Cattle fecal decomposition on *Pennisetum purpureum* Schum. pastures managed under different post-grazing stubble heights

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Introduction

Pasture management may affect cattle diet. Post-grazing stubble height is a pasture structural characteristic intrinsically linked to forage quantity and quality. Stubble height also indicates forage utilization rate, and as a result, affects nutrient pathway return (excreta or litter) and ultimately, nutrient cycling. Cattle excreta deposition affects soil chemical and physical characteristics (Carran and Theobald 2000). Slow release of nutrients from cattle dung, however, 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* Schum.) 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 three replications. Cattle fecal samples were collected directly from the animal´s rectum, dried at 65°C, and subsequently incubated in nylon bags for different periods: 0, 4, 8, 16, 32, 64, 128, and 256 days. Fecal collection and incubation occurred in 2007 and 2008. Bags were placed on the ground and covered with a thin layer of soil. Data were analyzed using proc mixed from SAS (SAS 1996). When incubation 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 cattle dung decomposition ($P = 0.0067$), decreasing decomposition with increasing post-grazing stubble height (Table 1). After 256 days of incubation, final remaining fecal biomass was 52%, 64%, and 70% for 40, 80, and 120 cm post-grazing stubble heights, respectively.

Nitrogen decay was slower along the 256-d incubation period (k = 0.00095 g/g/day), with only 30% release after 256 days of incubation (Table 2). Release of Ca, Mg, Na, and P from incubated dung after 256 days of incubation was 49.2, 59.3, 59.1, and 68.3, respectively. Potassium was the most extensively released nutrient (k=0.00654 g/g/day) among analyzed elements, with 83.3% of released K along 256 days of incubation.

Fecal C:N ratio decreased with increasing incubation period. All treatments presented C:N ratio < 20, with averages of 19, 12, and 9 for 120, 80, and 40 cm, respectively (Table 3). Post-grazing stubble height also affected ($P = 0.048$) fecal C:P ratio, with samples incubated in the 40-cm treatment presenting the least initial C:P ratio (32.8). Lignin:N ratio also varied with treatment, with higher initial (4.9) and final values (11.3) for the 120-cm treatment; the least initial (2.7) and final (5.0) lignin:N ratios were observed for the 40-cm treatment, and intermediate values (3.4 and 8.0 at the beginning and end of the 256-d incubation, respectively) for the 80-cm treatment. Post-grazing stubble height did not affect nutrient release ($P > 0.05$) which was influenced only by the incubation period; data

Table 1. Fecal remaining biomass (%) from cattle grazing on *Pennisetum purpureum* Schum. pastures managed at different post-grazing stubble height.

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

Table 2. Fecal nutrient release from cattle grazing on *Pennisetum purpureum* Schum. pastures managed at different post-grazing stubble height.

Nutrient release (%)	0	4	8	16	32	64	128	256	
	Days of incubation								
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	$y\ Na=82.5^{-0.00315t}$

Table 3. Nitrogen (N), phosphorus (P), lignin (LIG) and acid detergent fiber N (ADIN) concentrations, 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, before soil incubation.

Post-grazing stubble heights	N	P	LIG	ADIN	C:N	C:P	LIG:N	ADIN:N	LIG: ADIN
	----------g/kg organic matter--------				----------Ratio----------				
40 cm	22.9 a	7.3 a	70.1 b	9.5 a	13.3 c	32.8 b	2.7 b	4.3 b	7.4 b
80 cm	18.0 b	5.7 b	67.7 b	7.9 b	20.2 b	58.4 a	3.4 b	4.4 b	8.6 b
120 cm	14.9 c	5.7 b	79.3 a	6.7 c	27.4 a	60.2 a	4.9 a	6.3 a	11.8 a
SE	0.7	0.6	6.9	0.1	0.4	7.8	0.3	0.5	0.81
P	0.002	0.245	0.236	0.001	0.002	0.048	0.009	0.027	0.096

Means followed by the same letter within each column do not differ by Tukey test ($P>0.05$).

followed the single negative exponential decay model ($P < 0.001$).

Conclusions

Post-grazing stubble height affected cattle dung decomposition. Initial fecal composition was different among treatents, with lower post-grazing stubble height presenting lower C:N, C:P, ADIN:N, and lignin:N ratios.

References

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