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Scientific paper

Estimate of the chemical composition of Braquiaria cv. Marandú by chlorophyll meter

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Abstract

The conception of a fast, efficient and profitable methodology is important for the evaluation of the nutritional characteristics in forage plants due to a raised variation of these grassy parameters in the tropical ones in a short time. The aim of this work was to verify the use of chlorophyll meter Minolta SPAD-502, for evaluation of the dry matter (DM), crude protein (CP) and neutral detergent fiber (NDF) in plants of *Brachiaria brizantha* cv. Marandú. The samples were obtained in a pasture, where the variation of color of leaves was a principal parameter of selection. Subsequently to the readings of SPAD index in the middle section of leaves, chemical composition was determined. It was possible to design models of relation between content of DM, CP, and SPAD index. The adjustment of the quadratic model expressed the best relation between the content of CP and the readings of SPAD index. A linear model was adjusted to the relation between DM and SPAD index. It was not possible to stipulate a model between content of NDF and SPAD index.

Keywords: *Brachiaria brizantha*, dry matter, crude protein, neutral detergent fiber, nutritional status.

Introduction

Nowadays in Brazil pastures are the main source of food to the ruminants maintained in extensive breeding systems. Among the forage grass, the genus Brachiaria is noteworthy, and it is present in most part of the areas destined to the pasture (BATISTA, 2002; ALVES, 2006). *Brachiaria brizantha* is a plant with a tufting growing habit, great capacity of regrowth, tolerance to cold and dry weather, fire and resistance to the attack of leafhoppers (ALCÂNTARA e BUFARAH, 1992; BATISTA, 2002).

Considering the importance of the use of pasture in the exploitation of cattle, it can be seen that the correct characterization of the quality of the forage consumed by the animals in regime of pasture, is a indispensable information so that the results of the experiments in pasture may express close link to the reality (ALVES, 2006).

The monitoring of the content of Nitrogen (N) in the forage plant is very important to determine the content of crude protein (CP). The relative content of chlorophyll

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in the leaves is a parameter which can be used to evaluate the nutritional level of N in plants, since the amount of this pigment is related positively with the amount of this element in plants (PIEKIELEK and FOX, 1992; WASKOM et al., 1996; BOOIJ et al., 2000; ARGENTA et al., 2001). This correlation is due to the fact that from 50 to 70% of the total N of the leaves are integrant of enzymes which are associated to the chloroplasts (CHAPMAM and BARRETO, 1997).

The photosynthetic activity, the content of soluble proteins and of N existent in the leaves are variables which can be correlated to the content of chlorophyll in the leaf tissue (RAJCAN et al, 1999). Even though the content of N in the leaf is a parameter used in the determination of the quantity of CP, this kind of analysis demands a considerable interval of time between the collection and the attainment of data. Therefore, although these results are very precise, the effectiveness of its application may be limited by the disjunction between the dynamics of the vegetal metabolism and the logistics for its acquisition.

The estimate of the concentration of N in some crops has been made through the portable chlorophyll meter (ARGENTA et al, 2001). Generally, this estimation of the amount of N enables to diagnose deficiency of this element, but it can also occur the luxury consumption of N by the plant, in the form of nitrate. Since it presents low sensibility to the luxury consumption of N, the measure performed by the chlorophyll meter is being considered the most indicated to estimate the level of this nutrient in the plant (BLACKMER and SCHEPERS, 1995).

The determination of chlorophyll is made by direct and indirect methods. The direct methods are characterized by being destructive, laborious and lengthy. By contrast, the indirect methods, performed through the chlorophyll meters, allow to obtain indirect values of content of chlorophyll in a non-destructive, quick and simple way. To the forage plants, this fact has been proved in several studies (ZEBARTH et al., 2002; GABORCIK, 2003; SUNAGA et al., 2006).

Even though the relation between the content of N and the content of chlorophyll has been proved, the models which describe this relation range between crops and to the same crop, since the methods applied in the calibration of the chlorophyll meter and the characteristics of the meter itself require independent calibrations (MARKWELL et al., 1995). Although the relation between the content of N in the leaf and the SPAD index has been explored in several studies, it is little known about the use of this parameter to the practical evaluation of the content of crude leaf protein.

The quantity of fibers in neutral detergent (NDF) is useful in the estimate of the digestibility of food or ration. Due to the difficulty of the total collection of manure, it is increasing the use of indigestible substances, naturally present in the food itself, to estimate the digestibility. The NDFs are intern indicators and represent the structural compounds, as celluloses, hemicelluloses and lignin (SILVA et al. 2005).

The aim of this study was to evaluate the possibility of the use of the portable chlorophyll meter SPAD – 502 to estimate the content of dry matter (DM), CP and NDF in leaves of *Brachiaria brizantha* cv. Marandú

Material and Methods

The experiment was conducted in the experimental Field and in the Laboratories of Animal Nutrition and Vegetal Physiology in the State University of the Southwest of Bahia (Universidade Estadual do Sudoeste da Bahia) – UESB, Vitória da Conquista (Ba) in the month of July, 2005, when samples of leaf veins in pasture formed with *Brachiaria brizantha* cv. Marandú were collected. Random leaves were taken, whose tons of green ranged from yellow-green to intense dark green.

In order to calibrate the chlorophyll meter Minolta SPAD – 502 it was establishes 12 classes of leaf samples and two replications per class, with SPAD index value between 0 and 60 with variation of amplitude of 5 SPAD units between the classes. Thus, the first class presented values of SPAD index varying between 0 and 5; the second between 6 and 10; the third between 11 and 15; the fourth between 16 and 20; the fifth between 21 and 25; the sixth between 26 and 30; the seventh between 31 and 15, the eighth between 36 and 40; the ninth between 41 and 45; the tenth between 46 and 50, the eleventh between 51 and 55; the twelfth between 56 and 60.

Immediately after the collection in the field, the samples were taken to the Laboratory of Vegetal Physiology to perform the reading of the SPAD index in the medium third of each leaf vein. The average value of the reading of each leaf was composed by the arithmetic mean of four consecutive replications. In order to quantify the parameters DM, CP and NDF the samples were weighted, aiming to obtain the fresh weight. The following step of the work was performed in the laboratory of Animal Nutrition where a portion of the samples was placed in an oven at 105° C for 12 hours to obtain the DM. The content of CP was quantified through the semi-micro-Kjendhal method (AOAC, 1990). The values of NDF were obtained according to the methodology described by VAN SOEST (1967).

The mean results obtained were submitted to the analysis of variance of regression and of the coefficient of the equations, at 1% probability, through the program SAEG 8.0.

Results and discussion

Based on the data obtained it was possible to establish models to the relation between the content of dry matter, crude protein and SPAD index of the leaves of *Brachiaria brizantha* cv. Marandú (Figures 1 and 2). The percentage of dry matter changed significantly in the Marandú grass, due to the linear increase of the SPAD index, being observed an inversely proportional relation, i.e., the leaf dry matter decreases with the increase of the SPAD index (Figure 1). SANTOS Jr., working with the same cultivar, observed increase of the dry matter with the growing ages in the Marandú grass. Even though the relation between the SPAD index and the leaf tissue age is not subject of the study, this parameter highlights that the color of the leaf, detected by the chlorophyll meter, indicates direct relation with the dry matter.

According to Buxton and FALES (1994), the quality of the forage is influenced by the state of development of the leaf whose relation increases the structural compounds and there is a decrease in the content of chlorophyll. According to CORSI (1994) the redistribution of N of the older leaves to the younger leaves results in collapse of the chloroplasts and decrease in the content of chlorophyll. MÜLLER et al. (2005) verified that the young plants have their growth mainly related to the expansion of the leaf surface. These young leaves are organs in which it can be verified high content of N, in base of the dry matter. Therefore, it was observed that the highest percentage of dry matter accumulated in leaves was related to lowest SPAD index, characterizing a behavior of leaf senescence. Conversely, the highest contribution of water in the constitution of new leaves (lower content of dry matter) was related to a higher content of N.

The quadratic model of regression was significantly adjusted, for the relation between crude protein and SPAD index, being observed a direct quadratic relation (Figure 2). BATISTA (2002) verified, in study with the Marandú grass, evaluating the combination of doses of nitrogen (N) and sulfur (S), that when there is an increase to the dosed of N to any dose of S, there is an elevation of the SPAD value, while for the same dose of N associated to increments of S and the SPAD value remains constant, proving thus that N is fundamental to the alteration of the SPAD values

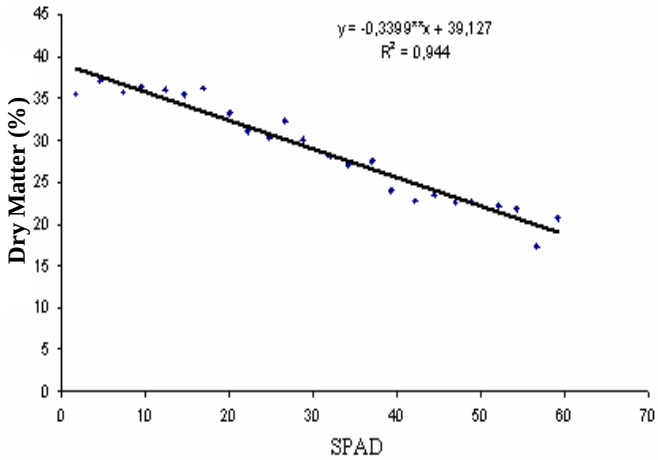

Figure 1. Content of Dry matter (%) and SPAD index evaluated in leaves of *Brachiaria brizantha* cv. Marandú. Vitória da Conquista, 2005.

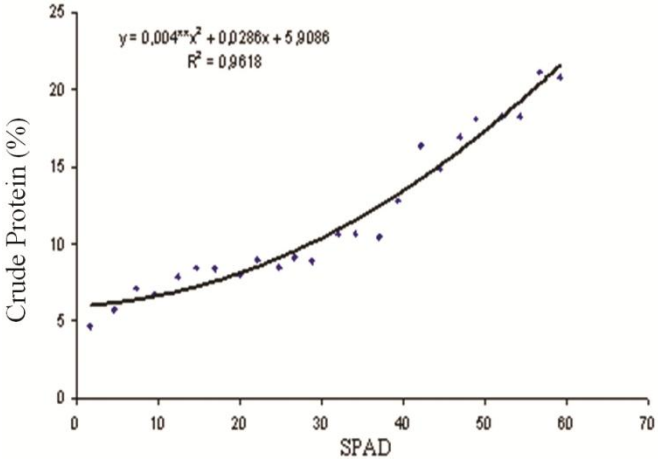

Figure 2. Content of crude protein (%) and SPAD index evaluated in leaves of *Brachiaria brizantha* cv. Marandú. Vitória da Conquista, 2005.

Similar result was obtained by SANTOS Jr. (2001), working with the Marandú grass, in which dosed of nitrogen change the SPAD value ($P<0.01$) in a linear way at the ages of 42, 49 and 56 days of growth and quadratic model of regression at the 21, 28 and 35 days, what explains the increase of CP related to the increase of concentration of N in the leaf tissues correlating with the SPAD index values investigated in the present study. Batista and MONTEIRO (2007) verified, in studies with Marandú grass cultivated in substrate of silica, in greenhouse, that the new leaves were the best indicators for the relation between SPAD index and availability of nitrogen in the growing environment.

The amount of NDF ranges according to the plant maturity, since it is related to the structural compounds, as cellulose, hemicelluloses and lignin. The advance in the leaf age results in decrease in the increment chlorophyll in the compounds of the cell wall,

drop on the coefficients of digestibility and in the contents of crude protein and consequent increase in the amount of dry matter (CORSI, 1994; MERTENS, 1994). However, despite the relation between the stage of plant development, color of the leaves and accumulation of dry matter, it was not possible to establish a relation between the SPAD index and the content of NDF (Figure 3).

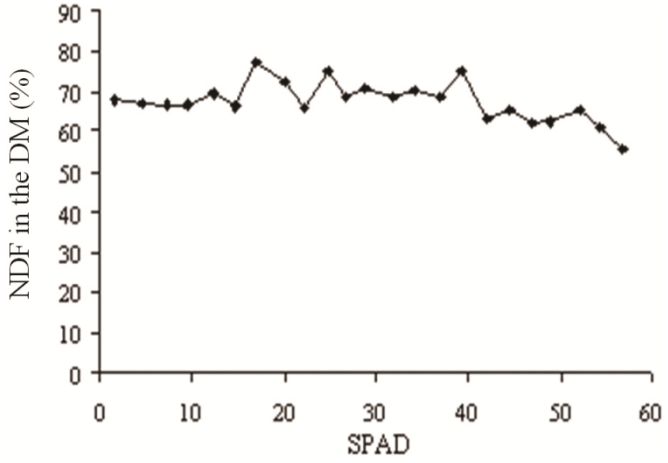

Figure 3. – Content of neutral detergent fiber based in the dry matter (%) and SPAD index evaluated in leaves of *Brachiaria brizantha* cv. Marandú. Vitória da Conquista, 2005.

Conclusions

It was possible to establish models between the content of DM, CP and SPAD index to the Brachiaria grass cv. Marandú in the municipality of Vitória da Conquista.

It was not possible to establish relation between content of NDF and SPAD index.

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