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Raising, Sustaining Productivity and Quality in Mixtures Imperata Cylindrica-Stylosanthes Guyanensis Pastures with Phosphorus Fertilization and Defoliation Management

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Abstract

Phosphorus fertilization on crop mixtures Cogongrass-Stylo's very important for the development of root nodules, nitrogen fixation and improve the botanical composition Stylo to confront an aggressive Cogon grass. This study aims to improve the productivity and quality of crops mixtures Cogon grass-Stylo through fertilization and defoliation frequency. The study consisted of two factors . The first factor is the phosphorus fertilizer with a dose of 0 (P0) and 100 kg P_2O/ha (P1). The second factor are the frequency of defoliation 3 times every 30 days (3D30), 2 times every 45 days (2D45) and once at the age of 90 days (1D90). The results showed that phosphorus fertilization increases dry matter yield to Stylo, (Cogon grass + Stylo), botanical composition of Stylo and crude protein mixtures (Cogon grass + Stylo). Defoliation frequency twice with an interval of 45 days resulted in the highest dry matter in Cogon grass and (Cogon grass + Stylo). Defoliation longs intervals lowering the crude protein content and in vitro dry matter digestibility.

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It can be concluded that phosphorus fertilization increases the production and quality of forage polyculture Cogon grass - Stylo. Defoliation frequency 2 times increase the production of dry matter forages mixtures Cogon grass-Stylo, defoliation long interval caused a decrease in quality.

Keywords: Imperata cylindrical; Intercropping; productivity; quality; Stylosanthes guyanensis.

1. Introduction

Cogon grass or Alang-alang (Imperata cylindrica (L .) Beauv.) is a kind of grass that still dominate grasslands in Indonesia. This grass generally considered a weed, extremely aggressive invaders with the capability of invading a range of sites [1], so that research on Cogon grass more towards the controlling compared with its use as the feed . The role of Imperata cylindrica in South East Asia is reviewed for particular respect to animal production. Imperata cylindrica is a useful native pasture species in Papua New Guine, Indonesia, Philippines and Thailand, where studies have indicated that it can support low levels of animal production of neglible inputs [2].

Cogon grass has been used in Southeast Asia as forage because it is the dominant vegetation on over 300 million acres [3]. Grassland dominated by Imperata cylindrica (L.) Beauv covers large areas of former forest land throughout moist tropical regions, Imperata cylindrica particularly in Southeast Asia [4]. In Indonesia alone, the total area of Imperata grassland have been estimated at 20 million hectares [5]. Several reports show that the dry matter yield and quality cogon grass lower . Usually does not exceed 5 tons per acre [3] and crude protein content is below the level of 11% [2]. Although the production of dry matter and low quality, but because of the large areas, the fast-growing, drought tolerant and difficult to eradicate it should be used only as feed. Cogon grass _utilization as the feed is widely practiced throughout the world, as a natural and mixed pasture legume.

One way to increase the production and nutritional value of Cogon grass is premises polyculture with legume [6]. Intercropping legumes into Cogon grass raises live weight gains potential for 0.2–0.25 to 0.4–0.5 kg/head/day at around one 400 kg animal per 2 Ha [7]. Over-sowing of legumes into native pasture increases both the quantity and quality of herbage available, resulting in better animal performance and higher productivity per unit area of land. Imperata plus Centro or Stylo pastures carrying 1 au/ha produced more liveweight gains compared to Imperata pasture stocked at 0.5 au/ha [8]. Although Cogon grasses intercropping with various kinds of legumes as an effort to increase production and quality of sward have been done by some researchers, but the frequency of defoliation of Cogon grasses no researcher reported. In connection with the above, this study aims to determine the effect of phosphorus fertilization and defoliation frequency on yield and quality of mixed Imperata cylindrica-Stylosanthes guyanensis Pastures.

2. Materials and Methods

2.1 Plant material and treatment

The research was conducted on an Imperata grassland that has growth and a rather uniform density chosen as the introduction to land legume Stylosanthes Guyanensis. Land where research textured sandy loam with a pH of 5.5 to 6.5 . Annual rainfall averages of 1200 mm per year with a wet season in of July to December. The study lasted from August until October 2015 .

Research arranged in groups of 2 X 3 designs with four replications . The first factor is the provision of fertilizer phosphorus (P) with doses of 0 (P0) and 100 kg P_2O_5 / Ha (P1) or (0 and 60 g P_2O_5/plot. The second factor are the frequency of defoliation 3 times every 30 days (3D30), 2 times every 45 days (2D45) and the first time at the age of 90 days (1D90) .

2.2 Plant culture

Stylosanthes guyanensis legume seeds originally were grown in polybag for 15 days and then planted with plots measuring 2 x 3 mater with a spacing of 25 x 25 cm. The distance between the two plots is one meters. Simultaneously with planting legume cutting Cogon grass as high as legume seeds and fertilizer phosphorus. Plants maintained for 90 days.

2.3 Dry matter yield

Plant were harvested at 5 cm above the soil surface then were weighed to derermine the fresh weight. In detemining the DM, 200 g of each sample of plant was taken and chopped into short lengths (2 – 5 cm). They were then placed in an oven at 55^oC for 48 hours. They weight after drying is the dry matter (DM). Dried samples then were 1 mm grounded by Willey mill. These samples were used to determine the dry matter [9]. Dry matter yields was calculated by multiplying the percentage of the total dry matter yield of fresh from materials.

2.4 Chemical analysis and In vitro dry matter digetibility

The dry samples were ground using a hammer mill fitted with a 1 mm sieve and about 100 g was stored in separate bottles for analysis. Crude protein was determined according to the method of Association for Official Analytical Chemist [9]. Determination of in vitro dry matter digestibility was conducted by the methods of Tilley and Terry [10].

2.5 Statistical analysis

Different experimental treatment (for all parameters) were compared with the Univariate ANOVA followed by LSD test for comparisons post hoc. A probability level of $P \leq 0.05$ was considered to be statistically significant. The SPSS software package (SPSS Ver. 16.0, SPSS Inc., Chicago, Illinois) was used for all tests.

3. Results and discussion

3.1 Effect of phosphorus fertilization on parameters

Data dry matter yield of Stylosanthes guyanensis grown intercropping with Imperata cylindrica varies between treatments. The treatments were given fertilizer phosphorus with a dose of 100 kgP_2O_5/ha yield 59.0 kg of dry matter/ha higher than without fertilizer phosphorus (40.1 kg/ha) (Table 1). This indicates that phosphorus fertilization can increase dry matter production Stylosanthe guyanensis. According to Jones [11] that for adequate growth, Stylosanthes usually given fertilizer phosphorus, as it supports legumes and can increase the proportion of legumes in polyculture [12].

Table 1: Average of dry matter of Stylo, Cogon grass, (Cogon grass + Stylo), botanical composition of stylo, crude protein and in vitro digestibility as influenced by different levels of phophorus

Parameters	Phosphorus fertilization (P)		SEM	Prob.
	P0	P1		
Stylo (Sg), kg/ha	40.11[b]	58.93[a]	1.672	0.000
Cogon grass (Cg), kg/ha	368.93[a]	382.20[a]	9.610	0.342
Sg + Cg , kg/ha	409.04[b]	441.14[a]	10.369	0.042
Stylo (Sg), %	9.78[b]	13.39[a]	0.351	0.000
Crude protein, %	7.63[b]	8.38[a]	0.267	0.024
In vitro digestibility, %	43.28[a]	43.72[a]	0.234	0.205

SEM: Standard Error of Means

[ab]superscript values in in the same row followed by a different letter are different at $P < 0.05$

Phosphorus fertilization did not affect the dry matter production of Cogon grass. During the growth phase, the average dry matter production of 368.93 kg/ha - 382.20 kg/ha, respectively obtained in the treatment without fertilization and with phosphorus fertilization (Table 1). According to Koenig [12] that the grass and grass-legume mixtures will respond to phosphorus fertilizer application when soil deficiencies. The use of phosphorus fertilizers and other nutrients to the legume are to tie the nitrogen from the air which is further used for the growth of the legume and grass [13].

Dry matter yield (Cogon grass + Stylo) (Table 1) showed significant differences between treatments . The lowest dry matter yield (409.04 kg/ha) under conditions without fertilizer and increase to 441.14 kg/ha in fertilizer phosphorus at a dose of 100 kg P_2O_5/ha . Increased production of dry matter due to an increase in dry matter Stylo due to phosphorus fertilization (Table 1). This is consistent with the statement of Koenig [12] that the phosphorus fertilizer increased the proportion of legumes in the cropping a mixture .

The botanical composition of Stylo increased due to the provision of phosphorus. Botanical composition of 9.78% with no fertilizer , increasing to 13.39% on phosphorus fertilizer application. According to Yoder and Burton [14] that phosphorus fertilization may increase the komponen legume.

Crude protein (Cogon grass + Stylo) herbage mixtures increased due to phosphorus fertilization (Table 1). The increase in crude protein as a result of the increasing proportion of legumes in the crops mixtures Cogongrass-

Stylo. Legumes have higher nutritive value than grass species so growing mixtures of grasses and legumes can improve forage quality compared to grass monocultures [15, 16]. High quality forage has high digestibility, low fiber content and high concentration of protein [17].

The in vitro digestibility of planting a mixture (Cogon grass + Stylo) is not affected by phosphorus fertilization. According to Ball [18] that the fertilization usually has little or no effect on digestibility. Fertilization with phosphorus (P), potassium (K), or other nutrients that increase yield may actually slightly reduce forage quality when growth is rapid.

3.2 Effect frequency of defoliation on parameters

Average dry matter yields of Stylo as affected by the frequency of defoliation are presented in Table 2. Dry matter yield Stylo highest at a frequency of defoliation twice followed by defoliation frequency of three times and one time during the 90-day study. The average total production of Cogon grass is influenced by the frequency of defoliation. Defoliation frequency twice every 45 days resulted in significantly higher dry matter compared with the frequency of every 30 har defoliation three times and one time every 90 days.

The of dry matter yield mixture (Cogon grass + Stylo) higher in frequency defoliation two times compared with the frequency of defoliation three times and one time during the growth period of 90 days (Table 2). At defoliation frequency of 2 times (interval of 45 days) of dry matter production is higher because the rate of photosynthesis faster so that the accumulation of dry matter much more. Thereby setting the proper defoliation can increase the productivity of dry matter.

Table 2: Average of dry matter of Stylo, Cogon grass, (Cogon grass + Stylo), botanical composition of stylo, crude protein and in vitro digestibility as influenced by different levels of Frequency of defoliation

Parameters	Frequency of defoliation			SEM	Prob
	3 (D_{30})	2 (D_{45})	1(D_{90})		
Stylo (Sg) (kg/ha)	45.99^{b}	54.41^{a}	48.17^{ab}	2.048	0.025
Cogon grass (Cg) (kg/ha)	364.83^{b}	408.50^{a}	353.36^{b}	11.770	0.009
Sg + Cg (kg/ha)	410.82^{b}	462.91^{a}	401.53^{b}	12.699	0.006
Stylo (%)	11.16^{a}	11.76^{a}	11.84^{a}	0.267	0.486
Crude protein (%)	10.06^{a}	7.70^{b}	6.26^{c}	0.378	0.000
In vitro digestibility (%)	44.60^{a}	44.31^{a}	41.59^{b}	0.406	0.000

SEM: Standard Error of Means

^{abc}superscript values in the same row followed by a different letter are different at $P<0.05$

Frequency of defoliation no significant effect on the botanical composition of legume Stylo planted among lang coarse, but tends to decrease the frequency of defoliation are more frequent (Table 2). This suggests that Stylo legume of dry matter does not contribute to increased dry matter yield of Cogon grass-Stylo a mixture on defoliation frequency 2 times at intervals of 45 days.

The average crude protein content (Cogon grass + Stylo) higher in frequency defoliation three times at intervals of 30 days compared with 45 days intervals and 90 days (Table 2). Defoliation frequency of three times and twice generate Crude protein> 7%. This shows that the quality of the forage mixture Cogon grass-Stylo at the age of 45 days is still feasible for ruminants. According to NRC [19] that level (> 7% CP) in the diet is required for maximal growth and activity of ruminal microorganisms, thus producing desired microbial crude protein amounts and maximizing ruminal fermentation. This shows that the longer the time interval defoliation crude protein content decreases because the plants is getting older. According to Ball [18] that the forage quality declines to advancing maturity.

There was no difference the in vitro dry matter digestibility Cogon grass+ Stylo at a frequency of 3 times and twice respectively at intervals of 30 and 45 days , but both are higher than the frequency of defoliation at the age of 90 days . This shows that digestibility of dry matter Cogon grass + Stylo at the age of 90 days started to decline due to age factor. Holmes [20] showed that 5 weeks old Imperata had a digestibility of 41.1% .

4. Conclusions

1. Phosphorus fertilization increases the production and quality of forage polyculture Cogon grass - Stylo.
2. Defoliation frequency 2 times increase the production of dry matter forages mixtures Cogon grass + Stylo, defoliation long interval caused a decrease in quality.

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