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Yield, quality and ecologically balanced utilisation of semi-natural grasslands on coastal areas of Estonia

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Abstract

The larger areas of species-rich coastal meadows are situated in the western part of Estonia and on the islands of the western coast. Salt marshes of the Baltic Sea are mostly not natural biotopes. They have developed during a long period of agricultural use, mainly by grazing of beef cattle and sheep. The coastal meadows, in comparison with organic sown grasslands in the same area, were studied in 2001 (four research areas) and in 2002 (ten areas). The plant material was analysed for crude protein, acid detergent fibre, neutral detergent fibre, P, K, Ca, Mg. The hay DM-yield ranged from 6.3 g m\(^{-2}\) in the plant association dominated by Juncus gerardii to 330 g m\(^{-2}\) in a grass sward rich in Festuca rubra. The content of mineral elements (P, Mg, K) in hay was quite low, and the digestibility values ranged between 57 % in case of Phragmites australis, and 68 % in the plant association dominated by Juncus gerardii. Low digestibility is due to a high content of acid detergent fibre in the fodder.

Keywords: coastal grasslands, soils, productivity, hay quality

Introduction

Traditionally large areas of seashore meadows and islands were grazed and mown, so that valuable plant associations, rich in species, developed. During the last ten years, due to the development of ecological agriculture in Estonia, the number of agricultural producers (especially smaller family farms), interested in improving the use of semi-natural grasslands for animal production, has increased significantly. According to the publication of the Statistical Office of Estonia (Agriculture, 2002) the total average area of semi-natural grasslands (grazed or cut) in the last four years (1998-2001) extended to 149,740 ha, with an average DM yield approximately 1400 kg ha\(^{-1}\). About 54 % of this area was mainly grazed (the average DM yield being about 1350 kg ha\(^{-1}\)), 41 % was used for haymaking (1400 kg DM ha\(^{-1}\)), and 5 % was cut for making silage and fresh fodder (1800 kg DM ha\(^{-1}\)). It is essential to continue the traditional utilisation of coastal meadows to preserve the biodiversity of the area. However it should be economically profitable for the farmers to run and manage these areas. The quality of fodder is an important factor for farms which use the coastal areas for grazing. The aim of this investigation was to analyse the quality of the grass on coastal grasslands and compare it with that of sown grasslands.

Materials and methods

The farm studied was Ristitee, in South-Eastern Hiiumaa, which has total area of 544 ha, of which approximately 350 ha comprises coastal meadows. This area has been divided into 3-7 parts. It is grazed by horses (55) and beef cattle (total 66, incl. 3 pedigree Scottish Highland cattle) making a total of about 100 animal units. Thus, the grazing intensity is quite low and varies over the area, depending on the productivity of the meadows. In some places the grazing has not been intensive enough to control the spread of reeds (Phragmites australis). The growing seasons during the experiment differed: the year 2001 was quite humid and therefore favourable for intensive grass growth, but in 2002 it was very hot and dry. Due to extensive grazing there was no serious grass shortage in the coastal meadows, even in 2002.
The researched coastal meadows were grouped by their management and the dominant species (Table 1).

Table 1. The types of grasslands studied.

<table>
<thead>
<tr>
<th>No of research area</th>
<th>Type of grassland</th>
<th>Use of grassland</th>
<th>Dominating species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sown grassland</td>
<td>Cutting, grazing</td>
<td>Trifolium pratense, Elssegia repens, Phleum pratense, Dactylis glomerata, Alopecurus pratensis, Dactylis glomerata, Festuca pratensis</td>
</tr>
<tr>
<td>2</td>
<td>Sown grassland (old)</td>
<td>Grazing, partly not used</td>
<td>Juncus gerardi, Phleum pratense</td>
</tr>
<tr>
<td>3</td>
<td>Coastal pasture</td>
<td>Grazing</td>
<td>Juncus gerardi, Festuca rubra</td>
</tr>
<tr>
<td>4</td>
<td>Coastal meadow</td>
<td>Grazing</td>
<td>Phragmites australis association</td>
</tr>
<tr>
<td>5</td>
<td>Phragmites australis association</td>
<td>Graded or not used</td>
<td></td>
</tr>
</tbody>
</table>

The herbage in each research area was cut in four replicates (plots 6 m²) twice per season, weighed and a subsample (1 kg) was taken to estimate the DM yield. A subsample taken for botanical analysis was sorted/grouped by species and weighed separately. The plant material was analysed for crude protein (CP), acid detergent fibre (ADF), neutral detergent fibre (NDF), P, K, Ca and Mg. The digestible DM (DDM = 88.90 - (0.779*ADF), %), the DM daily intake (DMI = 120/NDF, % of cattle weight), the relative feed value (RFV = (DMI*DDM) / 1.29, points) and the metabolizable energy (ME) content were calculated on the bases of ADF and NDF (National Research Council, 2001). Data were statistically analysed by ANOVA, and the Least Significant Differences (LSD0.05) are presented.

Results and discussion

The special ecological value of salt marshes was found in the rich and very specialised vegetation, in these areas which have been traditionally grazed. The most common plant associations in the studied coastal meadows were Clauco-Juncetum gerardii and Festucetum rubrae with its subassociations of Agrostidetum stolonifera and Festuco-Caricetum nigrae. The most widespread species were Festuca rubra and Juncus gerardi, comprising up to 71 % and 73 % in the examined plant associations, respectively. The proportion of other species varied widely in different research areas. One of the studied coastal meadows had a remarkably high content (16 %) of legumes in its botanical composition, including Lotus corniculatus, Trifolium pratense, Trifolium maritimum and Trifolium repens in their plant associations. The most prevalent species in sown grasslands were Trifolium pratense, Phleum pratense and Elssegia repens (Table 1). The hay DM-yield ranged from 630 kg ha⁻¹ in the plant association dominated by Juncus gerardi to 3300 kg ha⁻¹ in the grass sward rich in Festuca rubra.

Traditionally plant associations in coastal meadows have been used for grazing for a long time due to the stable quality of feed and good animal performance. Herbage quality for fodder was found to be low in the plant association dominated by Phragmites australis but was relatively high in the sward rich in Juncus gerardi (Table 2). The content of mineral elements (P, Mg, K) in hay was also quite low and digestibility was low to satisfactory, ranging from 57 % in the case of Phragmites australis, to 68 % in the plant association which included mainly Juncus gerardi (51 %). This plant association had also a high energy content, containing 10.8 MJ kg⁻¹ of metabolizable energy. Low DM digestibility was due to a high content of acid detergent fibre in the fodder, samples of reed and an ungrazed meadow dominated by Alopecurus pratensis and Elssegia repens having the highest values.
Table 2. Nutritive value of grass from cultural and semi-natural grasslands.

<table>
<thead>
<tr>
<th>No. of research area</th>
<th>CP (g kg⁻¹ DM)</th>
<th>ADF (g kg⁻¹ DM)</th>
<th>NDF (g kg⁻¹ DM)</th>
<th>DDM (%)</th>
<th>DMI (%)</th>
<th>RFV (points)</th>
<th>ME (MJ kg⁻¹ DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.6</td>
<td>31.9</td>
<td>54.3</td>
<td>64.0</td>
<td>2.2</td>
<td>109</td>
<td>10.1</td>
</tr>
<tr>
<td>2</td>
<td>9.8</td>
<td>32.2</td>
<td>63.0</td>
<td>58.4</td>
<td>1.9</td>
<td>86</td>
<td>9.0</td>
</tr>
<tr>
<td>3</td>
<td>10.0</td>
<td>26.9</td>
<td>55.5</td>
<td>67.9</td>
<td>2.2</td>
<td>114</td>
<td>10.8</td>
</tr>
<tr>
<td>4</td>
<td>10.2</td>
<td>32.9</td>
<td>61.7</td>
<td>63.3</td>
<td>1.9</td>
<td>96</td>
<td>9.9</td>
</tr>
<tr>
<td>5</td>
<td>9.2</td>
<td>41.0</td>
<td>74.6</td>
<td>57.0</td>
<td>1.6</td>
<td>71</td>
<td>8.7</td>
</tr>
<tr>
<td>LSDₙₙₙₙ</td>
<td>2.3</td>
<td>4.6</td>
<td>5.4</td>
<td>3.5</td>
<td>0.16</td>
<td>8.7</td>
<td>0.6</td>
</tr>
</tbody>
</table>

When comparing the hay quality of different types of grassland, it is obvious that the *Phragmites australis* plant association had the lowest values. However, in addition to reed, cattle also had access to herbage of much higher quality – the associations rich in *Juncus gerardii*, or sown grasslands rich in valuable forage legumes and grasses. Such a mixed diet seemed to be very suitable for beef cattle and horses. The initial experience of using Scottish highland cattle on Ristitee farm for environmental conservation management of coastal meadows is also quite promising. The most restrictive factors to achieving high productivity from dairy cows are low productivity of such meadows, and low protein and energy contents of herbage.

**Conclusions**

Salt marshes of the Baltic Sea are not natural biotopes but they have been developed by traditional agricultural use, mainly by grazing beef cattle and sheep. The disintegration of collective farms since 1991 and insufficient development of private farms have led to decreasing numbers of cattle. The consequences of this can be changes in flora, the overgrowth of meadows, and the disappearance of many species that finally lead to the degradation of species-diverse coastal grasslands.

The quality of grass on coastal meadows varies very much, ranging from a low quality in the case of *Phragmites australis*, to a relatively high quality in the plant association dominated by *Juncus gerardii*. The nutrient content and fodder quality of semi-natural grasslands were similar to, or even better than, sown grasslands.

**References**