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Estimation of Browse Biomass Productivity for *Acacia mellifera* (vah) Benth. in Tendalti Area of White Nile, Sudan

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ABSTRACT

The study was conducted in the southeast Tendalti city (Ardabh) forest, West Nile Forestry Department The objectives of this study were to estimate browse biomass productivity for *Acacia mellifera* and to establish its relationships with height to investigate the existing situation and the potential of browsing in the area. The twigs count method was used to estimate browse biomass productivity as dry matter (Kg/tree). Regression analysis was applied to establish the relationships between browse biomass (total and available browse) and height. The results showed that the average unavailable browse per tree was higher than available browse per tree (0.27 vs. 0.18 kg/tree,). Total browse biomass yield was (0.26 ton/ha). The positive relationship between browse biomass yield and height were found. The study concluded that, the height should be taken in consideration when applying the correlation and regression equations in the estimation of browse biomass yield for *Acacia mellifera.* It could be recommended that, more research should be carried out for *Acacia mellifera* in different area of the country to investigate the relationships between browse biomass yield and growth parameters.

Key words: Browse biomass, *Acacia mellifera*, Height, Tendalti, White Nile

INTRODUCTION

The rural population of Sudan, and also much of its urban population, depends largely on forests. Trees are the main source of energy and provide timber for roofing and building. Beside that, it provides vitamins and frequently mineral elements, which are mostly lacking in grassland pasture. The water sources were the principle element among pastoralist to determine the utilization of browse resources during the summer period. Therefore, browse is dependable forage that is available over a longer growing season than grass (Illius *et al*,2002). This period considered the best browse seasons because the fodder trees was available for livestock in villages where the grasses were disappeared while trees are still green). *Acacia mellifera* is a commonly occurring tree on rangelands throughout the savannah in western, eastern and southern. It also known as the blackthorn, is one of native African Acacia spp (Van der walt, 2008). Acacia mellifera is a low, branched tree with a more or less spherical crown. Black bark on stem becomes ash-grey to light brown on the branches, bearing small, short, sharply hooked spines in pairs. Leaves characterized by 2 pairs of pinnulae, each with a single pair of leaflets. Leaflets elliptic 0.6-2 cm long and 0.6-1.2 cm wide, glabrous and highly colored beneath. Flowering and fruiting start 3 years after planting and generally occur twice a year. Camels and goats browse the leaves, which are rich in protein, taking them from the shrubs or from the ground (Orwa *et al*. 2009***)***. Black thorn trees grow in groups of pure, dense, impenetrable and even-aged thickets (Nonyane, 2013).

Despite the fact that this forage potential of browse has been exploited (and over-exploited in most areas) by pastoralists, until recently it has been largely ignored by rangeland ecologists. The dynamics of browse has been seriously neglected when compared with the research effort and commitment allocated to rangeland communities. The main cause of this neglect is the lack of any standardized techniques for the determination of browse production and its consumption. The severe constraints that facing the assessment of its productive capacity for livestock and it has been hampered by the very knowledge of browse production, its seasonality, its response to rainfall, and its acceptability to and proportion utilizable by different classes of livestock. The main objective of this study was to collect information

related to browse productivity of *Acacia mellifera* in respect to the pattern of browse resource used and associated problems.

MATRIALS AND METHODS

The study was conducted in the southeast Tendalti city (Ardabh) forest, Aburukba forestry department. Total forest area about 1500 Fadden. This forest is established for the purpose of protection. The soil type in the forest is clay soil. One plot of a hectare (100mx100m) was selected based on the Releve method of sampling (Michael *et al*., 1987), which is dominated by *Acacia mellifera* (Kitter). Within the plot, five circular samples were marked (0.1 ha each). For the purpose of the study the diameter of twig at browsing point (d.b.p) (diameter of the twig at the terminal point of browsing) and browsing level (the height from the ground up to the highest point at the tree crown that animal can reach) were 1.8mm and 1.83m respectively. For these measurements compass, vernier, scissors, distance tape and clinometer (a tool for measuring height) were used. Density describes the number of individual plants in a given area. Direct count method was used, where the total number of trees was determined by counting them inside the circular sample plots. Two line transect of 100-meter long were laid randomly inside the plot. Two *Acacia mellifera* trees were selected, one to the right and the other to the left of the line along the transect at 20 m intervals. A total of 20 trees were selected and their height was measured. The height of trees arranged in classes for selecting five trees to estimate browse biomass productivity and its relationships. The twigs count method was applied for estimating available browse and total browse (Lazim, 2001). Available browse for *Acacia mellifera* was assessed in the five circular samples. For estimating available browse, all twigs between the ground level to goat browsing level (1.83m) with a diameter equal or less than the diameter at browsing point (1.8mm) for selected tree were counted. For estimating unavailable browse, all twigs above goat browsing level (1.83m) with a diameter equal or less than the diameter at browsing point (1.8mm) for each selected tree were counted. Twenty five twigs were randomly selected with a diameter approximately equal (1.8mm) and then clipped and collected. The selected twigs were oven dried for 24 hours at 102^{o}C. The average dry weight of the twig was obtained. Available browse/ tree were calculated by multiplying the average twig weight by the total number of

the available twigs/tree and then the average available browse/tree was calculated. The available browse / ha was calculated by multiplying the density of Acacia mellifera / hectare by average available browse/tree. The unavailable browse/hectare was calculated using the same method as mention before. Total browse/tree was calculated by summing up its available browse with its unavailable browse and then total browse/ hectare was estimated as dry matter (kg/ha). Estimation of browse biomass productivity was done in the late rainy season (November, 2014).

Statistical analysis

Regression analysis was used to establish relationships between:

1 Available browse and height.

2- Total browse and height.

RESULTS AND DISCUSSION

Tree density:

The average density of mature trees for *Acacia mellifera* was high compared with its natural regeneration. The density of natural regeneration was mixed between *Acacia mellifera* and *Acacia seyal*. This may give *Acacia seyal* a competitive advantage, and later dominance. This may affect the existence of *Acacia mellifera* in the future. Although, reasonable number of natural regeneration is expected to decrease along the natural selection process, as a result of interference of many factors. These factors may possibly include stand competition, excessive browsing, damage caused by human being. The density of shrubs was near of the density of natural regeneration and dominated by *Boscia senegalensis.*

Estimation of browse biomass yields from *Acacia mellifera*

Table (1) presents the results of the density, available browse, unavailable browse and total browse of *Acacia mellifera.* Unavailable browse (0.27 Kg/tree) of the *Acacia mellifera* was higher than its available browse (0.18 Kg/tree). This result could be attributed to some selected trees have a high height. The present study highlights the height of the trees into consideration, because it is very important when determining accessibility.

According to Hiernaux (1980) only a small proportion of available browse is directly accessible to animals. This proportion varies very considerably according to the height of the tree and also according to species. Sanon and Ledin (2009) they investigated that, Overall edible biomass accessible to animals is low and varied according to the species and the height of trees.

Table (1) Browse biomass yield productivity for *Acacia mellifera* in Tendalti

Density (tree/ha	Available browse (kg/tree)	Available browse (kg/ha)	Unavailable browse (kg/tree)	Unavailable browse (kg/ha)	Total browse (ton/ha)
580	0.18	104.4	0.27	156.6	0.26

Browse biomass yield (availble and total browse) and height

Figure 1, 2 show the regression lines for the relationships between browse productivity and height. The results indicated that there were positive relationship between browse productivity (available and total browse) and height (Table 3). The correlation between available browse and height (r^2 =0.41) was less than that of total browse (r^2 =0.50). This may indicate the sensitivity between available browse and the change in height of the tree. Furthermore, this might be attributed to the fact that, high trees are not accessible by browsed animals and the relationship between height and browse biomass is not significant due to over-grazing and tree cutting. Tree height was the appropriate parameter for predicting the tree foliage biomass (Jadalla *et al*, 2014). According to lazim (2001) who investigated that, there is a strong positive correlation between available browse and various tree growth parameters (height, crown area and diameter at the base of stem) in *Acacia mellifera* natural stand at the Butana area of central Sudan. Similar results were also reported by Jadalla *et al*, (2014), they found that tree height was the best correlated parameter with tree foliage biomass.

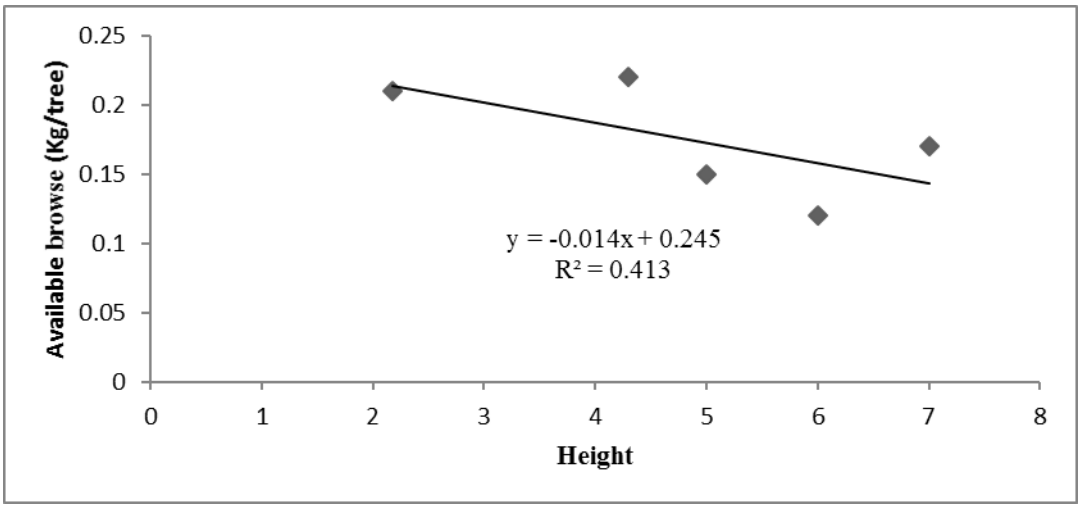

Figure (1): Relationship between available browse and height for *Acacia mellifera* in the late rainy season

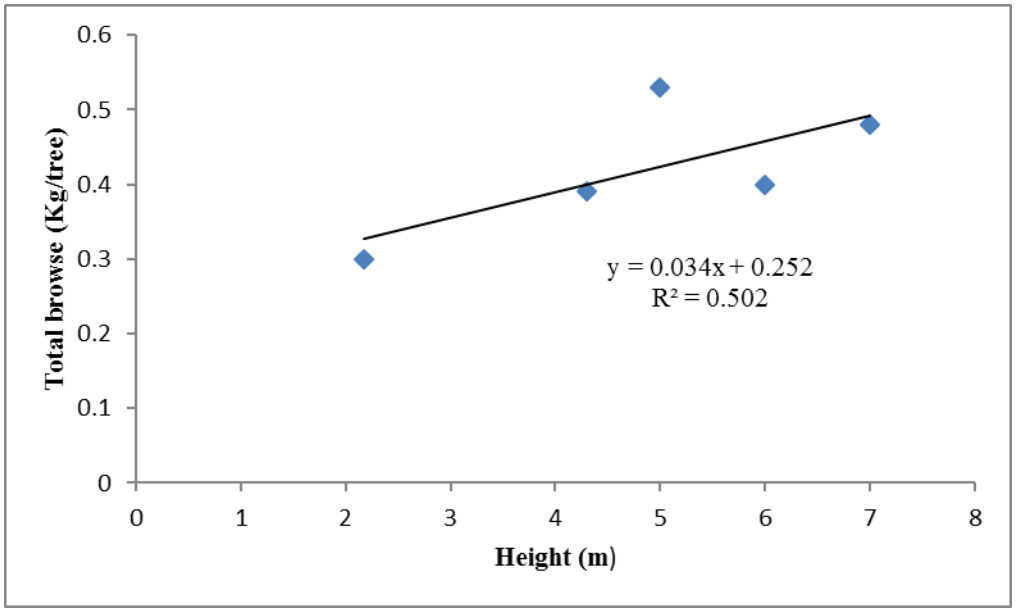

Figure (2): The relationship between total browse and crown area for *Acacia mellifera* in the late rainy season

CONCLUSION

The study could be concluded that, there was a positive relationship between browse biomass productivity (available and total browse) and height. The correlation between available browse and height was less than that of total browse. The regression equations indicated tree height could be an appropriate parameter for predicting the total browse biomass.

REFFERNCES

- Hiernaux, P. (1980). Inventory of the browse potential of bushes, trees and shrubs in an area of the Sahel in Mali: Methods and initial results. Paper presented at the International Symposium on Browse in Africa, April 1980, ILCA, Addis Ababa.

- Illius, A.W. Gordon, I.J. Derry, J.F Magadzire, Z.& Mukungurutse, E. (2002). Environmental variability and productivity of semi-arid grazing systems. Final Technical Report (FTR).

- Jadalla, J. B., Khatir, . A. A., Dawelbait E. M and M. Ali, S. A. (2014). Relationship between some Growth Parameters and Browse Biomass Produced from *Ailanthus excelsa* Tree in Kordofan, Sudan, Greener Journal of Agronomy, Forestry and Horticulture ISSN: 2354-2306 Vol. 2 (1), pp. 008-013.

- Lazim, A.M., (2001). Study on browsing in *Acacias* natural forest at Butana Area of central Sudan. M.Sc. Thesis.Sudan University of Science and Technology. Khartoum.

- Nonyane, F., (2013). *Acacia mellifera***.** South African National Biodiversity Institute (SANBI).

- Michael, G., Burk, J. and Pitts, W. (1987). Terrestrial Plant Ecology. The Benjamin Cummings Publishing Company, Inc.

-Nonyane, F., (2013). *Acacia mellifera*. South African National Biodiversity Institute (SANBI).

- Orwa C, A Mutua, Kindt R , Jamnadass R, S Anthony. (2009). Agroforestry Database: a tree reference and selection guide version 4.0.

- Sanon H.O., Ledin, I. (2009). Assessmen t of edi bl e bi omass produ ction of Acaci a sen egal , *Grewaa senegal en si s* and *Pterocarpu s l u cen s i* n th e Sah el i an zon e of West Afri ca. In : Papach ristou T.G. (ed.), Parissi Z.M. (ed.), Ben Salem H. (ed.), Moran d-Feh r P. (ed.). *Nutritional and foraging ecology of sheep and goats.* Zaragoza : CIHEAM / FAO / NAGREF, 2009 . p. 11 7 -1 2 1 (Option sMéditerran éen n es : Série A. Sémin aires Méditerran éen s; n . 85)

- Van der Walt FJJ (2008). Botrosphaeriaceae associated with Acacia species in southern Africa with special reference to A.melifera . M.Sc. Thesis, University of Pretoria: South Africa, 198 p.(http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp).