DM</th>
<th>ME (MJ) as per kg DM</th>
<th>Total</th>
<th>%</th>
<th>(g)</th>
<th>cost (1993 US $)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Late pregnant non-lactating cow</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artichoke foliage silage</td>
<td>12</td>
<td>3.6</td>
<td>8.4</td>
<td>30.2</td>
<td>5.0</td>
<td>180</td>
<td>0.18</td>
</tr>
<tr>
<td>Poultry litter + citrus peels silage</td>
<td>8</td>
<td>3.6</td>
<td>8.4</td>
<td>30.2</td>
<td>21.9</td>
<td>790</td>
<td>0.21</td>
</tr>
<tr>
<td>Dry standing pasture (estimated intakes) or wheat straw</td>
<td>2</td>
<td>1.8</td>
<td>6.7</td>
<td>12.1</td>
<td>1.9</td>
<td>25</td>
<td>0.10</td>
</tr>
<tr>
<td>Total/cow/day</td>
<td>-</td>
<td>9.0</td>
<td>8.1</td>
<td>72.5</td>
<td>11.2</td>
<td>1,005</td>
<td>0.49</td>
</tr>
<tr>
<td>NRC (1994) recommendations</td>
<td>-</td>
<td>9.5</td>
<td>7.3</td>
<td>69.4</td>
<td>7.0</td>
<td>661</td>
<td></td>
</tr>
<tr>
<td><strong>B. Suckling cow</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artichoke foliage silage</td>
<td>20</td>
<td>6.0</td>
<td>8.4</td>
<td>50.4</td>
<td>5.0</td>
<td>300</td>
<td>0.30</td>
</tr>
<tr>
<td>Poultry litter + citrus peels silage</td>
<td>8</td>
<td>3.6</td>
<td>8.4</td>
<td>30.2</td>
<td>21.9</td>
<td>790</td>
<td>0.21</td>
</tr>
<tr>
<td>wheat hay</td>
<td>3</td>
<td>2.7</td>
<td>9.1</td>
<td>24.6</td>
<td>10.0</td>
<td>270</td>
<td>0.24</td>
</tr>
<tr>
<td>Total/cow/day</td>
<td>12.3</td>
<td>8.6</td>
<td>10.5</td>
<td>105.2</td>
<td>11.1</td>
<td>1,360</td>
<td>0.75</td>
</tr>
<tr>
<td>NRC (1994) recommendations</td>
<td>10.8</td>
<td>9.6</td>
<td>10.4</td>
<td>114.2</td>
<td>11.1</td>
<td>1,194</td>
<td></td>
</tr>
</tbody>
</table>

1 Other commonly used components are: various vegetable foliage, cobless green maize-stalks, fresh citrus peels.
of the preceding annual peak LW, and BCS at the beginning of the mating period was ≥2.5. (Kahn and Lehrer, 1984 and unpublished data).

The changes in input, output, and economic variables over the 10 year report period are presented in Table 2. It can be seen that about 50% increase in stocking rate (as a result of about a 50% increase in the number of cows on about the same pasture area) was accompanied by about a 2 fold increase in annual cost of trough-feeding/cow resulted in 50% increase in stocking rate - mainly during the green pasture season, and by grazing (following proper agrotechnical development) within presently ungrazeable afforested and natural scrub areas. In our opinion, alternative potential sources should be investigated, for example intensive beef production (i) by suckler herds in full confinement - fed year-round on TMRs composed mainly of recycled wastes, (ii) by dual-purpose cattle - in the dairy herds all of which in Israel are under milk quotas, and (iii) under desert conditions based on grazing or trough-feeding of forage irrigated with saline water and /or recycled purified sewage water. Studies in all directions mentioned above are currently in progress.

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