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Decomposition of cattle feces from *Pennisetum purpureum* pastures managed under different post-grazing stubble heights

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Introduction

Pasture management can affect cattle diets. Post-grazing stubble height is a structural characteristic intrinsically linked to forage quantity and quality. Stubble height also indicates forage utilization rate, and as a result, affects nutrient return pathways (excreta or litter) and, ultimately, nutrient cycling. While deposition of cattle excreta affects soil chemical and physical characteristics (Carran and Theobald 2000), slow release of nutrients from cattle dung delays nutrient bioavailability for subsequent forage growth (Haynes and Williams 1993). This study evaluated how different post-grazing stubble heights on elephant grass (*Pennisetum purpureum*) pastures may affect cattle dung decomposition and nutrient release.

Materials and Methods

Three post-grazing stubble heights (40, 80 and 120 cm) were tested on elephant grass pastures, in a complete randomized block design, with 3 replications. Cattle fecal samples were collected directly from the animals' rectums, dried at 65 °C, and subsequently exposed in nylon bags measuring 15 x 30 cm and 75 µm mesh size. Bags were placed in a forced-air oven drier for 72 h at 65 °C and weighed thereafter. Samples of dried feces (11.25 g) were placed in bags to achieve a ratio of 25 mg of feces per cm^2 of bag surface. Incubated fecal samples were not ground in order to preserve original surface exposed to microbial attack. Bags were sealed, placed on the ground, covered with a thin soil layer and left for different periods: 0, 4, 8, 16, 32, 64, 128 and 256 days during 2007 and 2008. After the relevant periods, bags were retrieved, brushed, placed in the forced-air oven drier for 72 h at 65 °C and weighed. Analyses of the remaining material included DM, OM, N, P, K, Ca, Mg, ADFN (Silva and Queiroz 2006), carbon (Bezerra Neto and Barreto 2004) and lignin (Van Soest et al. 1991). Data were analyzed using Proc Mixed from SAS (SAS 1996). When exposure period was significant, non-linear models were tested and the single exponential negative decay model was used to fit the data, using SAS Proc Nlin.

Results and Discussion

Post-grazing stubble height affected both the composition of cattle dung (Table 1) and the remaining fecal biomass ($P<0.05$), with a decline in fecal decomposition rate as post-grazing stubble height increased (Table 2). After 256 days of exposure, final remaining fecal biomass was 52, 64 and 70% for 40, 80 and 120 cm post-grazing stubble heights, respectively.

Post-grazing stubble height did not affect nutrient release ($P>0.05$), which was influenced only by the exposure period; data followed the single negative decay model ($P<0.001$). Decay of the various nutrients over the 256 days varied greatly, ranging from only 30% loss of N to 83% of K (Table 3). Losses of P, Ca, Mg and Na were intermediate. Fecal C:N ratio decreased with increasing exposure period (Table 1).

After exposure, all treatments presented C:N ratios <20, with averages of 19, 12 and 9 for 120, 80 and 40 cm, respectively (Table 1). Post-grazing stubble height

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Table 1. Lignin (LIG) and acid detergent fiber N (ADFN) concentrations, and C:N, C:P, LIG:N, ADFN:N and LIG:ADFN ratios on an organic matter (OM) basis for feces of cattle grazing on elephant grass pastures managed under different post-grazing stubble heights (PGSH), before (0 day) and after (256 days) soil exposure.

PGSH (cm)	LIG (g/kg)		ADFN (g/kg)		C:N		C:P		LIG:N		ADFN:N		LIG:ADFN	
	0 d	256 d	0 d	256 d	0 d	256 d	0 d	256 d	0 d	256 d	0 d	256 d	0 d	256 d
40	70.1a[1]	121b	9.5a	12.2a	13.3c	9.2c	32.8b	73.4a	2.7b	4.4b	4.5b	4.3b	7.4a	10b
80	67.7a	139b	7.9b	9.2a	20.2b	12.2b	58.4a	63.6a	3.4b	6.4b	4.2b	4.4b	8.6a	14a
120	79.3a	182a	6.7c	11.1a	27.4a	19.1a	60.2a	102.8a	4.9a	11.3a	6.5a	6.3a	11.8a	17a
s.e.	6.9	6.9	0.1	0.1	0.4	0.3	7.8	9.3	0.3	0.7	0.6	0.8	0.8	0.8
P	0.236	0.002	0.001	0.213	0.002	0.001	0.048	0.06	0.009	0.001	0.002	0.003	0.096	0.003

[1]Means followed by the same letter within columns are not different by Tukey (P>0.05).

Table 2. Percentage of fecal biomass from cattle grazing *Pennisetum purpureum* pastures managed at different post-grazing stubble heights remaining after varying exposure periods.

Post-grazing stubble height (cm)	Days of exposure								
	0	4	8	16	32	64	128	256	
40	100.0	99.5	98.0	96.5	92.6	85.4	72.6	52.4	$y\ 40=100^{-0.00254t}$
80	98.0	97.3	96.7	95.4	92.9	88.1	79.1	63.9	$y\ 80=97.9^{-0.00167t}$
120	98.8	98.1	97.8	96.7	94.7	90.7	83.2	69.9	$y\ 120=98.8^{-0.00135t}$

Table 3. Percentage of fecal nutrients from cattle grazing *Pennisetum purpureum* pastures managed at different post-grazing stubble heights remaining after varying exposure periods.

Nutrient	Days of exposure								
	0	4	8	16	32	64	128	256	
N	95.4	94.9	94.5	93.6	91.8	88.3	81.8	70.11	$y\ N=95.4^{-0.00095t}$
P	92.0	90.5	89.1	86.3	80.9	71.1	54.9	32.7	$y\ P=92^{-0.00389t}$
K	99.6	96.9	94.2	89.1	79.6	63.7	40.7	16.6	$y\ K=99.6^{-0.00654t}$
Ca	98.5	97.3	96.3	94.2	90.1	82.4	68.9	48.3	$y\ Ca=98.5^{-0.00268t}$
Mg	96.5	95.2	93.9	91.4	86.6	77.7	62.6	40.7	$y\ Mg=96.5^{-0.00312t}$
Na	82.5	81.6	80.7	79.0	75.6	69.2	58.1	40.9	$y\ Na=82.5^{-0.00315t}$

also affected (P=0.048) fecal C:P ratio, with samples from the 40-cm treatment presenting the least initial C:P ratio (32.8). Lignin:N ratio also varied with treatment, with highest initial (4.9) and final values (11.3) for the 120-cm treatment (Table 1).

Conclusions

Increasing post-grazing stubble height increased fecal C:N, C:P, LIG:N and ADFN:N ratios and slowed fecal decomposition. This is an additional factor to consider when determining grazing strategies, as decomposition of feces has implications for nutrient recycling. Even after 256 days, 50–70% of the OM in dung was still in place, indicating the length of time taken for material to be incorporated back into the soil.

References

Bezerra Neto E; Barreto LP. 2004. Métodos de análises químicas em plantas. Imprensa Universitária, Universidade Federal de Pernambuco, Recife, PE, Brazil.

Carran RA; Theobald PW. 2000. Effects of excreta return on properties of a grazed pasture soil. Nutrient Cycling in Agroecosystems 56:79−85.

Haynes RJ; Williams PH. 1993. Nutrient cycling and fertility in the grazed pasture ecosystem. Advances in Agronomy 49:119−199.

SAS 1996. SAS statistics user's guide. Release version 6. SAS Institute Inc., Cary, NC, USA.

Silva DJ; Queiroz AC. 2006. Análise de alimentos: Métodos químicos e biológicos. 3rd Edn. Universidade Federal de Viçosa, Viçosa, MG, Brazil.

Van Soest PJ; Robertson JB; Lewis BA. 1991. Methods for dietary fiber, neutral detergent fiber, and nonstarch polysaccharides in relation to animal nutrition. Journal of Dairy Science 74:3583−3597.

Dubeux Jr JCB; Saraiva FM; Santos MVF dos; Mello ACL de; Teixeira VI; Freitas EV de. 2014. Decomposition of cattle feces from *Pennisetum purpureum* pastures managed under different post-grazing stubble heights. Tropical Grasslands – Forrajes Tropicales 2:45–47.
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