

EFFECT OF HARVESTING PERIOD ON HERBAGE PRODUCTIVITY AND CHEMICAL COMPOSITION OF HARKIYA (*Digitaria debilis*)

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Abstract

This study was carried out to determine the herbage yield and proximate composition of Harkiya (*Digitaria debilis*) harvested at different stages of growth. *Digitaria debilis* is a genus of plants in the grass family poaceae. It is native to tropical and warm temperate regions and can be grown in subtropical and cooler temperate regions. The experiment was conducted using Completely Randomized Design (CRD) with the treatments (T1, T2, T3 and T4) representing herbage of *Digitaria debilis* harvested at weeks 6, 8, 10 and 12 post-transplanting respectively. Transplanting was done 14 days after planting, corresponding to 7 days after germination. Fresh and dry herbage yields (kg/ha) were significantly ($P<0.001$) higher in treatment 4 (7041.70kg and 2433.30kg respectively). It was revealed that the productivity of the herbage increased as the harvesting period (weeks) increased. The result also revealed that crude protein was highest ($P<0.001$) in week 8 (8.93%) and lowest in week 12 (6.52%). Crude fibre, neutral detergent fibre and acid detergent fibre were significantly ($P<0.001$) higher in week 12 (treatment 4). It was concluded that *Digitaria debilis* harvested at week 8 had the highest crude protein while highest fresh and dry herbage yields was achieved at week 12 (treatment 4). It was recommended that *Digitaria debilis* should be harvested at week 8 for highest crude protein and at week 12 for highest herbage yield.

Keywords: Harvesting, period, productivity, proximate composition, *Digitaria debilis*.

Introduction

Digitaria debilis is a genus of plants in the grass family that is native to tropical and warm temperate regions but can occur in subtropical and cooler temperate regions as well. Common names include Crabgrass, Finger-grass, and Fonio. They are slender monocotyledonous annual and perennial lawn, pasture, and forage plants; some are often considered lawn pests. Digitus is the Latin word for "finger", and they are distinguished by the long, finger-like inflorescences they produce. The seeds are edible, most notably those of fonio (*Digitaria exilis* and *Digitaria iburua*), *Digitaria sanguinalis*, as well as *Digitaria compacta*. They can be toasted, ground into flour, made into porridge or fermented to make beer. Fonio has been widely used as a staple crop in parts of Africa. It also has decent nutrient qualities as forage for cattle (Gilani, 2003). *Digitaria debilis* is among the most important groups of poaceae in terms of socio-economic value of the species. It is found in a range of habitats but seems to be most diverse in open areas or grasslands (Boonsuket *et al.*, 2016). Crabgrass species grow in disturbed areas, particularly in gardens and cultivated fields, and are seldom observed in natural veld (Hugo, 2014). The socio-economic importance of *Digitaria* species is particularly in their uses as source of human food (Korochoet *et al.*, 2013; Ouedraogo *et al.*, 2015; Barnaudet *et al.*, 2017), fodder (Beck *et al.*, 2017; Harun *et al.*, 2017) and in pharmacopoeia (Poilecot, 1999; Pare *et al.*, 2016). Plant species composition determines the nutritional quality of semi-natural grasslands (French, 2017), alpine grasslands (Komacet *et al.*, 2014) and pasture (Chapman *et al.*, 2014). Herbivores can consume herbaceous legumes and non-legumes, as well as the foliage of shrubs and trees (Wood *et al.*, 2015). The study was aimed to improve the production of *Digitaria debilis* (high quality and quantity) to improve ruminant animal production in Nigeria.

Problems and Justification: Natural pastures in Nigeria are generally high in fibre, low in protein and energy and yet they form the main source of animal feed in the country (FAO, 2019). These resources are over utilized to the extent that they fail to meet even the maintenance requirements of indigenous animals especially when the dry season persists for long periods. This has resulted in significant decrease in milk production, loss of body weight, reduced draught power, increased susceptibility to diseases, reduced reproductive performance, retarded growth rate and high mortalities of young animals (FAO, 2019).

Materials and Methods

Experimental Site

The experiment was carried out in Ningi Town, Ningi Local Government Area of Bauchi State. Ningi Local Government covers area of 4,625sq kilometres with population of 387,192 at the 2006 census.

Ningi falls within Guinea savannah ecological zone with annual rainfall of between 1000mm and 1300mm per annum (Wikipedia (2022).

Fodder Production

The experimental site was cleared and demarcated with pegs into 16 plots. Each plot was 4m in length and 4m in breadth (16m²). *Digitaria debilis* (Harkiya) seeds were grown in a nursery of 16m². After two weeks, the seedlings were transplanted into the experimental plots with 30cm intra-row spacing and 60cm inter-row spacing with each plot replicated (4) times in Completely Randomized Design (CRD). *Digitaria debilis* was grown as a sole grass with two seedlings per hole. Weeding was carried out at week 4 and at week 8 post-transplanting. After 6 weeks post-transplanting, samples were harvested from 4 experimental plots. Each sample harvested from each of the four (4) plots was weighed immediately to obtain the fresh herbage yield. The samples were also weighed after sun drying to obtain the dry herbage yield. The same procedure was repeated at weeks 8, 10 and 12 post-transplanting.

Chemical Analysis

All representative samples of the herbage harvested at week 6, 8, 10 and 12 post-transplanting were analyzed for dry matter (DM), ash, and crude protein (CP) according to the procedures of AOAC (1990). Dry Matter (DM) percentage of the forage plants was determined from oven-dried samples at 65°C for 72 hours following the AOAC method. The procedure described by Van Soest and Robertson (1985) to determine the neutral detergent fibre (NDF) and acid detergent fibre (ADF)

Statistical Analysis

Data collected on proximate composition and herbage yield of *Digitaria debilis* were subjected to General Linear Model of Analysis of Variance (ANOVA) with Type III Sum of Squares (SAS, 1999). Differences among means were separated using Least Significant Difference (LSD).

Results and Discussion

Table 1: Effect of harvesting period on the fresh and dry herbage yields of *Digitaria debilis*

Parameters		Harvesting Periods (weeks)				S.E.M
		1 (6)	2 (8)	3 (10)	4 (12)	
Fresh	Yield, g/m ²	341.67 ^d	422.92 ^c	560.42 ^b	704.17 ^a	11.785
Dry	Yield, g/m ²	108.33 ^d	147.92 ^c	193.33 ^b	243.33 ^a	8.895
Fresh	Yield, kg/ha	3416.70 ^d	4229.20 ^c	5604.20 ^b	7041.70 ^a	118.03
Dry	Yield, kg/ha	1083.30 ^d	1479.20 ^c	1933.30 ^b	2433.30 ^a	89.008

^{abcd}Means on the same row having different superscripts are significantly different (P<0.001).

The result revealed that there was a significant effect of harvesting periods (P<0.001) on the fresh and dry herbage yields. Fresh herbage yield was highest in week 12 (704.17g/m²), followed by week 10 (560.42g/m²) and lowest in week 6 post-transplanting (341.67g/m²). Dry herbage yield was highest in week 12 post-transplanting (243.33g/m²) and lowest in week 6 post-transplanting (108.33g/m²). Fresh yield (kg/ha) was highest in week 12 (7041.70) and lowest in week 6 post-transplanting (3416.70). Dry herbage yield (kg/ha) was highest in week 12 (2433.30), followed by week 10 (1933.30) and lowest in week 6 (1083.30). Lounglawan *et al.*(2013) and Rambauet *al.*(2016) had similar observation and stated that forage and dry matter in Napier grass increases with age of the grass.

Table 2: Effect of harvesting period on the proximate composition and crude fibre fraction of *Digitaria debilis*

Parameters	Harvesting Weeks				S.E.M
	6	8	10	12	
Dry Matter	89.73 ^d	89.84 ^c	90.12 ^b	90.16 ^a	0.00707
Crude Protein	6.78 ^c	8.93 ^a	7.63 ^b	6.52 ^d	0.01780
Crude Fibre	19.63 ^d	20.51 ^c	23.69 ^b	25.19 ^a	0.01683
Ash	3.49 ^c	4.26 ^b	4.63 ^a	4.65 ^a	0.01780

Ether Extract	0.53 ^b	0.58 ^a	0.45 ^c	0.32 ^d	0.01000
NDF	39.69 ^d	42.59 ^c	43.80 ^b	45.70 ^a	0.01354
ADF	29.83 ^d	31.89 ^c	34.60 ^b	36.84 ^a	0.09168

^{abcd} Means on the same row having different superscripts are significantly different (P<0.001). Where: NDF= neutral detergent fibre and ADF= acid detergent fibre.

Proximate composition of *Digitaria debilis* was affected by harvesting periods. There was a significant effect (P<0.001) of harvesting periods on the dry matter, crude protein, crude fibre, ash, ether extract, neutral detergent fibre and acid detergent fibre of *Digitaria debilis*. Dry matter was highest at week 12 post-transplanting (90.16%) and lowest at week 6 (89.73%). Crude protein was highest at week 8 (8.93%) and lowest at week 12 post-transplanting (6.52%). Crude fibre was significantly highest at week 12 (25.19) and lowest at week 6 post-transplanting (19.63%). Ash was highest at week 10 and 12 (4.65% and 4.63% respectively) and lowest at week 6 (3.49%). Ether extract was highest at week 8 (0.58%) and lowest at week 12 (0.32%). NDF and ADF were highest at weeks 10 and 12 (45.70% and 36.84% respectively) and lowest at week 6 (39.69% and 29.83% respectively). This result was similar to that of Rambauet *al.* (2016) who reported that the crude protein of grasses decreases as the grass mature while dry matter, crude fibre, NDF and ADF increases with age of the grass. The significant effect of cutting age on the neutral detergent fibre and acid detergent fibre in this study agreed with the results of Agangaet *al.* (2005) which reported that the neutral acid detergent fibre rose consistently as forage maturity increased.

Conclusion and Recommendation

Conclusion

It was concluded that in terms of herbage productivity, *Digitaria debilis* should be harvested at week 12 for better fresh and dry fodder yields (7041.67kg/ha and 2433.03kg/ha respectively). *Digitaria debilis* should be harvested at week 8 for higher crude protein (8.93%).

Recommendation

It was recommended that for higher yield, *Digitaria debilis* should be harvested at week 12, but in terms crude protein, it should be harvested at week 8 post-transplanting.

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