Scientific Papers. Series D. Animal Science. Vol. LVI
ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN-L 2285-5750

CHARACTERISTIC AND GROWTH PATTERN OF *BRACHIARIA HUMIDICOLA* CV. TULLY UNDERNEATH COCONUTS PLANTATION

Selvie D. ANIS, M.A. CHOZIN, David A. KALIGIS

Department of Animal Nutrition and Forages Science. University of Sam Ratulangi, ITC Unsrat, Jl. Kampus Unsrat Manado 95115, Manado City, Indonesia

Corresponding author email: kaligis.david@yahoo.co.id

Abstract
The aims of the study were to determine growth characteristics and the pattern of growth of B. humidicola grown underneath coconut trees. The experiment was conducted at coconut research center area (BALITKA) Manado since April 2011 until July 2011. The variables consisted of growth and development based on the numbers of tillers, numbers of nodes, and length of stolon. Data were calculated with simple analysis of the mean and the standard deviations, and the regression equations. The results shows that number of nodes and the length of stolon steadily increased up to 10 weeks after planting, but the maximum number of tillers up to 8 weeks after planting and start to decrease at 10 weeks after planting. Furthermore, the increased of nodes, stolons and the number of tillers are positively corelated with the ages of plant and followed the normal distribution curves of growth.

Key words: *characteristic, growth pattern, humidicola, coconuts.*

INTRODUCTION

Brachiaria humidicola is one of the perennial forage grass with creeping habit growth, having stolon and rhizome, can grow well and tolerant of shaded conditions such as in coconut plantations. Understanding how grass plants grow and developed is essential to be able to manage properly a pasture. Grass like other green plants, capturing energy from the sun and stores it in the form of sugar and carbohydrates, all of which will be used along with other minerals and nutrients for cell division, growth, development and reproduction (Stichler, 2002).
The availability of light is the main ecological factors affecting plant growth. To respond the low light level plants can adapt genetic and phenotypically (Lambers et al*.,* 1998; Guenni et al., 2008). There are three responses to the shade acclimation namely a) by reducing the rate of respiration, b) increase the shoots / root ratio, and c) increasing the specific leaf area (Humphrey, 1994; Lambers et al., 1998).
Pasture development in the area of coconut plantations faced with the problem of shade, which led to the disappearance of pasture species and replaced with not edible feeds as weeds. This problem can be overcome by the introduced of shade-tolerant species, such as *Brachiaria humidicola* cv. Tully, which is recommended as pasture in the area of coconut plantations (Mullen et al., 1998). Nevertheless, the grass is still damaged when grazed freely (free grazing) or without properly management. These results indicate that the cause of the damage is not solely just on the issue of tolerance of forage in the shade, but also a factor that is not proper grazing management, led to not able to guarantee the health of pasture for continuing to grow and reproduce. It is strongly associated with characteristic and growth patterns of plant. For that reason, the study was conducted.

MATERIALS AND METHODS

Place and Time

The research was carried out on the Coconut and Other Palma Research Institute (BALITKA) in the village of Paniki Manado, North Sulawesi, Indonesia since the beginning of April 2011 until the end of July 2011. Field experiments conducted to study the growth pattern of the grass *B. humidicola*.

Materials and Devices

Materials used in the form of grass seedlings *B. humidicola* with a length of 15 cm, with a 2.5 young leaves and secondary roots. Two seedlings were planted, then three weeks after planting (WAP) one vigor plant were selected and allowed to grow as single plant. A total of five plants were sampled and planted at a spacing of 1.5 meters to facilitate the measurement. The variables measured in this experiment are the number of nodes and the length of stolon. Both measured on the parent plant (mother), while the number of tillers was obtained by counting all seedlings produced by observed parent plants. The equipment used small manual scales 'Ohaus', stationery, bags and oven drying samples.

Research Methods

To study the vegetative growth and development of grass the measurement was done along the vegetative periods of growth, performed every 2 weeks counted of weeks after planting (WAP) of 2, 4, 6, 8 and 10 weeks. The number of nodes is the sum of nodes in each period. The length of stolon was obtained in the last period of experiment at weeks ten, while the number of tillers was the some of tillers of each period of measurement. Furthermore, by dividing the length of stolon to the number of nodes, obtained an average length of each segment in the plant samples.

To get the growing pattern of *B. humidicola* during development phase was analyzed correlations between each of the variables measured with the age of the plant (Steel and Torrie, 1989).

RESULTS AND DISCUSSIONS

Growth Characteristics

Understanding how plants grow and the grass is very essential to be able to manage properly a pasture. Characteristics of growing *B. humidicola* in the area of coconut palm which is measured on the number of nodes, the length of stolon, and the ratio of stolon length/ number of nodes as listed in Table 1 below.

Table 1. Number of nodes (Nn), length of stolon (Ls) and the number of tillers per plant

Plant Number	Nodes Number (NN)	Stolon Length (cm) (Ls)	Ratio Ls/NN	Total Tiller
1	19.00	107.00	5.63	10.00
2	18.00	135.00	7.50	9.00
3	20.00	110.00	5.50	10.00
4	19.00	115.00	6.05	12.00
5	21.00	125.00	5.95	11.00
Mean	19.40	118.40	6.13	10.40
SD	1.1402	11.5239	0.8004	1.1402

Table 1 show that the number of nodes during the observation period of five plant samples ranged between 18 and 21 nodes. Length of stolon of the mother plant during the period of measurement varies between 107 cm to 135 cm. When calculated the ratio between the length of stolon and the number of nodes was obtained the ratio of Ls/Nn varied from 5.50 to 7.50 or the length of segment (cm) between two successive nodes on plant samples varies follow this ratio. This was probably due to the activity of photosynthetic process is more active, and is followed by more accumulation of assimilates, so the stimulation of the development of plant is bigger. Abdullah (2009) says the length of plant is supported by a number of nodes and the long of segments.

Growth Pattern

Average increase in the number of nodes, length of stolon and increasing the number of tiller is presented in Table 2.

Table 2. Average increase in the number of nodes, stolon length and the number of tiller at each age of observation

Week After Planting	Nodes Number	Stolon Length (cm)	Tiller Number
2	3.40	20.60	1.20
4	4.00	37.80	2.00
6	3.80	50.80	1.80
8	4.20	70.60	3.20
10	4.00	85.80	2.60

a. Nodes number

Growth of plant is always associated with the age of the plant. Table 2 shows that the number of nodes increased every 2 weeks during the measurement period until the age of 10 weeks. Statistical analysis showed that the number of nodes grew were strongly influenced by time or the age of the plant, and the relation follows a linear equation $y = 3.835 + 0.003750\ x$, where Y represents a variable number of nodes, and x is the time to grow the plants, with a regression coefficient R2 = 98.7%. Linearly in the number of nodes really help to support the production of biomass of *B. humidicola* because in each node that touches the ground produced new tiller that allows plants to grow, spread and produce new leaves and stems, as the character of the plant growing with stolon (Wong and Stur, 1994).

b. Length of Stolon

Table 2 shows the length of stolon of mother plant by 20.60 cm at the age of 2 weeks and increased gradually from 4 weeks at 37.80 cm up to 85.80 cm at the age of 10 weeks. Length of stolon is closely related to the age of mother plant following the linear regression equation $y = 4.160 x + 8.160$, with a regression coefficient $R2 = 99.7\%$. It shows one of the characters persistence of grass growing with stolon (Wong and Stur, 1994), especially those living individually where the competition of nutrients, water and sunlight are relatively low (McMaster et al., 2003).

c. Number of tiller

The highest average number of tiller of 3.20 produced in 8-week-old plants and decreased as much as 2.60 at the age of 10 weeks (Table 2). This suggests that at the age of 8 weeks the vegetative stage of growth is taking place, as well as the development of tropical grass in general (Tropical Forages). A decline in the number of tillers at the age of 10 weeks may be due to the high population density, resulting in overlap and competition for resources (Abdullah, 2009).

Statistical analysis showed a close relationship between the number of tillers and the age of the plant, following the cubic equation $y = 1.240$ to $0.143\ x + 0.0911\ x2-0.00625\ x3$ with regression coefficient $R2 = 82.9\%$. Previous research demonstrated that the number of tillers always follow the pattern of cubic (Emoto and Ikeda, 2005).

Heat Unit Requirement

The needs of heat unit (^{0}C-day) for the formation of a phyllochron are different for single plants and in the community. Single plant requires less heat units to produce one phyllochron as many as of 68.19^{0}C-day, compared to 130.44^{0}C-day for grass of *B. humidicola* that grown in the community (Anis et al., 2011). This happens because there is a strong competition of resources such as water, nutrients and light occurred among the plants grown in the community. In contrast, a single plant is less than a competition, the ground surface temperature is higher because more sunlight penetration. Leaf emergence is closely linked to temperature, but was dominated by the rise of ground surface temperature as a place where there are crowns to grow new tillers (McMaster et al., 2003).

CONCLUSIONS

From these results it can be concluded that:

1. The number of nodes and length of stolon remained increased up to the age of 10 WAP, but the highest number of tillers until age 8 WAP then decreased at 10 WAP.
2. The increasing number of nodes, stolon length and number of tillers were positively correlated with the age of the plant, and still follow the normal pattern of growth and development.
3. The need of heat unit (^{0}C-day) for the establishment of a phyllochron of *B. humidicola* growing individually less than those growths in the community.

ACKNOWLEDGEMENTS

We wish to thank to the Minister of National Education and Culture of the Republic of Indonesia for the financial support of this research.

REFERENCES

Abdullah L., 2009. Pola pertumbuhan rumput Signal (*Brachiaria humidicola* (Rendle Schweick) pada padang penggembalaan dengan aplikasi sumber nutrient berbeda. Med. Pet. 32 (1), p. 71 – 80.

Anis S.D., Chozin M.A., Soedarmadi. Ghulamahdi, M dan Sudradjat, 2011. Karakteristik pertumbuhan dan pengembangan vegetatif tajuk baru rumput *Brachiaria humidicola*. Dalam : Kajian tentang persistensi *Brachiaria humidicola* (rendle) Schweick setelah penggembalaan pada lahan perkebunan kelapa. Desertasi IPB Bogor 2011.

Emoto T., H. Ikeda, 2005. Appearance and development of tiller in herbage grass species Timothy (*Phleum pratense* L.). Grassland Sci. 51, p. 4-54.

Guenni O., Seiter S., R. Figueroa, 2008. Growth responses of three Brachiaria species to Light intensity and nitrogen supply. Tropical Grasslands 42, p. 75-87

Humphreys L.R., 1991. Tropical Pasture Utilisation. Cambridge University.

Lambers H., Chapin F.S., Pons T.L., 1998. Plant physiological Ecology. (Springer – Verlag: New York.

McMaster G.S., Wilhelm W.W., Palig D.B., Porter J.R., P.D. Jamieson, 2003. Spring Wheat leaf appearance and temperatur: Extending the Paradigm? Annals of Botany 91, p. 697-705.

Mullen B.F., Rika I.K., Kaligis D.A., W.W Stur, 1997. Performans of grass Legumes pastures under coconut in Indonesia. Expl. Agric. 33, p. 409-423.

Steel R.G.D., H.J.Torrie, 1989. Prinsip dan Prosudur Statistika: suatu pendekatan biometrika (terjemahan). Penerbit PT. Gramedia, Jakarta.

Stichler C., 2002.Grassgrowth and development. Texas A& M University. www.soilcrop.tamu.edu Tropical Forages.Brachiariahumidicola.http://www.tropicalforages.infokey/Forages/Media/Htm/Brachiaria_humidicola.htm. Downloaded 12/01/2010.

Wong C.C., W.W. Stur, 1994. Mechanisms of Persistence in Tropical Foreges to Defoliation under Shade. In: Integration of ruminants into plantation systems in Southeast Asia. Ed.: B.F. Mullen and H.M. Shelton. ACIAR Procc. No. 64.