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FORAGE QUALITY EVALUATION OF CHOPPED ELEPHANTGRASS HAY THROUGH INTAKE AND DIGESTIBILITY TRIAL[1]

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Abstract

The research was carried out to evaluate forage quality of chopped elephantgrass (*Pennisetum purpureum* Schum.) hay and to define a proper stage for cutting and haymaking of this grass. Chemical composition, voluntary intake, and apparent digestibility of the hays were studied at five different growth stages (30, 48, 63, 76, and 91 days). Twenty-five common wethers were utilized in a completely randomized experimental design. Dry matter (DM) voluntary intake was not different ($P>0.05$) from 30 to 63 days of regrowth and from 63 to 91 days and comprised 3.9; 3.5; 3.2; 2.1; and 2.4% of animal liveweight, respectively from 30 to 91 days. Digestibility coefficients of DM; OM; CP; EE; NDF; and ADF decreased linearly ($P<0.001$) as plant aged. At the experimental conditions haymaking of chopped elephantgrass showed good potential as a forage storage practice, particularly for low-input familial agricultural systems. According to DM yield, chemical composition, voluntary intake and apparent digestibility, the best grass cutting stage for haymaking occurred between 30 and 63 days.

Keywords: Forage conservation, haymaking, pennisetum purpureum

Introduction

Elephantgrass is one of the most important forage species in the semi-arid Brazilian Northeast dairy production systems. On the other hand, usual cut-and-carry practice is deficiently managed resulting in low productivity and poor forage quality. Forage conservation practices are also rarely performed promoting severe problems to livestock supplementation during the long annual drought period. The objective of this research was to evaluate forage quality of chopped elephantgrass hay and to define a proper stage for cutting and haymaking of this grass.

Material and Methods

The experiment was conducted at EMPARN's Felipe Camarão Research Station, Rio Grande do Norte State, Brazil. The experimental area comprised a 2.5 ha Cameroon elephantgrass cultivar. The experimental treatments consisted of clipping and drying the grass at T1 30 days of regrowth; T_2 – 48 days; T_3 – 63 days; T_4 – 76 days; and T_5 – 91 days. A field chopper was used to process forage material (two to three centimeters particle) which was transported and spread out on a cemented area in 10 cm layers. The drying period varied from 48-72 hours and the forage was mixed at three-hour intervals during the day.

Chemical composition, voluntary intake, and apparent digestibility of the hays were studied through total faeces collection in metabolic cages using 25 common wethers, 18 months-old with average 20 kg live weight. A completely randomized experimental design was applied with five treatments and five replications. Animal diets were composed exclusively of chopped elephantgrass hay *ad libitum*, plus mineral supplementation and

water. Procedures for determining voluntary intake and nutrient digestibility of hays with sheep were performed according to Moore (1981). Total trial length was 21 days, with 14 days for an adaptation period and seven days of sample data collection. Whirl-pack bags containing hay, orts, waste, and faeces samples were kept in air-tight containers until analyzed for dry matter (DM); organic matter (OM); crude protein (CP); ether extract (EE); neutral-detergent fiber (NDF); and acid-detergent fiber (ADF). All determinations were processed at the Animal Nutrition Laboratory of the Federal University of Rio Grande do Norte (UFRN), according to procedures of AOAC (1986) described by Silva (1990). Analysis of variance and regression analysis were performed and mean comparison among treatments were made using test at 5% level of probability.

Results and Discussion

An increase on age of regrowth period promoted a linear increase ($P<0.001$) concentrations of DM; OM; NDF; and ADF, and a quadratic decreasing effect ($P<0.001$) on CP concentration. Crude protein concentrations showed a high decrease from T_1 – 30 days (12.42%) to T_5 – 91 days (4.8%). These values are in agreement with Deschamps (1997) which reported elephant grass CP concentrations varying from 9.7 to 16.6% at four-week of regrowth, and from 3.8 to 7.5% at 14-week.

Voluntary intake and apparent digestibility data with their respective regression equations are presented in Table 1. Dry matter voluntary intake (DMVI) was not different ($P>0.05$) from T_1 – 30 days to T_3 – 63 days and from T_3 – 63 days to T_5 – 91 days. These results indicate a DMVI which comprised 3.9; 3.5; 3.2; 2.1; and 2.4% of animals liveweight, respectively from T_1 to T_5. Dry matter voluntary intake higher than 3% of liveweight (T_1 to T_3) can be considered promising since Matejousky and Sanson (1995) reported average values of 1.9; 2.7; and 2.8%, respectively for grass hays of low, medium, and high quality. Crude

protein voluntary intake was higher ($P<0.05$) for T_1 – 30 days (109.97 g/day) with a severe decrease up to T_4 – 76 days (22.94 g/day).

Digestibility coefficients for all variables decreased linearly ($P<0.001$) as plants developed . Relationship between CP voluntary intake and digestibility values obtained for the different regrowth periods is an important aspect to be discussed. The low CP concentration after T_3 – 63 days (<7.0%) and its low digestibility (<47.9%) probably have influenced the severe decrease on DMVI and digestibility. Milford and Minson (1966) reported that low forage CP concentration can limit intake and digestibility through inadequate N availability to rumen microorganisms. The high NDF digestibility observed in T_1 – 30 days (75.4%) is in agreement with Flores *et al.* (1993) which reported an average of 72.7% for Dwarf Mott elephant grass hay with 35 days.

Although 30 day regrowth hay showed high voluntary intake and digestibility coefficients, its DM yield (2.4 t/ha) was lower ($P<0.05$) than 48 and 63 day regrowth hay, 6.6 and 8.9 t/ha, respectively. In that way, putting together DM yield, chemical composition, voluntary intake and apparent digestibility, the best age for grass cutting and haymaking at the experimental conditions ranged from 30 to 63 days.

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Table 1 – Voluntary intake and apparent nutrient digestibility coefficients of chopped elephant grass hays and respective regression equations

Voluntary Intake (g/day)							Regression equations		
Variables[†]	T_1 – 30 days	T_2 – 48 days	T_3 – 63 days	T_4 - 76 days	T_5 – 91 days	CV[‡] (%)	Equations[£]	R^2	P[§]
DMI	872.11 a	711.46 a	634.29 ab	397.28 b	450.41 b	21.71	Y = 1087.521 – 7.7014x	0.8910	0.00004
OMI	716.57 a	585.70 a	541.18 ab	346.06 b	384.11 b	20.51	Y = 885.257 – 6.0141x	0.8874	0.00004
CPI	109.97 a	60.44 b	43.76 bc	22.94 c	28.50 c	21.59	Y = 229,27 – 0.4858x + $0.0028x^2$	0.9880	0.00018
EEI	7.40 a	8.07 a	6.97 a	4.22 b	3.20 b	15.20	Y = 10.849 – 0.0791x	0.7796	0.00001
NDFI	606.43 a	529.55 ab	501.52 ab	306.93 c	350.22 bc	22.25	Y = 757.669 – 4.8496x	0.8363	0.00017
ADFI	311.70 a	248.48 ab	246.18 ab	175.95 b	146.15 b	28.43	Y = 378.709 – 2.4840x	0.8127	0.00080
Apparent Digestibility (%)							Regression equations		
Variables[†]	T_1 – 30 days	T_2 – 48 days	T_3 – 63 days	T_4 - 76 days	T_5 – 91 days	CV[‡] (%)	Equations[£]	R^2	P[§]
DMD	63.76 a	59.02 a	56.23 a	46.66 b	43.52 b	12.34	Y = - 0.3669x + 75.849	0.8910	0.00005
OMD	69.55 a	60.18 ab	58.32 ab	47.22 bc	45.06 c	12.32	Y = - 0.4120x + 81,450	0.9501	0.00003
CPD	59.37 a	51.47ab	47.89 bc	44.13 bc	38.00 c	11.30	Y = - 0.3351x + 68.825	0.9894	0.00002
EED	55.51 a	51.97 a	47.59 ab	41.46 bc	37.92 c	10.88	Y = - 0.2788x + 64.074	0.8332	0.00006
NDFD	75.40 a	65.88 ab	65.11 ab	53.98 b	53.17 b	12.60	Y = - 0.3751x + 85.824	0.9236	0.00017
ADFD	56.61 a	51.56 ab	49.22 abc	42.41 bc	38.30 c	12.30	Y = - 0.3033x + 66.311	0.9748	0.00009

Means within the same column followed by different letters differ (P<0.05) by Tukey test.

[†] DM = dry matter; OM = organic matter; CP = crude protein; EE = ether extract; NDF = neutral-detergent fiber; ADF = acid-detergent fiber.

[‡] Coefficient of variation.

[£] x = age of regrowth (days) at elephantgrass haymaking stage.

[§] Probability