Identification and Quantification of n-Alkanes in Three Tropical Grasses

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IDENTIFICATION AND QUANTIFICATION OF N-ALKANES IN THREE TROPICAL GRASSES

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Abstract

The main goal of this paper was to quantify the profile of n-alkanes in three tropical grasses. Hand plucking samples to simulate grazing were taking from *Brachiaria brizantha* cv. Marandu, *Panicum maximum* cv. Mombaça and *Pennisetum purpureum* cv. Cameroon. These samples were collected from an experiment established to assess intensive beef production from grasses throughout the year, under rotational grazing. Rotation order through the paddocks remained constant, with 30 days of rest after each grazing bout (16 paddocks, 2 days of grazing). Profiles of n-alkanes were analysed in three separate periods of the year: in the middle of the dry season (August 98; PERIOD 1), at the beginning of the wet season (November 97; PERIOD 2) and at the end of the wet season (April 98; PERIOD 3). Chain length was measured from C_{27} to C_{35}. The concentration of odd n-alkanes, mainly C_{35}, C_{33}, C_{31} and C_{29}, showed a wide variation between species and some variation between sampling periods. The most frequent alkanes in the Cameroon cultivar were C_{33}, C_{31} and C_{29}, and in the cv. Marandu and Mombaça were C_{33} and

C_{31}.

Keywords: N-alkanes, rotational grazing, tropical grasses

Introduction

The use of n-alkanes as markers is seen as something unique since it allows the use of dosed and herbage alkanes as a means of estimating pasture intake by ruminants (Mayes et al., 1986). Chibnall et al. (1934) was the first to show the presence of n-alkanes in plant cuticular wax. The interest for the chemical composition of the cuticular wax increased as the analytical techniques, chiefly the chromatography both gaseous and liquid, became more accurate. According to Dove & Mayes (1991), the n-alkanes of herbages species are predominantly odd-chain in the range C_{21} to C_{37}, and that C_{31} is the most abundant, followed by the C_{29}. These authors have emphasised that each plant species own a particular profile of n-alkanes. Therefore, the knowledge of n-alkane profiles in the whole plant or anatomical components of these plants (leaves and stems) can be a useful tool for the identification of the diet chosen by grazing ruminants, mainly on pasture with more than one specie (Dove & Mayes, 1996). The aim of this experiment was to identify and quantify n-alkane profiles in three tropical grasses under rotational grazing.

Material and Methods

This experiment has been carried out at EMBRAPA/CNPGC, in Campo Grande, MS. The herbage samples for n-alkanes analysis were collected from pasture of *Brachiaria brizantha* cv. Marandu, *Panicum maximum* cv. Mombaça, and *Pennisetum purpureum* cv. Cameroon, under

rotational grazing.

These pastures where part of a research project design to compare the potential of tropical grasses for intensive beef production throughout the year. The steers were rotated on a predetermined schedule of 2 days of grazing per rotational paddock. Rotation order through the paddocks remained constant, with 30 days after each grazing bout.

For each grass specie, samples for n-alkane analysis were colleted simulating grazing (hand-plucking sample) in three different periods of the year: in the middle of the dry season (August 97; PERIOD 1), at the beginning of the wet season (November 97, PERIOD 2), and in the end of the wet season (April 98, PERIOD 3). The determination of n-alkanes, within the range of C-chain between 27 and 35, followed the methodology proposed by Mayes et al. (1986).

Results and Discussion

Table 1 shows the n-alkane contents (mg/kg MS) of the cultivars Marandu, Mombaça and Cameroon. The length of C-chain measured ranged from C_{27} to C_{35}. The concentrations of odd n-alkanes, mainly C_{35}, C_{33}, C_{31} and C_{29} showed a large variation between species and some variation between sampling periods. C_{33} and C_{31} were the most abundant alkane in the three species. C_{35} was at an intermediate level in the cultivar Marandu for the three sampling periods and C_{29} showed a high participation in the C-chain alkanes for cv. Cameroon. According to Casson et al. (1990), cited by Laredo et al. (1991), the low content of C_{35} found in the cultivar Mombaça and Cameroon at all sampling periods and Marandu at the middle of the dry season, disqualify this alkane to be used in the double-alkane technique. Their suggestion was that odd-chain alkanes could be used as an internal marker when they exceed 50 mg/kg of DM, although this critical concentration depends on the sensibility of the analysis as well as the accuracy required for the estimates of intake. Our results showed that at least for the cv. Cameroon, when

sampled at period 3, C_{35} contents were high enough to allow its use as an internal marker, however, for the cultivar Mombaça, this would not be possible at any sampling period.

Even-chain alkanes, as compared with odd-chain alkanes, showed only a small participation of the total C_{27}-C_{35} alkanes for all grasses studied, which is in agreement with the results of Dove & Mayes (1991). These authors found that C_{29} (nonacosane), C_{31} (hentriacontane) e C_{33} (triacontane) were the most abundant in the range C_{25}-C_{35} but a large difference in levels and patterns may be found due to the forage species or anatomical components of the plant (Dove & Mayes, 1991). Oliveira et al. (1997) found a reduction of C_{33} and C_{35} n-alkanes in napier grass hay with aging. Similarly, Laredo et al. (1991) found a reduction in n-alkanes contents in leaves of *Pennisetum glaucum* and *Sorghum sp*, as the plant mature. We found reduction, due to aging, in C_{35}, C_{33}, and C_{31} n-alkanes contents only for the cultivar Mombaça. The cv. Cameroon also showed reduction due to aging, in C29. The cv. Marandu did not show any reduction (Table 1). However differences were found among cultivars, being the most abundant for cv. Cameroon C_{35}, C_{33}, and $C_{31,}$ for cv. Marandu C_{33}, C_{31}, and C_{29} and for cv. Mombaça C_{33} and C_{31}.

References

Chibnall, A.C., Piper S.H., Pollard A., Williams E.F. and Sahai P.N. (1934). The constitution of the primary alcohols, fatty acids and paraffins present in plant and insect waxes. Biochemistry Journal, **28**: 2189-2208.

Dove, H. and Mayes R.W. (1991). The use of plant wax alkanes as marker substances in studies of the nutrition of herbivores: a review. Australian Journal of Agricultural Research, **42**: 913-952.

Dove, H. and Mayes R.W. (1996). Plant wax components: a new approach to estimating intake and diet composition in herbivores. Journal of Nutrition, **126**: 13-26.

Laredo, M.A., Simpson G.D., Minson D.J. and Orpin C.G. (1991). The potential for using n-alkanes in tropical forages as a marker for the determinations of dry matter intake by grazing ruminants. Journal of Agricultural Science, **117**: 355-361.

Mayes, R.W., Lamb C.S. and Colgrove P.M. (1986). The use of dosed and herbage n-alkanes as marker for the determination of herbage intake. Journal of Agricultural Science, **107**: 161-170.

Oliveira, D.E., Prates E.R. and Peralba M.C.R. (1997). Identificação e quantificação de n-alcanos presentes nas ceras de plantas forrageiras. Revista da Sociedade Brasileira de Zootecnia, **26**: 881-886.

Table 1 - N-alkane (C_{27} – C_{35}) contents in hand puckling samples of cultivars Marandu, Mombaça, and Cameroon (mg/kg DM) collected at the middle of the dry season (Period 1), at the beginning of the wet season (Period 2), and at the end of the wet season (Period 3).

Cultivars	n-alkane contents (mg/kg DM)							
MARANDU	C_{27}	C_{28}	C_{29}	C_{30}	C_{31}	C_{32}	C_{33}	C_{35}
Period 1	9.308	5.827	38.963	8.322	114.949	7.719	104.839	38.108
Period 2	8.846	3.830	34.062	8.876	122.634	9.060	152.819	63.029
Period 3	16.105	9.474	39.397	7.946	111.827	8.354	136.880	56.229
MOMBAÇA								
Period 1	12.335	10.028	45.717	15.176	189.634	10.005	120.853	18.829
Period 2	12.242	8.976	41.685	13.602	172.145	9.125	102.639	14.112
Period 3	15.557	10.092	40.428	10.888	133.224	7.755	91.248	19.166
CAMEROON								
Period 1	62.095	20.011	172.999	7.615	113.725	0.000	78.168	30.748
Period 2	30.262	13.893	114.316	7.406	123.454	0.000	108.277	46.882
Period 3	31.558	16.235	110.758	8.757	124.830	6.086	117.170	48.498