SCIREA Journal of Agriculture

https://www.scirea.org/journal/Agriculture

August 10, 2019

Volume 4, Issue 3, June 2019

Non destructive method of estimation for green mass of prickly pear

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Abstract

In the present study aimed to evaluate the use of metric variables as non-destructive method for estimating the green mass of prickly pear in semi-arid environment. The correlation between the weight of green mass, volume and real volume estimated by the variables of length, width and thickness of the cladodes was investigated in 500 cladodes of prickly pear, variety IPA20. The cladodes were collected in five different size classes (length). The coefficient of determination for the variables of weight and volume of real (0.922) confirmed the correlation between variables. The determination coefficients for the variables of weight and volume were estimated 0.922, 0.94, 0.971, 0.864, 0.889 and 0.982 for classes A, B, C, D, E and all classes together respectively. Except for class B, which also showed significant, high correlation was observed between the variables tested. Thus, we conclude that the use of tape and the caliper can be important tools in the estimation of green mass production of cactus pear.

Keywords: Archimedes Law; estimator; non destructive method; animal nutrition

Introduction

In the semi-arid regions of the Brazilian Northeast, the forage palm stands out for its adaptability and high dry matter production per unit area (Veras et al., 2002). Mature cladodes are used as animal feed, especially during dry droughts. Thus, a paper production has a high relevance for the livestock sector in the Brazilian semi-arid (BSA), as well as it can estimate its provided forage stocks.

Despite the existence of average cladodium weight estimators, such as that proposed by Pinto et al. (2002), few studies have been carried out on the estimation of green mass production of forage palm through a non-destructive method. The importance of adopting a non-destructive method is that it allows to follow the growth and expansion of the cladodium of the same plant until the end of the cycle or the test, besides being fast and precise, it also allows a great number of observations et al., 2009). One of the most used non-destructive methods is the estimation of the leaf area through regression equations between the real leaf area (Sf) and the linear dimensional parameters of the leaves (Bianco et al., 2001). Thus, the weight of the cladodium can be estimated by its volume as the leaf area can be estimated using dimensional parameters of leaves, which have good correlations with the leaf surface (Bianco et al., 2001).

The objective of this work was to determine an adequate ratio or equation to estimate the green mass production of O. ficus-indica.

Methodolgy

The work consisted of field collections at a planting of Opuntia ficus indica variety IPA20 at the Experimental Station of the National Semiarid Institute (INSA) in the municipality of Campina Grande.

Between August and September 2010 a total of 500 cladodes were collected in five length classes: A - up to 20 cm; B - from 20 to 25 cm; C - 25 to 30 cm; D - from 30 to 35 cm; and E - above 35 cm. In the cladodes the length (C), width (L), thickness (E), weight (P) and volume (V) were measured. Measure tape was used for the measurements of length and width, while for the thickness a precision caliper was used measuring the sides and the end of the cladodium, from which a mean thickness (ME) was reached. In order to obtain the volume of

the cladodium, the Law of Archimedes was used. "Every body immersed in a fluid at rest suffers from the fluid a vertical force upwards, whose intensity is equal to the weight of the fluid displaced by the body." - dipping the cladodium into a graduated bucket. The estimated volume (Ve) was calculated by the equation Ve = C * L * EM.

To select an equation that could represent the green mass or mass (MV) of the cladodium, regression studies were performed with the linear equation (Y = a + bx). The value Y estimates the green mass of the cladodium as a function of X, whose values are the product (C * L * EM). All the equations used are linear. The correlation between the variables was expressed by the coefficient of determination (R2).

Results and Discussion

There is a high correlation between the cladode green matter weight and volume (Figure 1), although the data suggest a certain class effect for the class B cladodes, it is possible to estimate the weight through the volume.

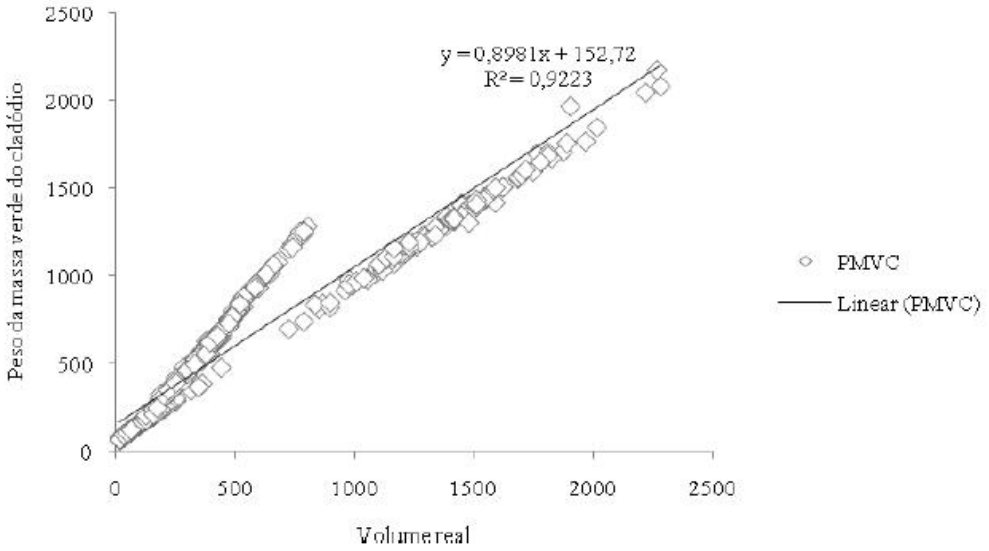

Figure 1 - Linear regression of cladode green mass as a function of volume.

The linear equations obtained can be used to estimate the green mass. From the practical point of view, it is suggested to opt for the equation involving the variables weight and estimated volume. Thus, the estimate of the green mass of O. ficus-indica can be made by the formula MVp = 0.757Ve + 0.538, which is equivalent to taking measures of length, width and average thickness of the cladodium to determine the weight, with coefficient of determination of 0 , 98

(Figure 2). This value indicates that the estimates obtained by these measurements explain 98% of the variation in the estimated values of actual production of green mass.

Comparing the two regressions (Figure 1 and 2), although both have highly significant coefficients of determination, it is noticed that in the first case (Figure 1), where the real volume determined by the Archimedes method is taken into account, there is a tendency to deviate from the curve for class B cladodes, 20 to 25 cm long, while in Figure 2 all classes follow the trend curve.

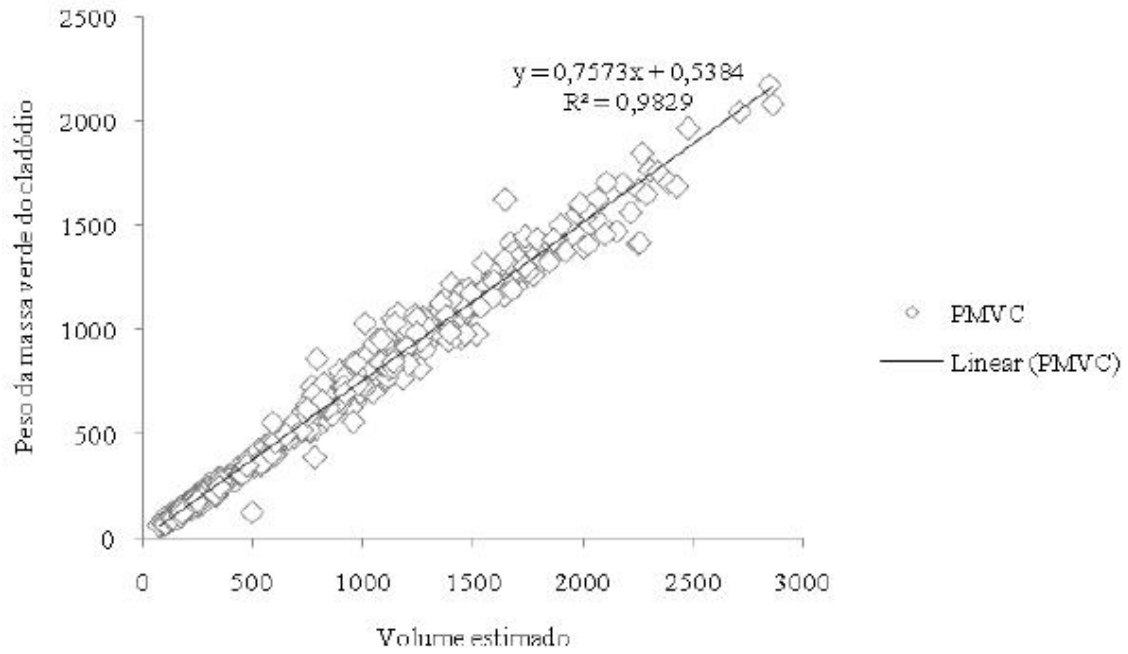

Figure 2 - Linear regression of the green mass of the cladodium as a function of the estimated volume.

Conclusions

The use of the trena and pachymeter is an efficient alternative for the non-destructive estimation of the green mass production of Opuntia ficus indica provided that the adjustment is made through a linear regression equation of the type y = a + bx.

Aknowledgements

To the National Semi-Arid Institute (INSA) - Campina Grande / PB for the assignment of the experimental area and laboratory analysis. To Capes for the scholarship. To the technician of the INSA Gustavo Queiroz for the aid.

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