

Growth characteristic of dwarf napiergrass on mixed cropping system at established year

by R F Utamy

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To cite this article: A N Churriyah *et al* 2020 *IOP Conf. Ser.: Earth Environ. Sci.* **492** 012006

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Growth characteristic of dwarf napiergrass on mixed cropping system at established year

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Abstract. Increasing of productivity of dwarf napiergrass as ruminant feed could be conducted with a mixed cropping system with legume such as centro. The objective of this study was to determine the growth character of dwarf napiergrass mixed cropping with centro. The research was carried out for 4 months, by 5 treatments and 4 replications so that it requires 20 plots. The treatment consisted of 100% of dwarf napiergrass as P1; 70% of dwarf napiergrass and 30% centro as P2; 50% of dwarf napiergrass and 50% centro as P3; 30% of dwarf napiergrass and 70% centro as P4; and 100% of centro as P5, respectively. The results showed that the treatments had not significant effect ($p>0.05$) neither on growth character of dwarf napiergrass and centro, nor chlorophyll. Nevertheless, the treatment showed a tendency increased of plant growth by the increased of measurement interval, not only in dwarf napiergrass but also in centro.

1. Introduction

Forage crop is the main feed source for ruminants [1]. Therefore, its sustainability and availability are very important to support ruminant livestock. In monoculture system, grass or legume is enhanced by high chemical and organic fertilizer input [2] to achieve high productivity. To decrease high input of fertilizer and increase forage productivity, mixed cropping system is one of the potential alternatives to solve this problem. Legumes have ability to fixate nitrogen and contribute to the other plants [3]. Therefore, legumes have potential to improve nutrient cycling in pasture by nitrogen fixation, taking up nutrients from deeper soil layers and recycling to surface layers, modifying the soil environment and providing more uniform shade across the pasture [4].

Dwarf napiergrass is tropical grass that has advantages such as high productivity and quality, high palatability and digestibility, resistance to disease, and convenience to culture [5,6]. Dwarf napiergrass is a forage crop with high productivity and nutrients compared to other tropical grasses [7,8]. Centro is perennial, with the high number of fixation nitrogen from the air, 80-280 kg N/ha fixation in a year [9]. Research [10] identified that mixed cropping of dwarf napiergrass and centro increase the productivity and quality of dwarf napiergrass.

The objective of this study was to investigate the effect of mixed cropping system on growth characteristic of dwarf napiergrass and centro such as plant height, plant length, tiller number, branch number and chlorophyll unit.

2. Research methods

This study was conducted from March to July 2019 at Forage Crop Science and Culture Laboratory, Faculty of Animal Science, Universitas Hasanuddin. The study was arranged in Randomized Block Design (RBD) with 5 treatments and 4 replications with a totally of 20 plots. The treatments consisted of 100% of dwarf napiergrass as P1; 70% of dwarf napiergrass and 30% centro as P2; 50% of dwarf napiergrass and 50% centro as P3; 30% of dwarf napiergrass and 70% centro as P4; and 100% of centro as P5, respectively.

2.1. Planting method

Plots were cultivated by hand tractor, to obtain homogeneous and clean soil from residual weeds. The plots were divided into 20 plots with a size of 2×1.5 m in each. Plant density was 1 plant/m². Before planting day, in a different place, dwarf napiergrass stems were prepared as high as 20 cm while legumes were sown for 15 days in polybag. Furthermore, dwarf napiergrass stems and legumes were mixed cropping and planted on 22nd March 2019 according to the study treatment by 1 m \times 0.5 m of plot spacing.

Data were collected at three times, 22nd April 2019, 22nd May 2019, dan 22nd June 2019, respectively. Plant height (cm) of dwarf napiergrass and plant length (cm) of legume were measured about 10 cm above the soil [5]. Growth characters of dwarf napiergrass and centro such as plant height/length and tiller/branch number were measure at 6 plants at all plots. Chlorophyll unit was measured by using SPAD Konica Minolta and by clipping leaves to the equipment and then automatically indicated the amount of grass and legume chlorophyll unit.

2.2. Statistical analysis

Growth character and chlorophyll data of mixed cropping dwarf napiergrass and centro were analyzed by repeated measures using SPSS software for Windows ver. 16.0, Chicago, IL, USA. Differences in mean values were tested at the 5% level using the Duncan Multiple Range Test (DMRT) [11].

3. Results and discussion

Mean data of growth characters of dwarf napiergrass and centro on mixed cropping were presented in figures 1a and 1b. Then, the average amount of chlorophyll was presented in figure 2.

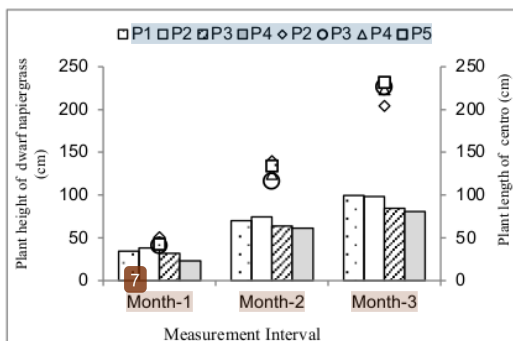


Figure 1a. Plant height and plant length.

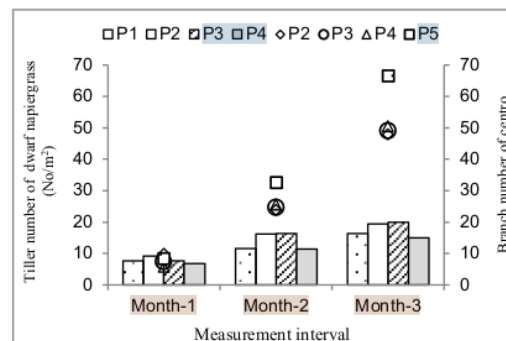


Figure 1b. Tiller number and branches.

The treatments were 100% of dwarf napiergrass as P1; 70% of dwarf napiergrass and 30% centro as P2; 50% of dwarf napiergrass and 50% centro as P3; 30% of dwarf napiergrass and 70% centro as P4; and 100% of centro as P5.

Based on the results, the treatments did not significantly affect ($p > 0.05$) plant height of dwarf napiergrass, plant length of centro, and tiller number as well as branch number of centro on mixed cropping system (figure 1a and 1b). Plant height and plant length of the plants increased from the Month-

1 to Month-3. Plant height and plant length from the Month-1 to Month-2 on P2 treatment showed a higher growth compared to other treatments, however, on the Month-3, the growth relatively decreases compared to others (figure 1a). Plant height of dwarf napiergrass and plant length of centro in P2 treatment were higher in Month-1 to Month-2 compared to other treatment, however, the growth decreased on Month-3 (figure 1a). This indicated that there was competition between dwarf napiergrass and centro in soil nutrition and sunlight. According to [12] that competition between plants in the same growing soil was common due to the limited resources such as water, nutrients, and sunlight. [13] also stated that in mixed cropping system, plants components had possibility to compete during in growing period. Moreover, [14] stated that in unbalanced composition between grass and legume on mixed cropping pasture, dominant plant would suppress the growth of other plants.

On Month-1, the average tiller number of dwarf napiergrass in P2 treatment (9.16 No./m²) was higher compared to P1 (7.58 No./m²); P3 (7.58 No./m²); and P4 (6.83 No./m²). Subsequently, in the Month-2, the average tiller number of dwarf napiergrass in P3 treatment (16.41 No./m²) was higher compared to P2 (16.16 No./m²); P1 (11.66 No./m²); and P4 (11.41 No./m²). Similarly, on Month-3, the average tiller number of dwarf napiergrass in P3 treatment (19.91 No./m²) was higher compared to P2 (19.41 No./m²); P1 (16.41 No./m²); and P4 (15.08 No./m²) (figure 1b) due to the P3 treatment had a balanced composition between dwarf napiergrass and centro, so that there was no competition to obtain sunlight in tiller growing. This was indicated that the average tiller number of dwarf napiergrass related to the average of chlorophyll of dwarf napiergrass in the same treatment. This was in accordance with [15] who stated that sunlight has an important role in the tiller number, which the higher intensity of solar lighting, the higher tiller number was obtained. [13] also stated that light intensity highly contributed to leaves growth which effects tiller growth. [16] also stated that tiller number will be maximized only if plants have good genetic traits and supported with favourable and appropriate environment.

On the Month-1, branch number of centro in P2 treatment (9.99 No./m²) was higher compared to P3 (7.5 No./m²); P4 (5.83 No./m²); and P5 (8.5 No./m²). However, in P5 treatment achieved the highest average branch number on Month-2 and -3, respectively in monoculture system. This was related with [17] that there was no competition in sunlight, water, and nutrients on monoculture plants.

The average branch number on Month-2 of P2 treatment (23.91 No./m²); P3 (24.66 No./m²); P4 (25.66 No./m²); and on Month-3, P2 (48 No./m²); P3 (49.16 No./m²); and P4 (50.55 No./m²) were relatively similar, due to the unbalanced composition between dwarf napiergrass and centro. Centro tend to be more competitive and aggressive compared to dwarf napiergrass in water, sunlight, and air [18-20].

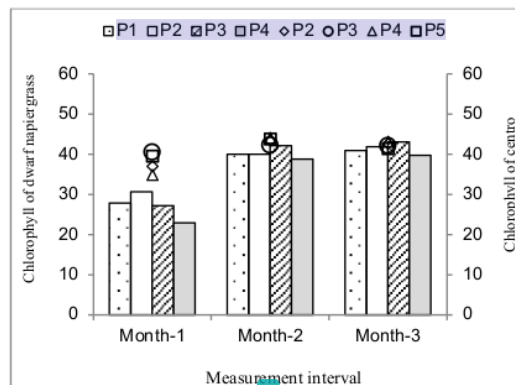


Figure 2. Chlorophyll dwarf napiergrass and centro As for the abbreviations of treatment, refer to figure 1.

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Results showed that chlorophyll did not significantly affect ($p>0.05$) mixed cropping system (figure 2). On the Month-1, chlorophyll of dwarf napiergrass on the P2 treatment (30.71 unit/leaf) was the highest, followed by P1 (27.81 unit/leaf); P3 (27.24 unit/leaf); and P4 (22.85 unit/leaf) treatment, respectively. On the Month-2 and -3, the P3 treatment increased significantly followed by P2, P1, and P4 treatment, respectively. This due to the composition between dwarf napiergrass and centro was comparable to adequate amount of sunlight. [21] stated that the formation of chlorophyll was influenced by sunlight, oxygen genetics, carbohydrate, water, and nutrients.

On the Month-1, the amount chlorophyll of centro on the P3 treatment (40.48) was higher compared to P2 (36.95 unit/leaf); P4 (34.83 unit/leaf); and P5 (39.55 unit/leaf), respectively. On the Month-2, the P2 treatment (43.36 unit/leaf); P4 (44.06 unit/leaf); and P5 (43.85 unit/leaf) were higher compared to the P3 treatment (42.31 unit/leaf), respectively. Subsequently, in Month-3, P5 treatment (41.39) was the lowest compared to P3 (42.06 unit/leaf); P2 (42.60 unit/leaf); P4 (43.16 unit/leaf), respectively. These results were influenced by leguminous plant ages. [22] stated that leaves ages and plant ages influenced various induction phases of photosynthesis. Short-term lighting on old leaves and young leaves are different, similarly photosynthesis capacity on leaves changes by age.

4. Conclusion

The treatment of mixed cropping system did not differ significantly on growth characteristic of dwarf napiergrass and centro. However, the highest plant height, tiller number, and chlorophylls of dwarf napiergrass in the P2, P3 and P3 treatment, respectively. Therefore, the best composition of mixed cropping was 30% of dwarf napiergrass and 70% of centro (P3 treatment).

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