ESTIMATING HERBAGE MASS IN STARGRASS (*Cynodon nlenfuensis* var nlenfuensis) USING SWARD SURFACE HEIGHT AND THE RISING PLATE METER.

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Abstract

Estimation of herbage mass is necessary both in research and farm management. Methods for such estimations should be inexpensive, rapid and reliable. Since estimations through hand clipping are time consuming, a range of indirect methods have been developed and tested in the literature. This study had the aim of comparing precision of two indirect methods, sward surface height (SSH) and the rising plate meter (RPM), to estimate herbage mass in stargrass pastures (*Cynodon nlenfuensis* var. nlenfuensis). Pre-grazing measurements of SSH and RPM readings were taken and compared with the paddock herbage mass. RPM readings were converted into centimeters. Average readings were related to herbage mass through linear regression analysis. Equations obtained were Herbage Mass (kg DM/ha) = - 212,94 + 50,59 SSH (cm) (r^2 = 0.88 ; Residual Standard Deviation (RSD) = 378 kg DM/ha) and Herbage Mass (kg DM/ha) = 522,21 + 108,42 RPM reading (cm) (r^2 = 0.51; Residual Standard Deviation (RSD) = 800 kg DM/ha). The results suggest that SSH was a better predictor to herbage mass than the RPM readings, probably because the lodging of the plants caused by the rising plate. However there was a quadratic trend for the relationship between herbage mass and height with poor adjust when pastures were over 70 cm average height.

Keywords: rising plate, sward surface height, biomass estimation, double-sampling, herbage mass, *Cynodon nlenfuensis*.

Introduction

Cynodon pastures are becoming increasingly important both for hay and pasture in the tropical and subtropical regions of the world. Measurement of pasture mass is important in grazing experiments in order to interpret pasture and animal performance results, as well as planning and controlling grazing systems in commercial farms (Parker, 1993). Estimation of herbage mass usually requires large number of observations to adequately represent a grazed paddock because of the high variability inherent to grazed pastures (Gibb and Ridout, 1986). Direct methods, based on cutting of samples of known area have the inconvenient of being labor intensive and expensive (Frame, 1981). Use of indirect, nondestructive methods coupled with double sampling techniques are frequently used in research and management with temperate and subtropical species. The accuracy of those techniques, however, will depend on pasture, equipment and operator factors (Santillan et al, 1979; Laca et al, 1989; Martinez et al., 1992). This study aimed at comparing the rising plate meter (RPM) and sward surface height (SSH) relationships with herbage mass of *Cynodon nlenfuensis* var. nlenfuensis in order to verify their suitability for use in farm management and research.

Materials and Methods

Measurements were conducted at Santa Mônica experimental station of Embrapa Gado de Leite, from December 1999 to April 2000 in an area being used for rotational grazing of dairy cattle within another farm system experiment. All paddocks were submitted to similar grazing management. Measurements were taken in *Cynodon nlenfuensis* var. nlenfuensis dominant pastures. Mean sward surface height (SSH) was obtained individually from 22 rectangular paddocks of 0.5 ha each, using a stick graduated every 2.5 cm. SSH observations were paired with herbage mass obtained by cutting at 10 cm from ground level and dried in forced air oven at 60 ^{o}C. All measurements were taken by the same operator in both methods. Simultaneously, 6 to 10 paired measurement with the rising plate meter (RPM) and herbage mass within a 0.25 m^2

circle was obtained from 20 out of the 22 paddocks reported above. Average readings and herbage mass were used in the statistical analysis.

Data set was analyzed through simple linear regression by the least square method, using the procedure GLM of the statistical package SAS (SAS, 1997) with the model $Y = \beta_0 + \beta_1 X$, where Y = herbage mass (kg DM/ha); X is SSH or RPM reading and β_0 and β_1 are model parameters. Deviation from linearity was tested by the inclusion of a quadratic effect in the model.

Results and Discussion

The data set was characterized by a cutting height which average herbage mass was above 3053 kg MS/ha and with a standard deviation of 1086 kg MS/ha. The equations obtained for the methods tested were:

Herbage Mass (kg DM/ha) = - 212.94 + 50.59 SSH (cm);

Herbage Mass (kg DM/ha) = 522.21 + 108.42 RPM (cm);

Regression coefficients were significant: $P < 0.0001$ and $P < 0.004$ for SSH and RPM reading, respectively. However the coefficient of determination (r^2) was much higher for SSH than for the RPM readings ($r^2 = 0.88$ and 0.51, respectively). Also the equation relating SSH with herbage mass presented lower RSD (378 kg DM/ha versus 800 kg DM/ha for SSH and RPM reading, respectively). The quadratic coefficient was significant only for $P < 0.10$ for SSH.

The RSD values found using the RPM were similar to those found by Gonzalez et al.(1990) for bermudagrass. The results presented here suggest a much lower RSD than found by that author for SSH suggesting that this measure is a better predictor of herbage mass in *Cynodon nlenfuensis* cv nlemfuensis than the RPM.

The low precision found for the RPM has been caused by the little structure of the *Cynodon* tillers' stem and their short leaves, which present little resistance to compression by the plate. This causes the plants to bend over and consequently the readings ends up with little relationship with herbage mass. This behavior is worsened, as the pasture gets taller. It suggests

that the plate of 3.5 kg/m^2 is excessively heavy for this kind of grass. In practice, SSH was more suitable than the RPM in predicting the herbage mass, until the pasture height of 70 cm. Figure 1 shows plots of the observations and the line describing the linear relationship.

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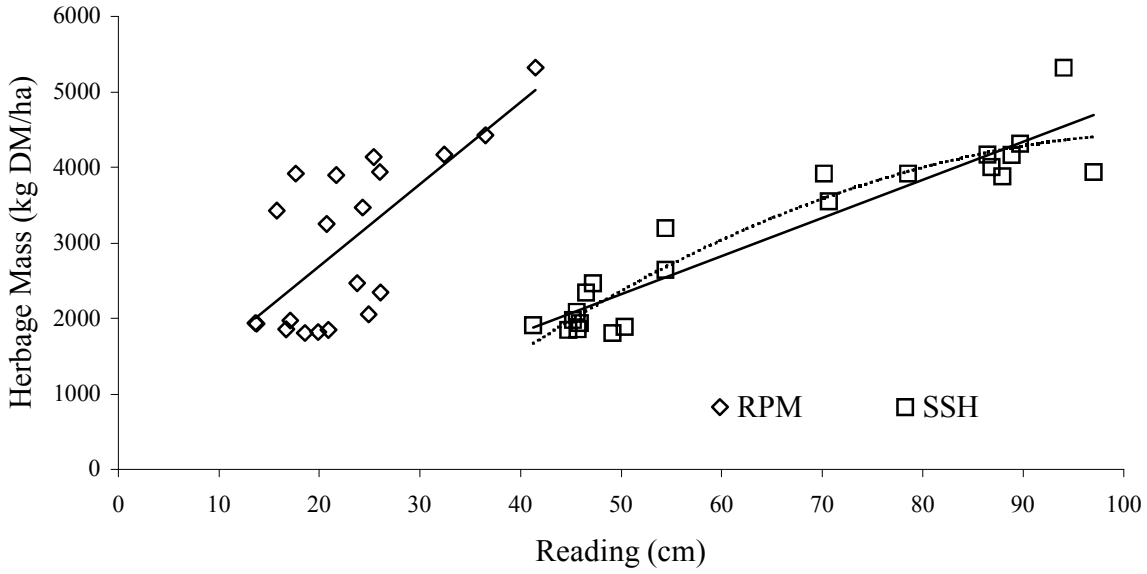

Figure 1 - Sward Surface Height (SSH) and compressed (RPM) height and average paddock pre-grazing herbage mass for stargrass pastures (*Cynodon nlenfuensis* var. nlenfuensis). Straight lines refers to linear regression fit; dotted line refers to quadratic fit.