Growth Performance of Brown Swiss Calves Fed Early and Late Cut Hay from Meadow Fertilized by Two Levels of N and P$_2$O$_5$

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Abstract


To determine effects of rations mainly formed by early or late-bloom cut hay from meadows fertilized by N and P$_2$O$_5$ or not fertilized, on the growth performance, 20 female Brown Swiss calves (6-12 m) were fed for 129 days. Average daily weight gain, feed per unit weight gain and total intake of meadow hay were better for hay from meadows fertilized with N and P$_2$O$_5$ as compared to hay from not fertilized meadow. Similarly these parameters were better for calves fed early bloom hay than for calves fed late bloom hay. Application of N and P$_2$O$_5$ fertilizers and early cutting stage for meadow hay is suggested for providing better growth performance and feed efficiency traits of the Brown Swiss calves.

Keywords: Brown Swiss, calves, average daily gains, fertilization, cutting stage.

Introduction

Approximately half of the meadow and pasture areas and 1/3 of livestock raised in Turkey exist in mountainous Eastern Region of the country. Livestock production, especially cattle raising, is very common in the Eastern Region of Turkey, but, hay yields are fairly low. This shortage of forage hay production could be alleviated by fertilization of the meadow (Davison et al., 2000). Even though there are numerous reports on the effects of fertilizers and cutting date of the meadow hay and pasture productivity, unfortunately, little information is available on the growth performance of female Brown Swiss calves fed diets mainly based upon hay harvested at early-bloom or late-bloom stages from meadows fertilized or not fertilized by N and P$_2$O$_5$.

The present study was undertaken with the objective of evaluating the effect of rations...
mainly formed by early or late-bloom cut hay from meadows fertilized or not fertilized with 150 kg N ha\(^{-1}\) and 50 kg P\(_2\)O\(_5\) ha\(^{-1}\) on the growth performance of female Brown Swiss calves.

**Materials and Methods**

Meadow of the Research Farm of Agricultural College at Atatürk University was divided into two portions. In early spring season, one of the meadow's portions chosen randomly was fertilized with 150 kg N ha\(^{-1}\) and 50 kg P\(_2\)O\(_5\) ha\(^{-1}\), while the fertilization was not applied to the other half of the meadow. Hay was cut from each part of meadows from either at early-bloom or late-bloom stages of the dominant plant species. The hay was dried, made up into bales and fed to calves. The quantity of the forage was determined by weighing the dry hay from different parts of the meadow.

A total of 20 female Brown Swiss calves of 6-12 months from cattle herd of the Research Farm of Agricultural College were used in this study. All calves were allotted to one of four treatment groups. While hay cut at early or late stages from fertilized meadow were offered to first and second groups of calves, respectively, third and fourth groups received early and late bloom cut hays from meadow not fertilized, respectively. Calves in all groups consumed 3.5 kg/day of meadow hay for first 14 days. While 4 kg/day of hay was offered to calves from second to fifth 14 days period, 5 kg/day hay per animal was given until end of the trial. Water was supplied by automatic waterers during the feeding period of 129 days. Half portion of the hay was offered to animals every morning at 8.30 a.m. other part was given every afternoon at 2.00 p.m. The amount of the concentrate given for each animal was 1 kg/day. Calves were fed individually and amount of the hay and concentrate remained in the feeder was weighed daily and recorded. The chemical composition (%) of the concentrate was 88.98 dry matter, 12.57 crude protein, 5.37 crude cellulose, 2.97 ether extract and 7.37 crude ash.

Calves were weighed individually at the beginning and end of the experiment as well as at 14 days intervals. The differences due to cutting stage and fertilizer treatments were statistically analysed by using 2x2 completely randomized factorial experimental design in SPSS statistics computer program (SPSS, 1998).

**Results and Discussion**

The application of the fertilizer resulted in an increase in meadow hay yield by 2100 kg ha\(^{-1}\). Late harvest of the meadow also caused an increase of the hay yield by about 771 kg ha\(^{-1}\). The results were in accordance with findings of Collins *et al.* (1990) and Davison *et al.* (2000), who also reported an increase of forage yields by nitrogen fertilization and late cutting time. On the other hand, crude protein level of the dry meadow hay was affected adversely from delayed cutting whereas, the fertilizer promoted crude protein level of the hay (Table 1). Similar results were already reported in different meadows and pastures by Lima *et al.* (1999), Davison *et al.* (2000) and Bailey *et al.* (2001). The results could be attributed to higher conversion rate of nitrogen given by fertilizer to the plant protein.

Initial weights of the calves assigned to the different treatment groups were not statistically different (Table 2). Average daily weight gain of the calves were significantly (P<0.01) influenced by application of fertilizer and cutting stages of the meadow hay (Table 2). The calves produced 21.7% increase in daily weight gain in favour of fertilized hay group. Similar results were reported by Lima *et al.* (1999), who indicated that application of the N fertilizer resulted in an increase in daily weight gain of heifers from 0.06 to 0.36 kg. The animal response could be due to effect of higher protein level of hay from fertilized meadow. Moore *et al.* (1991) have suggested that when crude protein concentration of forages is less than 70 g kg\(^{-1}\), there might be inadequate protein to supply the needs of rumen bacteria
Table 1
Chemical compositions (% DM basis) of meadow hays and concentrate used in the study

<table>
<thead>
<tr>
<th></th>
<th>Dry matter</th>
<th>Crude protein</th>
<th>Crude cellulose</th>
<th>Ether extract</th>
<th>Crude ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertilized and early cut hay</td>
<td>90.25</td>
<td>8.67</td>
<td>30.48</td>
<td>1.88</td>
<td>8.97</td>
</tr>
<tr>
<td>Not fertilized and early cut hay</td>
<td>89.73</td>
<td>6.52</td>
<td>32.04</td>
<td>1.53</td>
<td>9.59</td>
</tr>
<tr>
<td>Fertilized and late cut hay</td>
<td>90.85</td>
<td>6.79</td>
<td>29.53</td>
<td>2.40</td>
<td>10.39</td>
</tr>
<tr>
<td>Not fertilized and late cut hay</td>
<td>90.74</td>
<td>4.97</td>
<td>32.20</td>
<td>2.60</td>
<td>10.04</td>
</tr>
<tr>
<td>Concentrate</td>
<td>88.98</td>
<td>12.52</td>
<td>5.37</td>
<td>2.97</td>
<td>7.37</td>
</tr>
</tbody>
</table>

Table 2
Growth performance, feed efficiency ratio and meadow hay intake of the calves (mean ± SE)

<table>
<thead>
<tr>
<th>Application of fertilizer</th>
<th>Feed (kg) consumed per kg live weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial weight (kg)</td>
</tr>
<tr>
<td><strong>Application of fertilizer</strong></td>
<td></td>
</tr>
<tr>
<td>Fertilized (F)</td>
<td>138.8±9.5a</td>
</tr>
<tr>
<td>Not fertilized (NF)</td>
<td>138.9±9.5a</td>
</tr>
<tr>
<td><strong>Cutting stage</strong></td>
<td></td>
</tr>
<tr>
<td>Early bloom (EB)</td>
<td>139.2±9.5a</td>
</tr>
<tr>
<td>Late bloom (LB)</td>
<td>138.5±9.5a</td>
</tr>
</tbody>
</table>

a,bMeans in a column in each subgroup with different superscripts differ (P<0.01).
Fertilization x cutting stage interaction was not significant for any parameter except concentrate intake per kg live weight gain.

and forage intake and animal performance. The average daily weight gain of the female Brown Swiss calves fed early cut hay in the present study was 0.166 kg greater than that of calves consumed late cut hay (Table 2). Similar results were reported by Lacefield et al. (1998), who stated that heifers fed hay harvested at early bloom stage had 0.249 kg more daily weight gain than those given late cut hay. The results could be attributed to the decreasing of the crude protein level and digestibility of hay with advancing of the cutting time.

Forage intake and feed efficiency ratio were influenced significantly (P<0.01) by the application of the fertilizer and cutting time of hay (Table 2). The amount of fertilized hay consumed per kg weight gain was 0.396 kg less than that of hay from not fertilized meadow. The fertilizer also reduced significantly (P<0.01) hay intake. The finding was in accordance with results of Lima et al. (1999). Feed efficiency ratio for early or late cut hay was also affected significantly (P<0.01) (Table 2). Adverse influence of the late harvest stage on the feed efficiency value could be attributed to maturation of meadow hay and decrease of digestibility as well as nutrient content of the hay.

The overall results of this study indicated that application of N and P₂O₅ fertilizers and cutting stage of hay from meadow had significant effects on the growth performance
of the Brown Swiss calves fed meadow hay based diets. It was suggested that the meadows should be fertilized and the hay should be cut at the early bloom stage of the dominant plants in the meadow for providing better growth performance of female Brown Swiss calves.

References


SPSS. 1988. SPSS for Windows. Released 10.0, SPSS Inc., Chicago, IL., USA.

印. कौमानकी, एम. याना, एन. तुमेमण, एम. टेन, एल. तग्य, औं. बेनेसे. नाइटोजन और पास्टर्ज दो मात्राओं से उद्धत शाखें से अधिक और विलय से केटे 'हे' के प्रभाव पर श्रोत अग्री सीलिस का वर्धन नियन्त्रण।

नाइटोजन और पास्टर्ज को हू दो मात्राओं से उद्धत अधिक दिन हृद मात्रकों के शाखा से अधिक और विलय विकास के 'हे' से मुख्य निर्माता वाला वर्धन नियन्त्रण पर प्रभाव कानून के लिए 20 मात्रा ब्राउन स्कीसिस गोवर्स (३०-८० मीटर) के १२९ विज्ञा तक तिलकाय गया। नाइटोजन और पास्टर्ज उद्धत ब्राउन के 'हे' विकास से उद्धत न होने गए शाखा के 'हे' की तुलना में वैणक अधिक हृद दिन, आल्फा और इलंडैर भार वृद्धि और शाखा के सकल उपमाणु अधिक था। इसी प्रकार ये सभी शाखाओं अधिक विकास बाली हैं वाले वाले पद्ष रहे विकास रहे वाले से अधिक था। ब्राउन अग्री गोवर्स में अधिक वर्धन नियन्त्रण और अधिक आल्फा उपमाणु दक्षता के लिए शाखाओं में नाइटोजन और पास्टर्ज उद्धत वाला और अधिक करारा उपमाणु है।