MACRO-ELEMENTS CONCENTRATION OF MANURES DEPOSITED BY SELECTED LARGE HERBIVORES IN AFRICAN TROPICAL SAVANNA ECOSYSTEM

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ABSTRACT

Wildlife and livestock co-existence is a common phenomenon in African tropical savanna where they share resources, but very little is known about their manure contribution to macro-elements (carbon (C), nitrogen (N), and phosphorus, (P)) to soils. This study was conducted at the Mpala Research Centre and conservancy in Laikipia district, Kenya. The objective of the study was to determine the composition of C, N, and P content of fresh manures deposited on soils by browsers (camel and giraffe), intermediate feeders (elephant and impala), and grazers (cattle and zebra). Six composite samples of fresh manure from different herds of each herbivore species were collected. The total C content was significantly higher ($p< 0.0001$) in the browsers manure with giraffe and camel having 490 and 450 g/kg, respectively, followed by intermediate feeders, elephants and impala at 400 and 390 g/kg, respectively. While the grazers had significantly lower C with zebra and cattle having 350 and 330 g/kg. The total P in the manure was significantly different ($P<.0001$), with impala, Camel and Giraffe having 6.8, 5.7, and 4.9 g P/kg respectively while zebra, elephant and cattle had 3.0, 2.5, and 1.8 g P/kg, respectively. The browsers, giraffe and camel had highest total N ($P<.0001$) at 30 and 26 g N/kg, followed by the impala at 23 g/kg, while elephant, zebra, and cattle had the lowest amount of N at 16, 13, and 11 g N/kg, respectively. Giraffe, camel, and impala manures had the lowest C/N ratio at 17, 17, 18 respectively ($P<.0001$), while cattle, zebra, elephant had the significantly higher C/N ratio 30, 27, and 26, respectively. Impalla, camel and giraffe had significantly lower C/P ratio ($P<.0001$) at 62, 81, and 109, respectively, while cattle, elephant, zebra had significantly higher C/P ratio at 186, 163, and 148, respectively.

The variability in composition of manures depends on the type of vegetation consumed by these animals. The browsers camel and giraffe predominantly feed on C-3 plants such as acacia leaves which are rich in N. while intermediate feeders, elephant and impala feed on grasses, forbs and acacia leaves/trees. While cattle and zebra predominantly feed on grasses (C-4 plants), as indicated by C-13 isotopic signature. Lower values of C-13 for camel, elephant, and giraffe manures suggest that these animals are potentially feeding C-3 plants. Impala are known to spend a lot of time in the glades (former cattle kraals) which have nutritious vegetation that could be leading to high P and N in their manure. Amount of macro-element element contribution by these animals to soils depends on the density of herbivores, lability and decomposition of manures deposited.