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.

Fig. 1. Napier grass growing under optimum water (OW, left panel) and water stress (WS, right panel) conditions

RESULTS

Sources of Variation	PH	LW	TN	TFW	TDW	WUE
Genotype	139.39***	151.79***	15293.4***	51.08***	4.74***	25.26***
Treatment (OW/WS)	3306.68**	857.3*	33433***	3377.94**	308.73**	109.3**
Genotype X Treatment	21.07*	19.69ns	3287.9***	18.36***	1.72*	7.93*
Range	1.67-60.33	3-35.33	0.67-264	0.02-36.74	0.04-17.42	0.05-27.24
Mean	12.11	19.01	82.52	3.89	1.2	2.75
GCV%	31.26	21.57	51.37	58.29	54.39	55.07
PCV%	51.64	30.74	63.14	69.84	71.49	72.35

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

PH = plant height; LW = Leaf width; LL = Leaf length; TFW = Total fresh weight; TDW = Total dry weight
WUE =Water use efficiency; *,**,*** = Significant level at 0.5% .0.1%and 0.001%, ns=Non significant

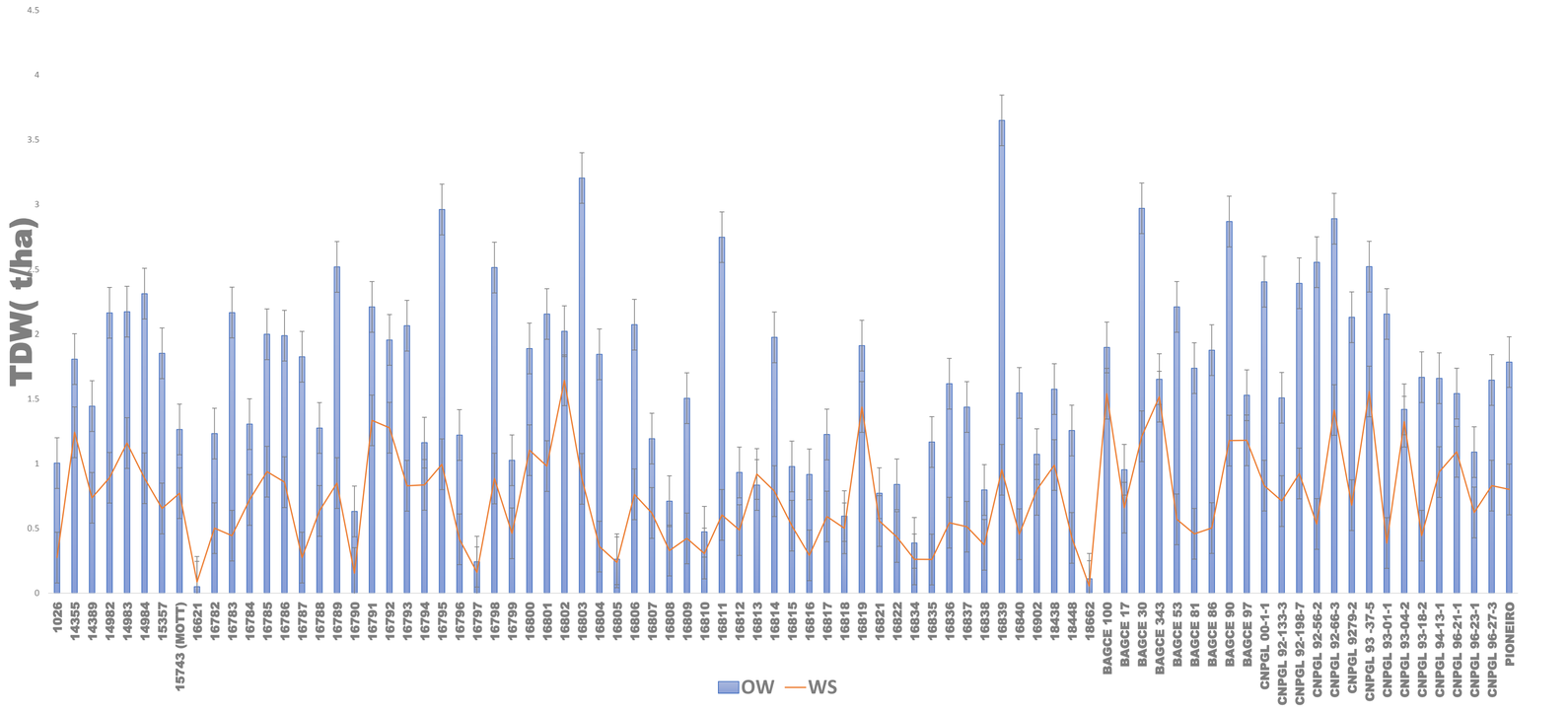

Fig. 2. Total dry weight of 84 Napier grass accessions averaged over four dry season harvests between OW/WS

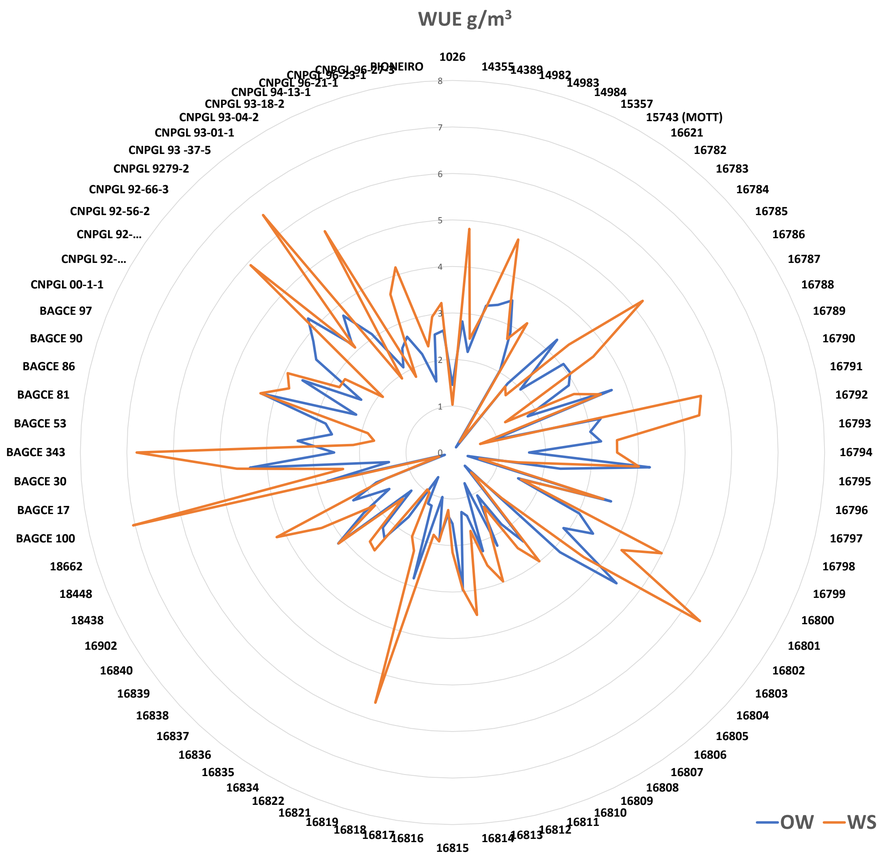

Fig. 3. WUE of 84 Napier genotypes under OW/WS over four dry season harvests

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.

Ermias Habte:
E.Habte@cgiar.org, Feed and Forage Development, International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia. ilri.org

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

Rural Development Administration

ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

CGIAR