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Effect of Seed Variety and Cutting Age on Dry Matter Yield, Nutritive Values and *In Vitro* Digestibility of Teff Grass

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Abstract

While there is substantial ongoing work to improve the drought tolerance of grain crops, less effort has been made to decrease the water needs for forage crops. Water-efficient warm-season forage crops, with acceptable nutritional value, could prove an attractive alternative to traditional forages like alfalfa and corn silage. Teff (Eragrostis tef) is a and to 5 cutting ages (40, 45, 50, 55, or 60 d after planting [DAP]). Samples were dried, weighed, and analyzed for crude protein (CP), neutral detergent fiber (aNDFom), and 24 h *in vitro* NDF digestibility (IVNDFD). It was found that seed variety had no effect on dry matter (DM) yield, CP, aNDFom, or IVNDFD. DM yield increased linearly as cutting age increased from 40 to 60 DAP. Similarly, aNDFom concentration increased quadratically with increasing cutting age. CP and IVNDFD decreased linearly as cutting age increased from 40 to 60 DAP. To assess carryover effects of cutting age on yield and nutritive values, 2 additional cuttings were taken from each pot. It was found that increasing the age at first cutting from 40 to 60 DAP significantly decreased CP concentration in the second cutting. Additionally, increasing DAP significantly reduced DM yield in subsequent cuttings. Across all seed varieties and cutting ages, CP decreased and aNDFom increased linearly with each additional cutting. Results indicate that, under greenhouse conditions, the first cutting of teff should be taken between 45 and 50 DAP to optimize nutritive values and digestibility in that cutting and additional cuttings.

Keywords: Drought; Teff grass; Dry matter yield; Nutritive value; Dairy cattle

Introduction

One of the most pressing issues facing the dairy industry is drought. In the Southwestern and High Plains regions of the United States, where annual precipitation is low, irrigation for growing feed presents the greatest water-utilization challenge for dairy producers. More than 90% of the water used to support a dairy farm is devoted to producing crops that feed the cattle [1]. While the dairy industry has seen impressive growth in states like Kansas, New Mexico, and Texas, ground water levels in these areas have been decreasing at an alarming rate [2]. As ground water levels drop, some wells are no longer able to provide fields with the intended volume of water. Given the high water demands of crops like alfalfa and corn, and that alfalfa hay and corn silage are the most commonly fed forages in the dairy industry, the sustainability of the dairy industry in the Southwest and High Plains is questionable without an intentional shift toward water conservation.

While there is substantial ongoing work to improve the drought tolerance of grain crops, less effort has been made to decrease the water needs for forage crops. Water-efficient warm-season forage crops, with acceptable nutritional value, could prove an attractive alternative to traditional forages like alfalfa and corn silage. Teff (*Eragrostis tef)* is a warm-season annual grass (C4 physiology) native to Ethiopia that is well-adapted to arid conditions. For thousands of years, teff has been used as a grain crop for human consumption [3]. Once introduced to the United States, however, researchers began evaluating teff as a forage crop [4].

While teff grass has potential to fit the needs for forage production in water-stressed regions, very little is currently known about its nutritional characteristics and whether it can support high levels of milk production by dairy cattle. In Ethiopia, because teff is primarily grown as a grain crop, most feeding trials have aimed at improving the nutritive value of low-quality teff straw [5-7]. Additionally, studies that have investigated the quality of teff grass before it reaches full maturity have reported nutritive values that are highly variable. The crude protein (CP) concentration of teff has been reported to range anywhere from 8.5 to 21.5% [4,8-10]. The neutral detergent fiber (NDF) concentration, a predictor of intake in ruminants, has been reported to range from 52.5 to 72.5% [4,8,10]. Due to the extreme variation in reported nutritive values for teff, it is difficult to know at this point if teff grass is a suitable forage source for high producing dairy cows. Given that the productivity of a dairy cow is highly dependent on forage quality and digestibility [11], standardized quality and digestibility values for teff must be established before the productivity of cows fed teff grass can be investigated. Because both variety and age at harvest play a crucial role in dictating the quality of a given forage, the objective of this study was to investigate the effect of variety and cutting age on dry matter yield, nutritive values, and *in vitro* digestibility of teff grass.

Materials and Methods

Design and treatments

This experiment was conducted in a climate-controlled greenhouse

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space at Kansas State University (Manhattan, KS). The designated space averaged 24.6°C with 14 h of light/d as a combination of both natural and artificial light. Eighty plastic pots (3.78 L) were blocked by location and randomly assigned to 4 teff varieties and 5 cutting ages. The 20 treatment combinations were assigned in replicates of 4. The 4 varieties of teff seed used in this study were Corvallis, Dessie, Moxie, and Tiffany. All 4 varieties were commercially available at the start of the study and coated. Although the exact coating used on the seeds is proprietary, most seed coatings consist of a combination of lime to regulate soil pH, fertilizer to direct specific nutrients to the site of seed-soil contact, as well as insecticides and fungicides, all held together by a binding agent. Coating grass seeds can both enhance germination and add weight to the seeds for easier and more uniform sowing [12].

Seeds were planted in Metro Mix 360 (Sungro Horticulture, Agawam, MA) at a rate of 30 seeds per pot (equivalent to 16.81 kg/ha) and to an average depth of 0.48 cm. At planting, 0.15 g of urea (equivalent to 56 kg N/ha) was applied to each pot and the pots were lightly watered with a spray bottle. Pots were watered with a spray bottle until the seedlings were strong enough to withstand watering with a hose. Mature plants were watered to maintain "well-watered" conditions. An additional 0.15 g of urea (equivalent to 56 kg N/ha) was applied to all pots at d 60 after planting. The 5 cutting ages were 40, 45, 50, 55, and 60 d after planting (DAP).

Data and sample collection

Each pot was harvested at the assigned cutting age. Entire plants were cut with gardening clippers to a height of 10 cm and top biomass was collected and weighed. To assess the carryover effects of first-cutting harvest age on DM yield and nutritive values, a second cutting was taken from each pot 30 d after the first cutting. A third cutting was taken 30 d after the second cutting. After the third cutting, regrowth was insufficient to justify a fourth cutting.

Analytical techniques

Harvested samples were placed in paper bags and dried at 55°C in a forced-air oven for 72 h. After 24 h of air equilibration, dried samples were weighed to determine dry matter (DM) yield. Samples were then ground through a 1-mm screen using a Cyclone Sample Mill (UDY Corporation, Fort Collins, CO). Concentrations of amylase-treated, ash-free neutral detergent fiber (aNDFom) were determined in the presence of sodium sulfite [13] using an Ankom Fiber Analyzer (ANKOM Technology, Macedon, NY). Crude protein (CP) was determined by oxidation and detection of N_2 (LECO Analyzer, LECO Corp., St. Joseph, MI), multiplied by 6.25. Concentrations of all nutrients except for DM were expressed as percentages of DM determined by drying at 105°C in a forced-air oven for more than 8 h. *In vitro* NDF digestibility (IVNDFD) was analyzed using a DAISY Incubator (ANKOM Technology, Macedon, NY). Ground grass samples were placed in filter bags with 25 μm porosity (ANKOM Technology, Macedon, NY) and incubated for 24 h in rumen fluid collected from a mature Holstein steer fed a 50:50 forage:concentrate diet. Once removed from incubation, samples were dried at 55°C and transferred to an Ankom apparatus to determine NDF concentration of the residue. Second and third cutting samples were analyzed by Dairy One Forage Testing Laboratory (Dairy One Inc., Ithaca, NY) using identical analytical techniques.

Statistical analysis

The data were analyzed using JMP (version 10.0, SAS Institute, Cary, NC). An analysis of variance was conducted to analyze how the fixed effects of teff seed variety, cutting age, and their interaction influenced dependent variables. Independent variables were declared significant at $P<0.05$ and means were separated by Tukey's HSD test.

Results and Discussion

Cutting 1

Plant maturity at harvest is one of the principal factors influencing forage quality and digestibility [13]. With the development of higher quality and more digestible varieties, however, plant genetics are playing an increasingly crucial role in determining the overall quality of a given forage. Researchers worldwide have investigated the effect of seed variety on the quality and digestibility of a number of forage types including alfalfa [14], corn silage [15], sorghum [16], tall fescue [17], oats, and vetch [18] to name a few. There are multiple varieties of teff seed on the market today; some are better for grain production, others for forage production. Grain types tend to mature earlier than forage types, resulting in lower DM yields and forage quality [4]. In this experiment, all 4 teff varieties evaluated were bred for forage production. In Cutting 1, seed variety had no effect ($P>0.30$) on DM yield, aNDFom, CP, or IVNDFD (Table 1).

Cutting age, however, had significant impacts on first cutting forage yield, quality, and digestibility (Figure 1). As expected, DM yield increased linearly ($P<0.001$) from 4.1 to 26.4 ± 0.45 g/pot as cutting age increased from 40 to 60 DAP. Additionally, aNDFom concentration increased ($P<0.001$) from 51.7 to 63.5 ± 0.81% of DM with increasing DAP and CP decreased linearly ($P<0.001$) from 28.7 to 11.2 ± 0.49% of DM. As forages mature, quality decreases as photosynthetic products are converted to fibrous, structural components [19]. Grasses like teff, as opposed to legumes, have structural components in both their leaves and stems. Therefore, the forage quality of grasses tends to decline more rapidly with age than that of legumes [19]. In this study, the CP concentration of first cutting teff decreased linearly at a rate of 0.88% per d (Figure 1). Similar trends have been seen with brome grass [20] and sorghum-sudan grass [21]. The average greenhouse temperature could explain the higher-than-expected CP concentration of teff cut at 40 and 45 DAP. Lower temperatures slow the maturation process and the subsequent production of fibrous structural compounds thus improving CP concentration and overall forage quality [19].

Cutting age also had a significant effect on the IVNDFD of first-cutting teff (Figure 1). As cutting age increased from 40 to 60 DAP, IVNDFD decreased linearly ($P<0.001$) at a rate of 0.95% per day (60.8 to 41.2 ± 1.0%). The NDF component of teff, like all forages, is composed primarily of cellulose, hemicellulose and lignin. Lignin represents the indigestible fraction of NDF [19]. As a plant ages, lignin concentration increases, ultimately decreasing the overall digestibility of the fiber [22]. Other studies have confirmed this trend [20-21]. While the nutrient composition and digestibility of forages grown in a greenhouse are not always the same as those grown in the field, other studies [14,23,24] have used quality and digestibility values of greenhouse grown forages as initial estimates of what could be expected in a more practical cultivation scenario.

Cuttings 2 and 3

In Cutting 2, teff variety had no effect ($P=0.47$) on DM yield, aNDFom concentration ($P=0.13$), or CP concentration ($P=0.84$, Table 1). Additionally, there was no effect ($P=0.30$) of variety on the cumulative DM yielded from the 2 cuttings. First-cutting harvest age, however, had a significant effect ($P<0.001$) on second-cutting DM yield as well as second-cutting aNDFom and CP concentrations (Figure 2). Dry matter yield from Cutting 2 decreased from 23.68 to 11.59 ± 0.91

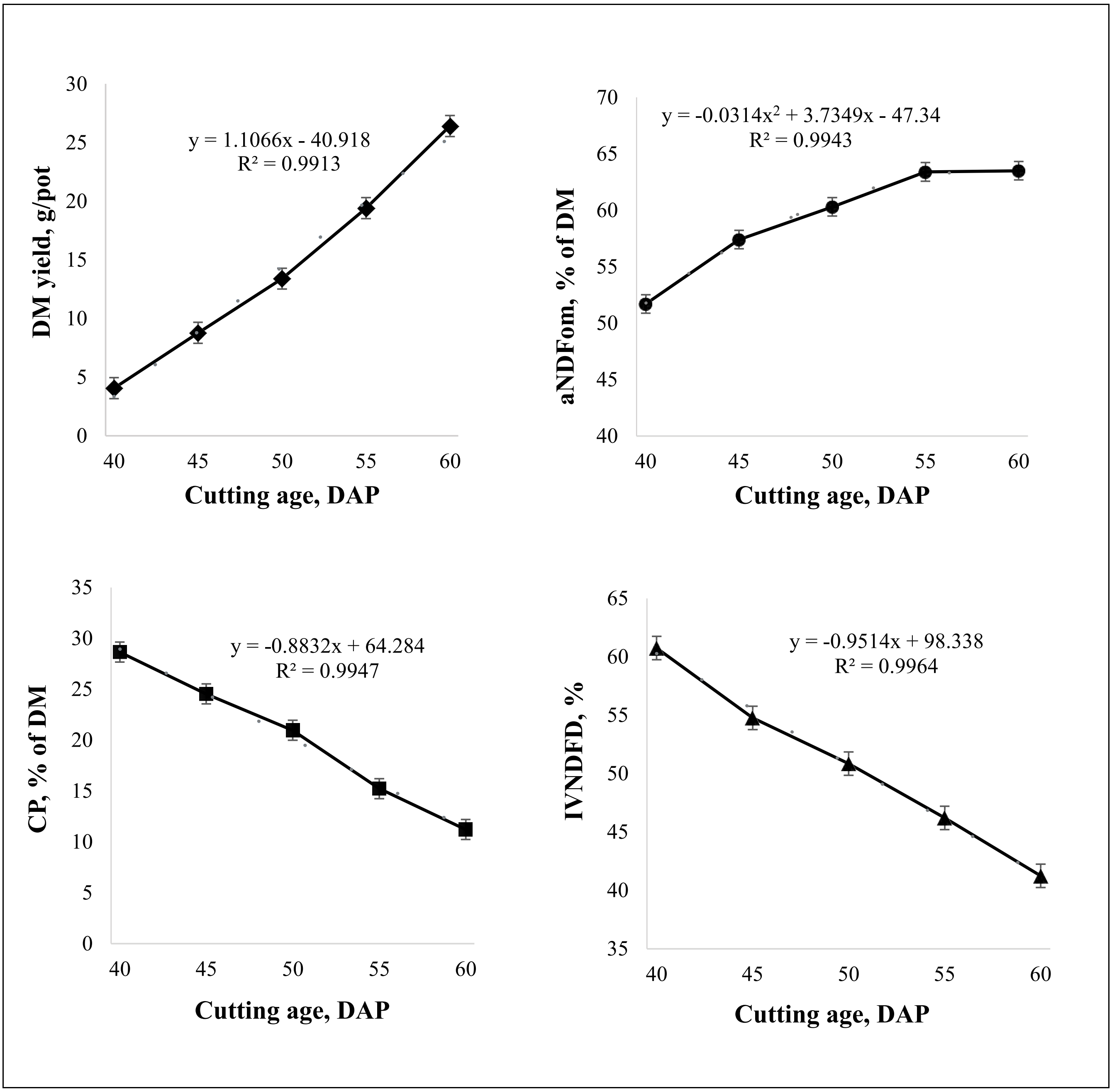

Figure 1: Effect of cutting age on yield, nutritive values, and digestibility of first-cutting teff grass. Increasing cutting age from 40 to 60 DAP significantly increased DM yield and aNDFom concentration (P<0.001) but significantly decreased CP concentration and IVNDFD (P<0.001).

g/pot when first-cutting harvest age increased from 40 to 60 DAP. We found that second-cutting aNDFom concentration was greatest (P<0.001) in those samples that were first cut at 45 and 50 DAP. Crude protein concentration of the second-cutting teff decreased dramatically, from 11.94 to 6.43 ± 0.32% of DM, when first-cutting harvest age was increased from 40 to 60 DAP.

In Cutting 3, again, teff variety had no effect (P=0.40) on DM yield, aNDFom concentration (P=0.10), or CP concentration (P=0.48, Table 1). Additionally, seed variety had no effect (P=0.49) on the cumulative DM yielded from the 3 cuttings. Like what was seen with Cutting 2, first-cutting harvest age had a significant effect (P<0.001) on third-cutting DM yield, aNDFom concentration, and CP concentration (Figure 2). DM yield decreased from 18.70 to 5.24 ± 0.30 g/pot when first-cutting harvest age increased from 40 to 60 DAP. Third-cutting aNDFom concentration was greatest in samples originally cut at 45 DAP and least in those cut at 55 DAP (P<0.001). CP was greatest in samples originally cut at 45 DAP and least in those cut at 55 DAP.

Whereas seed variety had no effect on the agronomic characteristics of teff, first-cutting harvest age played a critical role in influencing yield and nutritive values in Cuttings 2 and 3. According to Van Soest,

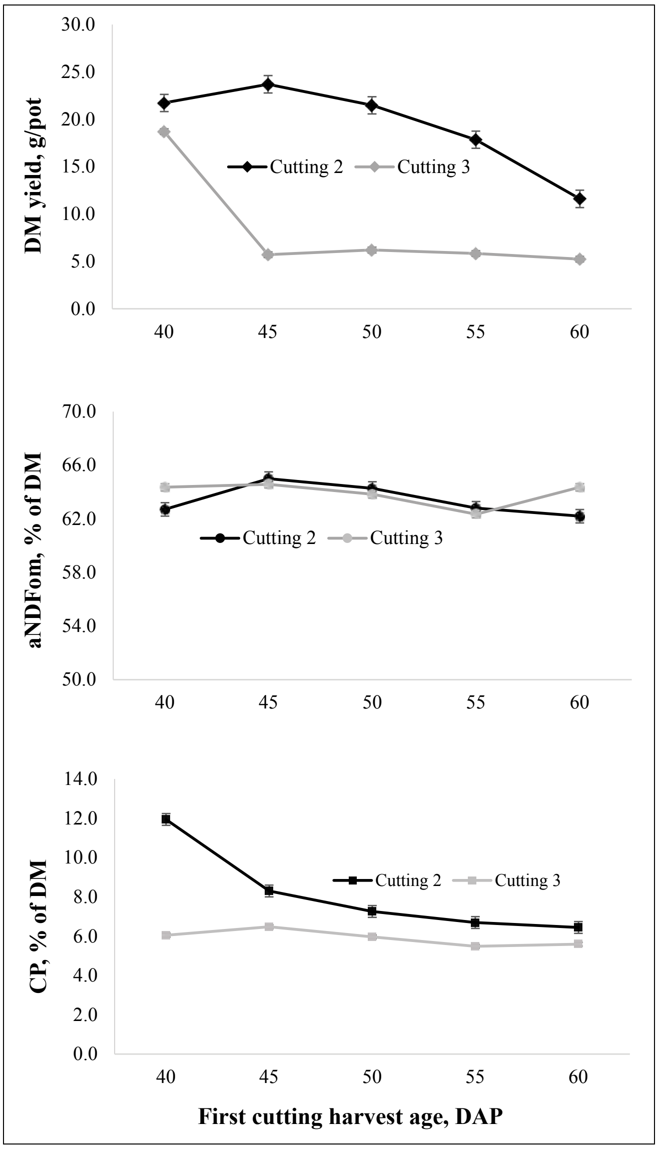

Figure 2: Effect of first-cutting harvest age on yield, nutritive values and digestibility of second- and third-cutting teff grass. For all pots, Cutting 2 was taken 30 d after Cutting 1. Cutting 3 was taken 30 d after Cutting 2. For Cuttings 2 and 3, first-cutting harvest age was a significant predictor (P<0.001) of DM yield and concentrations of aNDFom and CP.

Item	Variety				SEM	P-value
	Tiffany	Moxie	Corvallis	Dessie		
Cutting 1						
DM[1] yield, g/pot	14.77	14.56	14.48	13.83	0.40	0.38
aNDFom[2,3]	60.27	58.61	59.13	59.13	0.73	0.43
CP[2,4]	20.39	19.89	19.58	20.63	0.44	0.32
IVNDFD[5], %	51.21	49.66	50.39	51.81	0.85	0.32
Cutting 2						
DM yield, g/pot	19.48	20.12	19.12	18.30	0.82	0.47
aNDFom	62.70	63.33	64.21	63.37	0.44	0.13
CP	7.99	8.27	8.23	8.44	0.35	0.84
Cumulative DM yield (g/pot)	34.26	34.68	33.60	32.13	0.99	0.30
Cutting 3						
DM yield, g/pot	8.35	8.38	7.97	8.63	0.27	0.40
aNDFom	63.82	64.44	63.68	63.66	0.24	0.10
CP	5.87	5.83	5.96	5.98	0.08	0.48
Cumulative DM yield (g/pot)	42.61	43.06	41.57	40.76	1.15	0.49

[1]Dry matter
[2]Nutrients expressed as a percent of DM
[3]Ash-free neutral detergent fiber with amylase
[4]Crude protein
[5]*In-vitro* neutral detergent fiber digestibility

Table 1: Effect of teff variety on yield, nutritive values, and *in-vitro* digestibility of teff grass.

photosynthetic compounds are either stored or converted to structural material in plants. In a young plant, most of these photosynthetic compounds are stored. Stored nutrients are crucial for regrowth. When grasses are harvested during the late vegetative to early boot stage (40 to 45 DAP), these stored nutrients assist in the regrowth process and improve overall nutritive values. Grasses harvested during the boot to early heading stage (55 to 60 DAP), however, have already converted a large portion of these photosynthetic compounds to structural compounds. These structural compounds are mostly unavailable to the plant [19]. Therefore, after harvesting, mature plants have less nutrients available for regrowth, ultimately reducing subsequent yield and protein concentration while increasing the fiber concentration.

Delaying the first cutting from 40 to 60 DAP had a significant impact on the cumulative DM yielded over the course of the trial (Figure 3). After 2 cuttings, delaying the first cutting from 40 to 60 DAP significantly increased (P<0.001) total DM yield from 25.76 to 38.00 ± 1.11 g/pot. This was most likely due to the fact that the first-cutting yield from plants harvested at 40 and 45 DAP was so low that the cumulative yield for the early-cut plants was still less than that of the late-cut plants after 2 cuttings, despite having a relatively higher second-cutting yield. After 3 cuttings, however, an initial cutting age of 40 DAP yielded significantly more (P<0.01) DM than an initial cutting age of 45 DAP (44.47 vs. 38.15 ± 1.29 g/pot, or roughly 26 vs. 22 tons DM/ha) and numerically more DM than original cutting ages of 50, 55, and 60 DAP. After 3 cuttings, the advantage of harvesting a plant at an earlier maturity at Cutting 1 significantly outweighed the greater first cutting yield of a more mature plant. It is important to note that, although yield data collected from the greenhouse is useful for detecting differences among seed varieties and first-cutting harvest dates, yields observed in field trials do not typically match those observed in a controlled greenhouse setting.

Finally, across all teff varieties and cutting ages, Cutting 2 yielded significantly more DM (P<0.01) than Cuttings 1 and 3 and Cutting 1 yielded significantly more DM (P<0.001) than Cutting 3 (Table 2). Additionally, aNDFom concentration increased (P=0.01) and CP decreased (P<0.001) when cutting number increased from 1 to 3. Van Soest describes lignification as one of a plant's protective mechanisms against predatory attack or, in this case, a harvest event. As cutting number increases, then, it is expected that the concentration of the protective, fibrous component of teff would increase. This is supported by the fact that, as cutting number increased from 1 to 3, forage DM concentration, at harvest, increased (P<0.001) from 19.96 to 31.37 ± 0.92% (Table 2). Reid et al. reported a similar trend with smooth brome grass. As cutting number increased from 1 to 4, yield and digestibility

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	Cutting Number				
Item	**1**	**2**	**3**	**SEM**	**P-values**
DM yield, g/pot	14.58^{b}	19.26^{a}	8.33^{c}	0.72	0.001
DM %	19.96^{c}	26.72^{b}	31.37^{a}	0.92	<0.001
aNDFom[1]	59.40^{b}	63.40^{a}	63.80^{a}	0.40	<0.001
CP[1]	19.97^{a}	8.23^{b}	5.90^{b}	0.45	<0.001

[1]Expressed as a percent of DM

[a,b]Means with different superscripts are significantly different (P<0.05) by Tukey's HSD

Table 2: Effect of cutting number on yield and nutritive values of teff across all varieties and first-cutting harvest ages.

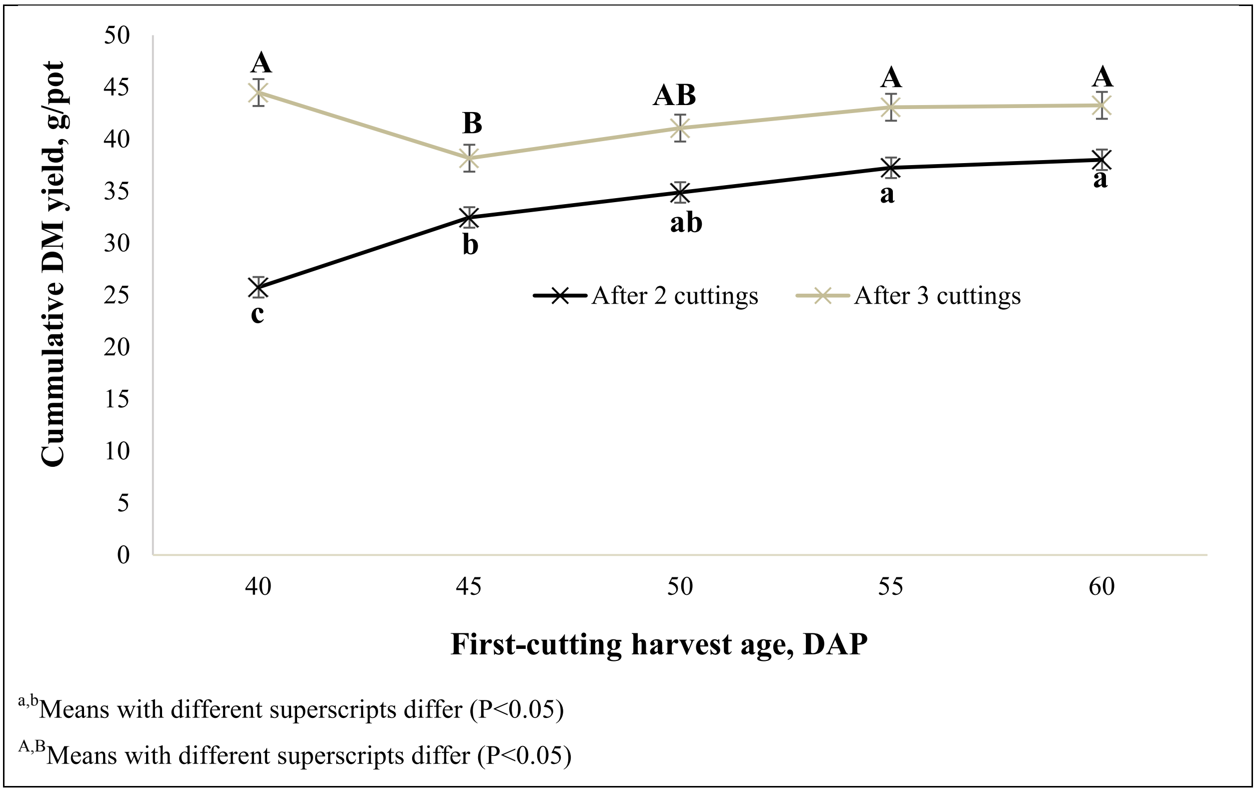

Figure 3: Effect of first-cutting harvest age on cumulative DM yielded from 3 cuttings.

tended to decrease while lignin concentration increased. The decrease in the CP concentration as cutting number increased could be due to both the increase in the fiber portion of the plant as well as the overall depletion of N and other key nutrients from the soil over time. While additional N (0.15 g of urea) was applied at d 60, N was not applied between Cuttings 2 and 3.

Conclusion

Results from this study indicate that, under greenhouse conditions, the first cutting of teff grass should be harvested at 45 to 50 DAP to optimize forage yield, quality, and digestibility in that cutting and in subsequent cuttings. For best results, N should be applied at planting and at every cutting to optimize regrowth and CP concentrations. Overall, the agronomic characteristics and nutrient profile of teff grass are similar those of other commonly fed forages like timothy [4], smooth brome grass, and sorghum-sudan grass. To use teff grass in the diets of a high producing dairy cow, maturity at first cutting and soil fertility must be well managed to ensure that the forage provided in the diet is of the highest quality and as valuable as possible to the animal.

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References

1. Innovation Center for US Dairy (2013) US Dairy's Environmental Footprint.
2. Cross JA (2015) Change and Sustainability Issues in America's Dairyland. Focus on Geography 58: 173-183.
3. Mengesha MH (1966) Chemical composition of teff (*Eragrostis teff*) compared with that of wheat, barley and grain sorghum. Econ Botany 20: 268-273.
4. Miller D (2011) Teff grass: crop overview and forage production guide.
5. Bonsi MLK, Osuji PO, Tuah AK, Umunna NN (1995) Intake, digestibility, nitrogen balance, and certain rumen characteristics of Ethiopian Menz sheep

fed teff straw supplemented with cotton seed cake, dry sesbania, dry leucaena, or fresh leucaena. Agrofor Syst 31: 243-256.

6. Bonsi MLK, Tuah AK, Osuji PO, Nsahlai VI, Umunna NN (1996) The effect of protein supplement source or supply pattern on the intake, digestibility, rumen kinetics, nitrogen utilization, and growth of Ethiopian Menz sheep fed teff straw. Anim Feed Sci Technol 64: 1996.
7. Mesfin R, Ledin I (2004) Comparison of feeding urea-treated teff and barley straw based diets with hay based diet to crossbred dairy cows on feed intake, milk yield, milk composition and economic benefits. Livest Res for Rural Dev, p: 16.
8. Roseberg RJ, Norberg S, Smith J, Charlton B, Rykbost K, et al. (2005) Yield and quality of teff forage as a function of varying rates of applied irrigation and nitrogen. Klamath Exp Stn 2005 Annu Rep 119-136.
9. Roseberg RJ, Charlton BA, Norberg S, Kugler J (2006) Yield and forage quality of six teff seed brands grown in three Pacific Northwest environments. Klamath Exp Stn 2006 Annu Rep 31-45.
10. Young A, Creech E, ZoBell D, Israelsen C, Eun J (2014) Integrating Teff into Livestock Operations. Utah State Univ Febr 2014 Ext Rep.
11. Allen MS (1996) Relationship between forage quality and dairy cattle production. Anim Feed Sci Technol 59: 51-60.
12. Burns J, Bennett B, Rooney K, Walsh J, Hensley J (2002) Coatings for legume and grass seed. Proc 57th South Pasture Forage Crop Improv Conf Athens, GA April, pp: 23-25.
13. Van Soest PJ, Robertson JB, Lewis BA (1991) Methods for dietary fiber, neutral detergent fiber and nonstarch polysaccharides in relation to animal nutrition. J Dairy Sci 74: 3583-3597.
14. Guo D, Chen F, Wheeler J, Winder J, Selman S, et al. (2001) Improvement of in-rumen digestibility of alfalfa forage by genetic manipulation of lignin O-methyltransferases. Transgenic Res 10: 457-464.
15. Ballard CS, Thomas ED, Tsang DS, Mandebvu P, Sniffen CJ, et al. (2001) Effect of corn silage hybrid on dry matter yield, nutrient composition, in vitro digestion, intake by dairy heifers, and milk production by dairy cows. J Dairy Sci 84: 442-452.
16. Carmi A, Aharoni Y, Edelstein M, Umiel N, Hagiladi A, et al. (2006) Effects of irrigation and plant density on yield, composition and *in vitro* digestibility of a new forage sorghum variety, Tal, at two maturity stages. Anim Feed Sci Technol 131: 120-132.
17. Chen L, Auh C, Dowling P, Bell J, Chen F, et al. (2003) Improved forage digestibility of tall fescue (Festuca arundinacea) by transgenic down-regulation of cinnamyl alcohol dehydrogenase. Plant Biotechnol J 1: 437-449.
18. Assefa G, Ledin I (2001) Effect of variety, soil type and fertiliser on the establishment, growth, forage yield, quality and voluntary intake by cattle of oats and vetches cultivated in pure stands and mixtures. Anim Feed Sci Technol 92: 95-111.
19. Van Soest PJ (1982) Nutritional Ecology of the Ruminant. Corvallis: O & B Books Inc., Print.
20. Kilcher MR, Troelsen JE (1973) Contribution of stems and leaves to the composition and nutrient concentration of irrigated brome grass at different stages of development. Can J Plant Sci 53: 767-771.
21. Ademosum AA, Baumgardt BR, Scholl JM (1968) Evaluation of a sorghum-sudan grass hybrid at varying stages of maturity on the basis of intake, digestibility and chemical composition. J Anim Sci 27: 818-823.
22. Jung HG (1987) Forage lignins and their effect on fiber digestibility. Agron J 81: 33-38.
23. Mir Z, Acharya SN, Mir PS, Taylor WG, Zaman MS, et al. (1997) Nutrient composition, *in vitro* gas production and digestibility of fenugreek (*Trigonella foenum-graecum*) and alfalfa forages. Can J Anim Sci 77: 119-124.
24. Reid RL (1962) Investigation of plant species and maturity stage on forage nutritive value as determined by in vitro techniques. Final Report USDA Contract 12-14-100-4524. W Va Agr Exp Sta, Morgan Town.

Citation: Benjamin SA, Bradford BJ, Min DH (2017) Effect of Seed Variety and Cutting Age on Dry Matter Yield, Nutritive Values and *In Vitro* Digestibility of Teff Grass. Adv Crop Sci Tech 5: 281. doi: 10.4172/2329-8863.1000281