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ROOT PATTERN DEVELOPMENT OF *Brachiaria humidicola* AND *Imperata cylindrica* AND CHANGE OF BOTANICAL COMPOSITIONS OF PASTURE IN COCONUTS PLANTATION

Selvie Diana ANIS[1], Yohannis TULUNG[1], Agnitje RUMAMBI[1], Poulla WALELENG[2], Siane RIMBING[3]

[1]Laboratory of Forages Science, Faculty of Animal Science, University of Sam Ratulangi. Jalan Kampus Unsrat, Manado 95115, North Sulawesi, Indonesia
[2]Laboratory of Social Economic, Faculty of Animal Science, University of Sam Ratulangi. Jalan Kampus Unsrat, Manado 95115, North Sulawesi, Indonesia
[3]Laboratory of Animal Production Faculty of Animal Science, University of Sam Ratulangi Jalan Kampus Unsrat, Manado 95115, North Sulawesi, Indonesia

Corresponding author email: selvie_anis@yahoo.com

Abstract

Brachiaria humidicola is one of perennial forage grass with creeping growth habit, having stolon, grown well and tolerant under shade environment, persist regular defoliation and in rotational grazing produce more and long vigorous roots. Imperata cylindrica is considered as the worst weed of over the agricultural land in most tropical regions. This type of weeds impact the lost of soil water via plant evaporations. The aims of this research was to studied the ability of B.humidicola to transform I. cylindrica field to be a good pasture in coconut plantation. In this experiment B. humidicola was planted in the area grown by I. cylindrica but already slashed 5 cm above ground level. Treatments consisted of planting distance of B.humidicola PD-1 = 30 x 30 cm, PD-2 = 50 x 50 cm and PD-3 = 100 x 100 cm apart (A factor), and cutting frequencies CF-1 = 15 days, CF-2 = 30 days and CF-3 = 45 days (B factor). Cutting of B. humidicola together in the same time with I. cylindrica. Treatments were put as factorial arrangement based on completely randomized design. The variables measured were botanical composition, below ground (BG) dry matter, forages production and quality. Data analysis was using ANOVA followed by HSD. The results showed all variable measured were significant higher at the treatments interaction of planting distance of PD-1 and cutting frequencies CF-3. At this interaction botanical composition and below ground dry matter production were dominated by B. humidicola component. Based on these results it could be concluded that B. humidicola as forage cover crops potential and useful as biological herbicide to control I. cylindrica and transformed it to be a good pasture in coconut plantations.

Key words: *botanical, brachiaria, coconuts, imperata, root development.*

INTRODUCTION

Cogon grass (*Imperata cylindrica* Beauv.), family Poaceae, is an invasive, rhizomatous, aggressive C_4 perennial grass that has become one of the most serious invasive species all over tropical and subtropical region. It does not tolerate shaded environments because it assimilates carbon via the C4 photosynthetic pathway (Patakh et al., 2018). It is a strong competitor for growth factors such as water, nutrients, and light because it sprouts and grows more rapidly than most crops (C3 plants). This sensitivity to shading can be exploited in its control by the use of fast growing cover crops, shrubs, or species of grasses with prostrate growing habits (Macdicken et al., 1997; Chikoye et al., 2001). The best way to control *I. cylindrica* is by implementing an integrated approach that employs a variety of options, for example can be suppressed by flattening, tillage or chemical control followed by planting competitive cover crops. *Brachiaria humidicola* cv. Tully is one among several species recommended as well adapted forages in shade environment underneath coconuts plantation in North Sulawesi (Kaligis and Sumolang, 1990) and pesistent under free grazing system in mixed pasture (Kaligis, 1998; Anis et al., 2015). Negative effects of defoliation frequency decrease dry matter production and growth of forage, inhibit develop and even cause death of the rooting (Mousel et al., 2005) because it inhibits nutrient absorption and the effectiveness of photosynthesis. However, recent research results show that the increase in the frequency of defoliation contrary raised the concentration of TNC in the crown and root (Gittins et al., 2010) and even earlier it was reported that heavy grazing of yaks up to 2.9 heads/ha produced root/shoot ratio biomass higher than the lighter grazing pressure (Gao et al., 2007).

MATERIALS AND METHODS

Study Area

This experiment was conducted in the BPPT research station located 67 meter above sea level, at 01^{0} 30' N and 124^{0} 54' E. in North Minahasa regency, province of North Sulawesi, Indonesia. The climate of the area is tropical and humid which receives an annual average rain fall of 2700 mm. Rainfall distribution is fairly even, except for a period of lower rainfall 100-150 mm per month from July to September (Anis et al., 2015). The pH of the fertile, sandy loam soil is around 6. Light transmission (PAR) at the site under mature tall coconuts averages 73% at 10.00 a.m. on a sunny day. Study area are dominated by *Imperata cylindrica.*

Treatment

In this study involved two kinds of grasses *I. cylindrica* as weeds, and a tropical grass *Brachiaria humidicolla* as competitor to be evaluated was planted in the area grown by *I. cylindrica* but already slashed 5 cm above ground level. Area has been divided to 45 plots by 5x5 meter or 25 meters square each. *I. cylindrica* plant populations were varies between 65 – 90 plants per meter square of experimental area. Treatments consisted of planting distance (PD) of *B. humidicola* PD-1 = 30 x 30 cm (average 16 plant per meter square), PD-2 = 50 x 50 cm (average 8 plants per meter square), and PD-3 = 100 x 100 cm apart (average 4 plants per meter square) as A factor. Cutting frequencies (CF) as factor B consist of CF-1 = 15 days, CF-2 = 30 days and CF-3 = 45 days were applied to both species of *B. humidicola* together in the same time with *I. cylindrica.* Treatments were put as 3x3 factorial arrangement based on completely randomized design with 5 replications. Tiller of *B. humidicola* previously planted in poly bag and grown in a shade house. After grown 30 days in poly bag, then transplanted in experimental plots according to treatments of plant distance being evaluated. The plant grown without any fertilizer applied.

Measurement

Above ground (AG) green material yield of each species was obtained by cutting the central area of each plot containing of different number of *B. humidicola* plant depending on treatment of planting distance. Sampling was used quadrant of 50 x 50 cm lay down randomly two times in the middle of each plot. Below ground (BG) yield i.e., roots and rhizome were sampled from the same quadrants of 50x50 cm after the green materials has been take away. Sample of BG materials was taken used a soil core with inner diameter 5,5 cm up to 25 cm soil depth. Soil sample collected were washed carefully to remove adhered soil with roots and rhizome (Pathak et al., 2018). The samples of surface and BG collected were oven dried at 70 ^{0}C up to constant weight to obtain the biomass. The variables measured include dried weight (ton/ha) of AG dry matter of green materials, and BG dry matter yield of roots and rhizome. In this report we have been used data from 5th harvest of each treatment, considered it is enough to show the morphological change of both plants under the treatments being evaluated. Data were then statistically analyzed by using analysis of variance (ANOVA) by means of MINITAB (Version 16). Honestly Significant Difference (HSD) was applied to determine the difference among treatments, and the differences were considered at $P<0.05$.

RESULTS AND DISCUSSIONS

The effects of treatments of planting distances and cutting frequencies on surface or above ground green material dry matter production showed in Table 1. Planting distance PD-1 has a Bh:Icy ratio at 3.96 point significantly higher than PD-2 and PD-3 treatments 1.93 and 1.42 respectively. This data was attribute by the higher content of *Brachiaria humidicola* in this PD-1 treatment. Even though in the beginning the plant population of *I.cylindrica* in each plot of all planting distance was dominant but due to the aggressiveness growth of *B.humidicola* where this species has a growth habit exponential (Abdullah et al., 2009; Anis et al., 2013) enable to compete with *I.cylindrica*. More over regular cutting treatment influenced significantly the root growth and produced vigorous new roots of *B. humidicola* (Anis et al., 2015).

Tabel 1. Above ground green material DM production (tone/ha)

Cutting Frequencies (CF)	Planting Distance (PD)									Total-CF
	PD-1			PD-2			PD-3			
	Bh	Icy	Total	Bh	Icy	Total	Bh	Icy	Total	
CF-1	1.57	0.36	1.93	1.01	0.87	1.88	0.87	0.65	1.52	1.78[c]
CF-2	2.04	0.48	2.51	1.73	0.79	1.52	1.28	0.98	2.26	2.43[b]
CF-3	2.30	0.76	3.06	2.10	0.85	2.96	1.65	1.02	2.67	2.90[a]
Total-PD	5.91	1.60	2.50	4.84	2.51	2.45	3.80	2.65	2.15	
Ratio Bh:Icy	3.69[a]			1.93[b]			1.42[c]			

Notes: Bh = *Brachiaria humidicolla.* Icy = *Imperata cylindrica*

Tabel 2. Below ground roots and rhizome DM production (tone/ha)

Cutting Frequencies (CF)	Planting Distance (PD)									Total-CF
	PD-1			PD-2			PD-3			
	Bh	Icy	Total	Bh	Icy	Total	Bh	Icy	Total	
CF-1	0.34	0.10	0.44	0.29	0.16	0.45	0.20	0.20	0.40	1.29
CF-2	0.39	0.12	0.51	0.30	0.17	0.47	0.25	0.19	0.44	1.50
CF-3	0.45	0.11	0.56	0.37	0.15	0.52	0.29	0.21	0.50	1.58
Total-PD	1.18	0.33	1.51	0.96	0.48	1.44	0.74	0.60	1.34	

Bh = *Brachiaria humidicola.* Icy = *Imperata cylindrica*

Below ground dry matter production including roots and rhizome influenced by those treatment as shown in Tabel 2 below. Below ground DM production was dominated by Bh at treatment PD-1 interact with cutting frequencies CF-3 at 0.45 ton/ha, then decrease sharply to PD-2 at 0.37 and PD-3 at 0.29 ton/ha respectively. The higher yield of bellow ground of Bh due to content of crown as the source of energy for re-growth is heavier than the biomass of roots itself (Anis et al., 2015). Nevertheless, in general data show that DM yield below ground of *Brachiaria humidicola* decreased following the increasing of planting distance from 1.18; 0.96 and 0.74 respectively. Contrary, *Imperata cylindrica* yield tend to increase sharply. These results is in the same trend with the earlier reported (Pathak et al., 2017) that production of root and rhizome of *Imperata* was 3.8 times higher than the surface litter production.

CONCLUSIONS

Based on the results it could be concluded that *Brachiaria humidicola* potential and useful as biological herbicide to control *Imperata cylindrica* and transformed it to be a good pasture in coconut plantations.

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