Growth rates, biomass yield and forage quality of three local Poaceae in Annaba’s region, North East Algeria

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Growth rates, biomass yield and forage quality of three local Poaceae in Annaba’s region, North East Algeria

M. Boudelaa¹, S. Slimani¹, A. Ladjama², M. Benkadour¹ and I. Nadjeh¹

¹Laboratory of Plant Biology and Environment, University Badji Mokhtar, Annaba, 23000 (Algeria)
²Laboratory of Applied Biochemistry, University Badji Mokhtar, Annaba, 23000 (Algeria)

Abstract. In the Algerian context, the development of durable fodder agriculture and breeding require complex strategies of which one of the elements consists in developing the use of fodder species adapted to the local biotope characteristic of Mediterranean climate. The aim of this work consisted to study and cultivates 3 Algerian varieties of Poaceae fodder, reed canary grass *Phalaris arundinacea*, rye grass *Lolium multiflorum* and tall fescue *Festuca arundinacea* in order to evaluate their agronomic performance; the growth rates and the field biomass output. The obtained results showed that the biomass production was more important for the reed canary grass in complete cycle than in incomplete cycle of vegetation, contrary to rye grass and tall fescue. Moreover, the analysis of growth kinetics showed that it is the spring growth which presented the best characteristics of the plant development and dry matter (DM) yield production. From fodder value, the reed canary grass and the tall fescue are well provided in Total Nitrogen Matter (TNM) and relatively low in Fodder Units (FU). Contrary, the rye grass is rich in energy compounds (EU) but contains low protein content.


I – Introduction

In Algeria, the fodder forage deficit is still pronounced and chronic, as feeding of livestock is mainly based on grazing and natural fodder resources (Adem and Ferrah, 2001). Indeed, studies of prospecting collection and evaluation were interested in these local forage species that are already adapted to our climate and local environment (Boudelaa, 1992; Abdelguerfi and Laouar, 2001). The aim of this work is to evaluate the potential production of DM biomass of three species (*Lolium multiflorum* Lamk, *Festuca arundinacea* Schreb and *Phalaris arundinacea* L). The objec-
tive was to determine i) the growth rates of DM in these species based on local climatic conditions, ii) the potential production of DM over several years in complete and incomplete cycle of vegetation and iii) the nutritive value of forage species.

II – Materials and methods

Trial was performed at the Fetzara station, situated at around 36°46’North latitude and 7°36’East longitude (North East Algeria). The study was carried out from September 2007 to June 2011 in four years. The experiment was set up on a balanced soil texture (sandy clay loam) with a seedling density of 940 plants/m². The soil chemical characteristics were pH: 7, N: 0.10% (relatively poor), P₂O₅: 20 ppm (poor in P), K₂O: 30 ppm (poor in K), organic matter (OM): 2.5% (medley relatively rich). The experiment was arranged in completely randomized block design with three replication. Parcel dimension was 4 m by 4m with seven lines and 80 cm row spacing. The climate is Mediterranean, characterized by an annual rainfall between 600 and 700 mm and an average yearly temperature of 17.5°C. Two experiments were conducted, one in an annual cycle of growth from seedlings (October), until the final harvest in (June) and the other in cutting cycle by making three cuts per year (i.e. incomplete cycle of vegetation). The yields of fresh material (FM), dry matter (DM) were calculated by cuts of plots. Parcel weight was geren matter yield. The plants sampled were then placed in an oven at 80° C for 48 hours; their weight after this period was dry matter yield, DM yield, (Cornet, 1984). Specific leaf weight was determined from the ratio dry weight / leaf area of a subsample of 20 leaves per species (Araus et al., 1998). for forage analysis, the total nitrogen content is determined by the method of Kjeldahl nitrogen digestible matter are determined by the formula of Demarquilly. For energetic value, the approach is to estimate digestibility of organic matter (OM) and then to calculate according to Leroy formula. Les FUMi and FUMe are calculated sequentially from the estimated gross energy (EB), the digestible energy (DE) and metabolizable energy (ME) and net energy (NE) (Andrieu et al., 1988).

III – Results and discussion

1. Biomass production, DM yield

Dry matter yields varied among the species studied. In annual cycle of vegetation, it is the canary grass that produced the largest production (223 q.ha⁻¹). Ryegrass and tall fescue performed almost similarly 164 and 154 quintals per hectare respectively (Table 1). In Incomplete cycle of vegetation, i.e. operating section and three sections produced during the four years from 2007 to 2011 (Table1), red canary grass gave the highest production (327.5 qx.ha⁻¹), followed by ryegrass (305 q.ha⁻¹). Fescue produced a low yield equal to nearly half of the two before mentioned species with a value of 164 quintals per hectare. However, the DM production of the year 2009/2011 by cutting (Table 2) showed that this was the second cut that produced the most DM for ryegrass and canary grass and subsequently decreased in the third cut. The other species, fescue had a constant production of DM and a marked increase from the first to the last cut with a highest peak of 70 quintals per hectare. The results of DM showed that the canary grass produced more biomass in the annual cycle than the incomplete cycle of vegetation, in contrast to ryegrass and tall fescue. The dry matter accumulation of plant cover or species can be represented as a function of absorbed radiation useful for photosynthesis (Eckardt et al., 1977). Indeed, this incident radiation absorbed varies from one species to another and at the vegetation itself. It also depends, leaf area index and the angle of insertion of the leaves and also the structure of the foliage, which is very different in species of the architectural and optical point of view (Gosse et al., 1986). In incomplete cycle of cutting operation of plant, we note that is the second cut, which gave a high yield in the red canary grass and ryegrass. This cut was made in the period
were climatic conditions are again favorable (good rainfall and adequate temperatures). It is the spring growth (Ollerenshaw et al., 1982; Kemp, 1988; Kemp 1989; Duru et al., 1995; Kyle 2006). The drop in biomass in the third cut is explained by Gillet (1980) by “cutting effect”, depletion of root reserves in response to repeated cuts made or overexploitation.

Table 1. Dry matter yields of species over four years (q.ha⁻¹)

<table>
<thead>
<tr>
<th>Species</th>
<th>DM in complete cycle Value ± SD</th>
<th>DM in incomplete cycle Value ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ryegrass</td>
<td>164 ± 46.3</td>
<td>305 ± 100.8</td>
</tr>
<tr>
<td>Tall fescue</td>
<td>154 ± 57.3</td>
<td>164 ± 15.7</td>
</tr>
<tr>
<td>Canary grass</td>
<td>223 ± 24</td>
<td>327.5 ± 100.6</td>
</tr>
</tbody>
</table>

SD: Standard deviation.

Table 2. Dry matter yields of species according to cuttings in incomplete cycle of vegetation during the 2009/2010 year in (q.ha⁻¹)

<table>
<thead>
<tr>
<th>Species</th>
<th>1st cut</th>
<th>2nd cut</th>
<th>3rd cut</th>
<th>Total yield Mean value ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rye-grass</td>
<td>100</td>
<td>150</td>
<td>70</td>
<td>320 ± 33</td>
</tr>
<tr>
<td>Tall fescue</td>
<td>24</td>
<td>50</td>
<td>70</td>
<td>144 ± 18.83</td>
</tr>
<tr>
<td>Canary grass</td>
<td>27</td>
<td>80</td>
<td>13</td>
<td>120 ± 28.85</td>
</tr>
</tbody>
</table>

SD: Standard deviation.

2. The fodder value of forage

The analysis of the feed value was made at the heading stage of the complete cycle of vegetation. The results showed that ryegrass was more energy-rich compounds (FU 0.94, 0.81 and 0.77 FUMi, and FUMe) (Table 3). Reports TNM/FU and L/S respectively 54.8 and 0.22 are relatively small compared to the other two species. In contrast, tall fescue and reed canary grass are poor in crude FU but filled with respective values of 73 and 39.5 g.kg⁻¹ of DM and an L/S is 0.4 and 0.3 in the fescue in the canary. Moreover, the best leaf specific weight (LSW) is observed in rye-grass with an average weight of 0.52 g.cm⁻². Tall fescue introduced through a LSW. By cons, the LSW the lowest was recorded in the canary with 0.3 g.cm⁻². From fodder value point of view, the red canary grass and tall fescue are well provided in Total Nitrogen Matter (TNM) and relatively low in Fodder Units (FU). Contrary, the ryegrass is rich in energy compounds, but contains low protein content report by the ratio TNM/FU and L/S, which are indices of forage quality.

Table 3. Forage quality parameters of species

<table>
<thead>
<tr>
<th></th>
<th>Ryegrass</th>
<th>Tall fescue</th>
<th>Red canary grass</th>
</tr>
</thead>
<tbody>
<tr>
<td>FU in (g.kg⁻¹of DM)</td>
<td>0.94 ± 0.02</td>
<td>0.7 ± 0.08</td>
<td>0.55 ± 0.1</td>
</tr>
<tr>
<td>FU milk</td>
<td>0.81 ± 0.02</td>
<td>0.68 ± 0.07</td>
<td>0.52 ± 0.07</td>
</tr>
<tr>
<td>FU meat</td>
<td>0.77 ± 0.02</td>
<td>0.65 ± 0.04</td>
<td>0.07</td>
</tr>
<tr>
<td>TNM in (g.kg⁻¹ of DM)</td>
<td>51.5 ± 7.5</td>
<td>73 ± 12</td>
<td>39.5 ± 2.5</td>
</tr>
<tr>
<td>Ratio TNM/FU</td>
<td>54.8</td>
<td>110.6</td>
<td>71.8</td>
</tr>
<tr>
<td>LSW in (g.cm⁻²)</td>
<td>0.5 ± 0.01</td>
<td>0.4 ± 0.01</td>
<td>0.3 ± 0.15</td>
</tr>
<tr>
<td>Ratio L/S</td>
<td>0.2</td>
<td>0.4</td>
<td>0.3</td>
</tr>
</tbody>
</table>
IV – Conclusion

These studied species, appear to have interesting characteristics in biomass production. In optimum conditions and proper, they can increase forage production and there by improve the livestock feed, but, they can never by themselves solve the problem of feeding in Algeria.

References


