Non-structural carbohydrate profile of some tropical forage grasses

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Introduction

Forage crops are one of the important feed sources in sub-Saharan Africa. Forage sources provide organic nutrients, such as structural and non-structural carbohydrates (NSC), which are required for livestock production. In temperate forages, it has been noted that increased NSC levels are associated with rapid regrowth of forage crops, increased energy value of feed and tolerance to drought stress, however the information about NSC content and seasonal dynamics in tropical forages is limited. This study was conducted to examine NSC content of some grass forage grass species held in the ILRI field genebank in Ethiopia. The results of the study indicated the existence of significant accession, species and seasonal variation in NSC content. The highest overall NSC content was observed in *Urochloa decumbens* followed by *Cenchrus purpureus* but the variation within species was, in most cases, as large as the variation between and NSC levels also varied with the harvest season.

Methodology

- Five field genebank tropical grass species were used for the study (Fig. 1 and Table 1).
- Twelve accessions from each selected species were harvested at every three months of regrowth period for one year.
- Water soluble carbohydrates (WSC) and Starch were determined by anthrone method as described by Yoshida (1976). NSC = WSC + Starch.

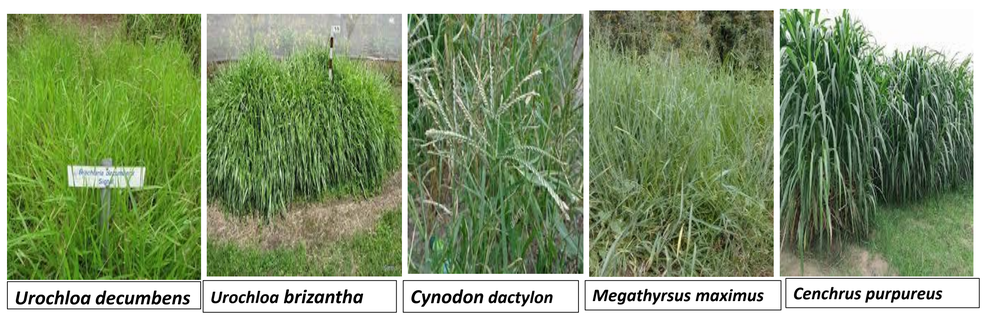

Figure 1. Species studied for non-structural carbohydrate levels

Table 1. Harvest time

Harvests	Harvesting time	Season
H-1	Apr-18	Dry season
H-2	Jul-18	Wet season
H-3	Oct-18	Wet season
H-4	Jan-19	Dry season

Results

Non-structural carbohydrate variation

Table 2. Analysis of variance of five grass species and harvest seasons for non-structural carbohydrate components.

Sources of variation	Mean Squares		
	Starch	WSC	NSC
Species	8.11*** (8%)	29.05**(12%)	65.89***(17%)
Harvest	30.94***(23%)	31.15***(10%)	107.91***(20%)
Species X Harvest	4.96***(15%)	13.98***(18%)	15.00***(11%)

Values in brackets indicate explained variance. Water soluble carbohydrates (WSC) and non-structural carbohydrates (NSC). ***=Significant level at 0.001%.

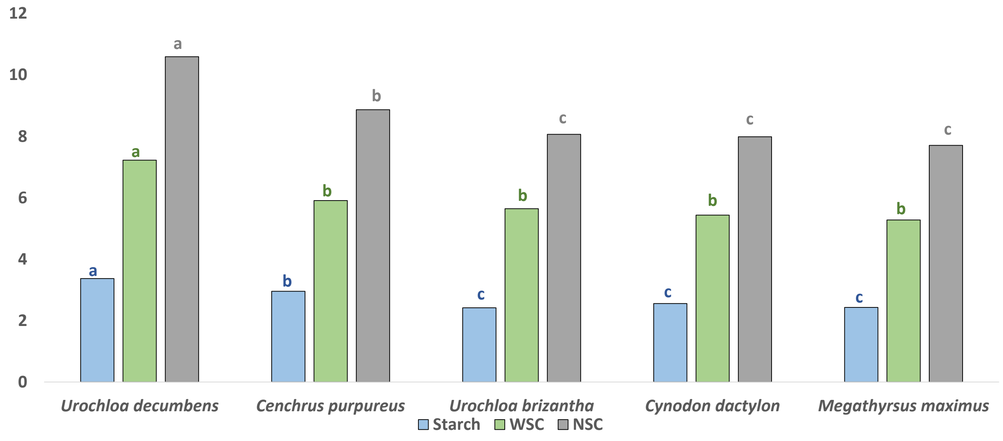

Figure 2. Mean levels of Starch, Water soluble carbohydrates (WSC) and non-structural carbohydrates (NSC) of tropical grass species. Mean values are expressed on dry matter basis (%DM). Different letters for each Starch, WSC and NSC indicate significant differences after LSD test ($p<0.05$).

Seasonal dynamics of non-structural carbohydrates

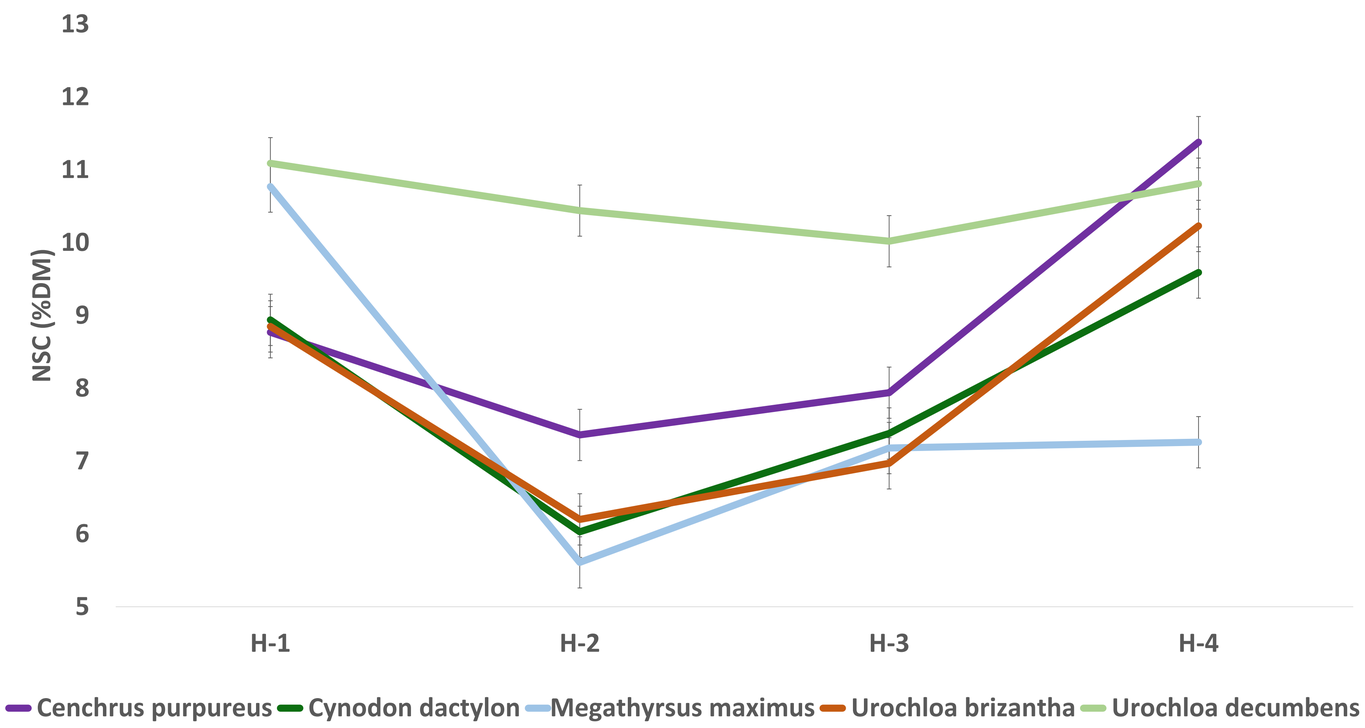

Figure 3. Seasonal dynamics of non-structural carbohydrates (NSC) of five tropical grass species. Error bars indicate standard error of difference of among harvests. NSC is expressed on dry matter bases (%DM). H-1 up to H-4 are harvesting seasons.

Accession performance for non-structural carbohydrates

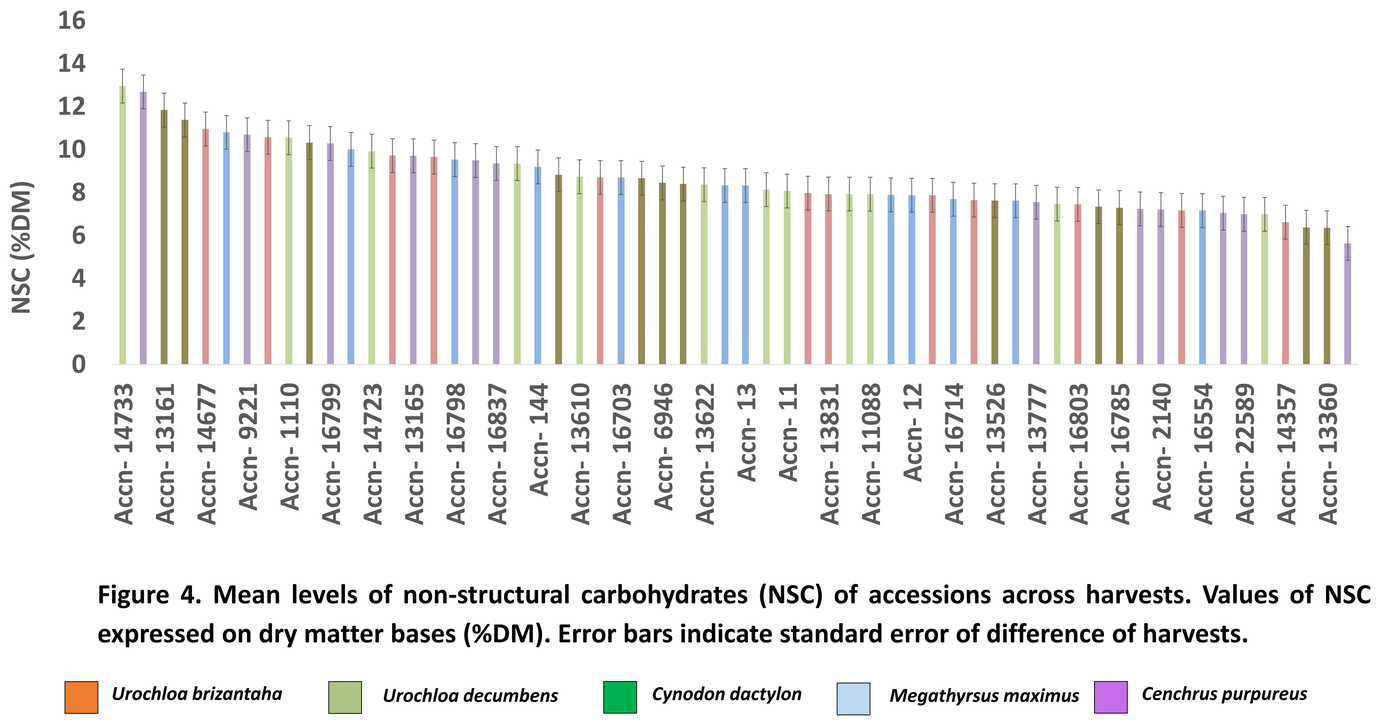

Figure 4. Mean levels of non-structural carbohydrates (NSC) of accessions across harvests. Values of NSC expressed on dry matter bases (%DM). Error bars indicate standard error of difference of harvests.

Major findings

- The result from the current study suggests that NSC level was dependent on grass species and harvest time. (Table 1).
- *Urochloa decumbens* had the highest NSC level followed by *Cenchrus purpureus*. (Figure 2)
- Trends in seasonal dynamics revealed that tropical grass species respond to the dry season environmental stress condition. (figure 3.)
- Accession variation for NSC level within each species suggests that selection for increased NSC is possible in tropical perennial grasses. (Figure 4.)
- Generally, the current preliminary study indicates the opportunity to capture genotype variability and to develop feed resources with increased NSC level.

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