Identification of Water Use Efficient Napier Grass Accessions Using Field Drought Stress

Ermias Habte, Meki S. Muktar, Alemayehu T. Negawo, Ki-Won Lee and Chris S. Jones

INTRODUCTION

Napier grass (Cenchrus purpureus Schumach L.) is an important perennial forage native to Africa and now introduced and grown in many tropical and subtropical countries. It is considered as a short-term drought tolerant forage, which is a useful trait in areas with low soil moisture during the dry season, although it is recommended for planting in areas with rainfall >1,000 mm. In order to exploit the potential of this grass species for improved water use efficiency (WUE), a field drought stress experiment was conducted with the objective to identify traits that underlie enhanced water use efficiency and to select best performing genotypes that can thrive in low soil moisture areas.

METHODOLOGY

- Eighty four accessions from ILRI and EMBRAPA collections of Napier grass were planted using a P-rep design in four blocks in Bishoftu, Ethiopia.
- After establishment plants were exposed to optimum water (OW) with 20% soil moisture or water stress (WS) with 10% soil moisture during the dry season.
- Agronomic and physiological data were collected at every 8 weeks of re-growth.

RESULTS

Table 1. Summary ANOVA and coefficient of variation for morphological and agronomic traits of four dry season harvests

<table>
<thead>
<tr>
<th>Trait</th>
<th>OW/WS</th>
<th>OW</th>
<th>WS</th>
<th>OW/WS</th>
<th>OW</th>
<th>WS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomass (kg)</td>
<td>3.68</td>
<td>3.91</td>
<td>3.51</td>
<td>3.85</td>
<td>3.94</td>
<td>3.52</td>
</tr>
<tr>
<td>Relative growth</td>
<td>1.27</td>
<td>1.24</td>
<td>1.20</td>
<td>1.24</td>
<td>1.20</td>
<td>1.22</td>
</tr>
<tr>
<td>Water use efficiency</td>
<td>0.87</td>
<td>0.85</td>
<td>0.83</td>
<td>0.89</td>
<td>0.86</td>
<td>0.82</td>
</tr>
<tr>
<td>COV%</td>
<td>5.64</td>
<td>5.91</td>
<td>5.74</td>
<td>5.70</td>
<td>6.14</td>
<td>5.97</td>
</tr>
</tbody>
</table>

MAJOR FINDINGS

- The study revealed significant differences between plants grown under optimum water and water stress (Fig. 1).
- Significant genotypic differences were observed among genotypes for morphological and agronomic traits which suggests selection for improved forage performance will be efficient (Table 1).
- Genotypes showed significant variation for total dry weight (Fig. 2) and enhanced water use efficiency (Fig. 3) implying that genotypes differ in economic use of water for increased biomass production under water limited conditions.
- Genotypes showed consistent performance for biomass dry weight and water use efficiency observed across dry season harvests, indicating promising Napier grass accessions could be identified for low soil moisture areas forage production.

---

This research was supported by the "Cooperative Research Program for Agriculture Science & Technology Development (Project No. PJ012187)" , Rural Development Administration, Republic of Korea.