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PRODUCTIVITY OF BENGGALA GRASS (*PANICUM MAXIMUM*) ASSOCIATED WITH *CENTROSEMA PUBESCENS* AND *MACROPTILIUM ATROPURPUREUM* FERTILIZED BY FERMENTED OF WASTE WATER SOAKGREEN BEAN

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ABSTRACT

Low productivity of ruminant livestock is 70% caused by environmental management, including feed. Providing forage for livestock is still very difficult carried out continuously with high quality. Benggala grass *(Panicum maximum)* type of superior grass in Indonesia, has good quality to meet the needs of ruminant livestock. The Study aimed to obtain productivity of associated benggala grass (*Panicum maximum*). with *Centrosema pubescens* and *Macroptilium atropurpureum* fertilized by fermented of waste water soak green beans. The fodder crops used were benggala grass which is planted in a cropping pattern and fertilized with fermented of waste water soak green bean. The experiment used a complete randomized split plot pattern design. The main plot consists of Benggala grass monoculture (R), combination of Benggala grass with *Centrosema pubescens* (Rc) and Benggala grass with *Macroptilium atropurpureum* (Rs), while the sub-plot is a concentration of liquid fertilizer from fermented waste water soak green bean consisting 2, 4 and 6 liters of water. Each treatment was repeated 4 times. The variables observed were growth and quality of results. The results of the research show monoculture planting provides yields high plant height but lower root length than combination planting. Growth monoculture plant height was 218,17 cm and while the root length was 32,79 cm. There is an interaction in root lenght, dry matter and organic matter between fertilizer concentration and planting patterns. It was concluded the plant association pattern on benggala grass could be applied, but with an

suitable concentrationof fermented of waste water soak green bean.

KEYWORDS: Productivity, planting patterns, fermented of waste water soak green bean, benggala grass.

INTRODUCTION

People need for animal protein is increasing, along with increasing population and the importance of nutritional value for humans, one of which is meat from ruminant livestock. Pusat Kajian Anggaran dan Badan Keahlian DPR RI (2021) informing the need for beef in Indonesia during the period the same tends to increase in 2016 – 2020 compared in terms of production, in 2020 the national demand for beef will be 717.15 thousand tons, domestic production capacity is only able to meet 515.63 thousand tons (71,9%). The deficit is 201,52 thousand tons or 28,1% of national beef needs still have to be met through imports. Low productivity of ruminant livestock is 70% caused by environmental management, including feed. Saking and Qomariyah (2017) forage for ruminants reaches 70% of the total feed, the rest is concentrate. Providing forage for livestock is still very difficult carried out continuously with high quality. Benggala grass *(Panicum maximum)* is a type of superior grass in Indonesia, has good quality to meet the needs of ruminant livestock. To increase the productivity of grass, planting techniques and fertilization technology are needed.

Associations of *centrosema pubescens* and *macroptilium atropurpureum* are expected increase production and quality of forage. The presence of legumes will cause fixation of nitrogen in the atmosphere (N^2) becomes nitrogen (N) available in the soil with the help of *rhizobium* bacteria which is located on the root nodules. Purwantari and Sajimin (2016) stated that biological fixation of atmospheric N^2 is very promising in increasing sustainable and environmentally friendly agricultural production (reducing the use of inorganic N fertilizer, maintaining fertility and protecting the environment due to global warming). Providing fermented of waste water soak green beans are expected to increase sustainable and environmentally friendly agricultural production. Green bean soaking water is one of the organic wastes from the green bean sprout industry which is widely available and has no management. The addition of the EM4 activator is expected to improve the quality of organic materials and microorganisms from waste used. The advantages of EM4 are will speed up the fermentation of organic materials so that the nutrients contained will be quickly absorbed and available to plants (Hadisuwito, 2012).

RESEARCH METHOD

Research was conducted at the Greenhouse Research Station, Faculty of Animal Husbandry Udayana University for 3 months. The plants used are benggala grass, *Centrosemapubescens* and *Macroptilium atropurpureum*. The fertilizer to be used comes from green bean soaking water waste fermented with EM4. The research used instruments including: shovel, 2×2 hole size wire sievemm, trey, plastic pot, measuring cup, scissors, measuring tape, leaf area meter, scalesmanual with a capacity of 15 kg with a sensitivity of 100 g and digital scales with a capacity of 500 g with a sensitivity of 0.1 g, brown envelope, oven 220 volt.

Results of Soil Analysis of latosol pH Value: 6,8, C-Organic: 1,29%, Total N: 0,12%: P-available: 15,61 ppm. The soil texture is classified clayey clay. The analysis results of fermented of waste water soak green beans used are: C-Organic: 1,21%, N: 0,25 %, P: 0,02%, K: 0,21%, Ca: 0,002%, organic material: 2,23%.

The study used a completely randomized design (CRD) Split plot. Main plot: Benggala grass monoculture (R), combination of Benggala grass with *Centrosema pubescens* (Rc) and Benggala grass with *Macroptilium atropurpureum* (Rs) and Sub plot was the concentration liquid fertilizer of fermented waste water soak green bean, namely: 1 liter liquid fertilizer + 2 liters of water (P2), 1 liter liquid fertilizer + 4 liters of water (P4), 1 liter liquid fertilizer + 6 liters of water (P6). The experiment was repeated three (4) times so that there were 36 experimental units. Benggala grass in pols shape. *Centrosema pubescens* and *Macroptilium atropurpureum* in the form of seeds sown on trey. Plants of uniform size were selected as samples. The soil used is sifted first so that the structure is even or homogeneous, 7 kg is weighed and put into the pot. The fermentation process of waste water soaking green beans uses EM4 with the ratio used, namely15ml/500ml, stirred until homogeneous in a fermenter then closed tightly and placed at room temperature for 10 days (Harianingsih *et al*., 2019). combination planting using one grass and legume plant in 1 pot. The variables observed in this study were plant growth: plant height, amount leaves, amount tillers, amount flowers, root length and forage quality: dry matter and organic matter.

The data obtained was analyzed using variance between treatments shows a significant difference ($P<0,05$), then the calculation continues with the test multiple distances from Duncan (Steel and Torrie, 1991).

RESULTS AND DISCUSSION

The results of research on productivity of benggala grass (*Panicum maximum*) associated with *Centrosema pubescens* and *Macroptilium atropurpureum* fertilized by fermented of waste water soak green bean are as follows;

Table 1: The effect of planting patterns with the concentration of fermented waste water soakgreen bean on the growth of Benggala grass (*Panicum maximum*).

Variable	Treatmen	Concentration fermented waste water soak green bean			Average
		P2	P4	P6	
			-- cm --		
	R	223,75a±33,75	223,25a±24,58	207,50a±16,54	218,17[1)]
		A	A	A	A
	Rc	169,75a±48,30	166,88a±55,21	181,00a±16,80	172,54
Plant height		A	A	A	B
	Rs	185,13a±24,52	208,50a±26,53	176,88a±21,03	190,17
		A	A	A	B
	Average	192,88a[1)]	199,54a	188,46a	
			-- Sheet --		
	R	33,25a±14,77	33,75a±9,14	30,75a±5,91	32,58
		A	A	A	A
Amountleaves	Rc	24,50a±7,33	21,25a±7,04	8,29a±8,29	25,25
		A	A	A	A
	Rs	27,25a±12,61	29,00a±10,68	31,75a±6,70	29,33
		A	A	A	A
	Average	28,33a	28,00a	31,75a	
			-- Stem --		
	R	5,75a±1,89	5,25a±1,26	5,00a±2,16	5,33
		A	A	A	A
Amounttillers	Rc	3,75a±1,50	4,25a±1,26	5,25a±0,96	4,42
		A	A	A	A
	Rs	5,00a±2,71	4,75a±1,26	6,00a±1,63	5,25
		A	A	A	A
	Average	4,83a	4,75a	5,42a	
			-- fruit --		
	R	4,00a±1,41	4,25a±1,89	2,75a±3,40	3,64
		A	A	A	A
Amountflowers	Rc	2,75a±2,22	2,25a±1,26	3,00a±1,41	2,67
		A	A	A	A
	Rs	3,75a±1,50	3,00a±1,83	3,25a±0,96	3,33
		A	A	A	A
	Average	3,50a	3,17a	3,00a	
			-- cm --		
	R	32,50a±2,68	32,00a±2,58	33,88a±3,71	32,79
		A	B	A	B
Root length	Rc	33,75a±4,03	34,25a±2,63	39,00a±3,37	35,67
		A	A	A	A

	Rs	43,38a±2,84	38,25a±3,86	35,75a±3,86	37,04
		A	A	A	A
	Average	36,54a	34,83a	36,21a	

Notes

1. Standard deviation
2. Rc = Benggala grass with *Centrosema pubescens*, Rs = benggala grass with *Macroptilium atropurpureum*.
3. P2 = concentration of waste water soaking fermented green beans 1 liters + water 2 liters, P4 = concentration waste water soaking fermented green beans 1 liters + water 4 liters, P6 = concentration waste water soaking fermented green beans 1 liters + water 6 liters.
4. Values with the same lowercase and uppercase letters in the same row and column indicate not. Significantly different (P>0,05).

The results of the research on all growth variables, namely plant height, number leaves, number of tillers, number of flowers and root length on concentration fertilization P2, P4, and P6 showed results that were not significantly different (P>0,05) on Benggala grass (Table 1). This may be due to the low dose of fertilizer used concentration of fermented green bean soaking water waste. Fermented waste water soak green bean is a fertilizer that is expected to resemble liquid organic fertilizer. The disadvantage of organic fertilizer is that it is needed in large quantities because of its nature bulky with relatively low macro and micro nutrient content and impact production takes a relatively long time. Fermented waste water soak green bean not meet the requirements as a liquid organic fertilizer, where the elements - elements such as organic N, P, K, and C-organik percentages below 3%. Permentan (2011) informs that liquid organic fertilizer has a standardization, namely C – organic: minimum 6%, nitrogen (N): 3 – 6%, phosphorus (P) 3 – 6%, and kalium (K): 3 – 6%. Besides that, Sitanggang *et al*. (2022) stated that the shortcomings of liquid organic fertilizer are: (1) the vitality of the microorganisms contained is very low, (2) the population of microorganisms is small (<106 cfu/ml), the nutrients contained are very low, generally the nutrients contained are in the form of additional nutrients such as urea and NPK, (3) the microorganisms in it are easily reduced and (4) it does not last long.

Growth variables are plant height and root length R, Rc, and Rs planting patterns showed significantly different results (P<0,05) on Benggala grass (Table 1). This is due to competition between grasses and legumes compete for nutrients. Length of grass roots in combination planting this may be due to the lack of availability of water and nutrients in the soil causes the roots to try to lengthen the area of the contact site. The available N element in combination planting is utilized more by the presence of *rhizobium* microbes in legumes as a food source and cell formation for the body of microorganisms. Salisbury and Ross (1995) states that, plants that get too much nitrogen have stunted root system. Plant height in combination plants too has a shorter height, which means the nutrients are absorbed by grass plants lower than monoculture plants. Lingga (2001) If plants obtain large amounts of N, this can play a role accelerate overall plant growth, especially in stems and leaf. The covering of grass leaves by the presence of creeping legumes can affect the amount of light intensity received by the grass, which can affect its growth. Suarna *et al*. (2014) competition will occur depends on the level of supply of resources such as soil fertility, radiation, moisture balance and natural soil communities especially resource requirements individual plants, number of plants per unit area and sparse canopy.

Interaction of planting patterns R, Rc, and Rs with fertilization concentrations of P2, P4, and P6 showed significantly different results ($P<0,05$) on root length of benggala grass (Table 1). This may involve interactions within each internal requirement absorb nutrients and water. Monoculture plants has a shorter root length compared to combined planting with legumes. Budiasih (2009) an increase in root length and volume is an important morphologicalresponse in the process of plant adaptation to water shortages. Besides that, some nutrients areabsorbed by legume plants in combination plants to accelerate the formation of root nodules. Weisany *et al*. (2013) nitrogen-fixing plants have higher P requirements than plants receiving direct nitrogen fertilization, possibly due to the need for nodule development and signal transduction. Suarna *et al*. (2019) function P include; cell division, albumin formation, formation of flowers, fruit and seeds, speed up maturation, strengthen the stem so that it does not collapse easily, root development, improve plant quality, resistant to disease, forms nucleoproteins (DNA and RNA), carbohydrate metabolism and energy transfer ATP and ADP.

Table 2: The effect of planting patterns and the concentration of waste water soaking greenbeans onQuality of fermented forage Benggala grass (*Panicum maximum*).

Variable	Treatmen	Concentration fermented waste water soak green bean			Average
		P2	P4	P6	
			-- % --		
	R	88,915a±0,093	89,331a±0,130	87,902b±1,325	88,716[1)]
		A	A	B	A
Dry matter	Rc	88,138a±0,660	88,800a±0,286	88,603a±0,326	88,513
		A	A	A	B
	Rs	88,980a±0,291	89,721a±0,285	89,520a±0,173	89,407
		A	A	A	A
	Average	88,678a[1)]	89,284a	88,675a	
			-- % --		
	R	87,631a±0,627	86,833b±1,405	87,138a±0,474	87,201
		A	A	A	A
Organicmatter	Rc	88,651a±0,563	86,925a±1,120	87,839a±0,292	87,805
		A	B	A	A
	Rs	87,632a±0,215	88,630a±0,349	87,108a±0,116	87,790
		A	A	A	A
	Average	87,971a	87,463a	87,362a	

Notes

1. Standard deviation
2. Rc = Benggala grass with *Centrosema pubescens*, Rs = benggala grass with *Macroptilium atropurpureum*.
3. P2 = concentration of waste water soaking fermented green beans 1 liters + water 2 liters, P4 = concentration waste water soaking fermented green beans 1 liters + water 4 liters, P6 = concentration waste water soaking fermented green beans 1 liters + water 6 liters.
4. Values with the same lowercase and uppercase letters in the same row and column indicate not. Significantly different (P>0,05).

The results of the research on all forage quality variables, dry matter and organic matter in fertilization P2, P4, and P6 concentrations showed non-significantly different results (P>0,05) benggala grass (Tabel 2) Fertilization with a concentration of fermented green bean soaking waste water of 2 to 6 liters of water has not had an impact on forage quality. Widjajanto (1998) increasing plant age will increase the amount of nutrients plants need. Nutrients provided are very helpful in the photosynthesis process of plants so that the accumulation of dry matter in plant parts such as roots, stems, leaves and generative parts can increase. Additionally, when if the plant has entered the generative phase, the quality of the forage will decrease further. Tabri and Zubachtirodin (2013) stated that at 9 wap the plant has entered the generative phase where assimilate from photosynthesis and a third of the assimilate stored in the stem is transported to the seeds. Ressie *et al*. (2018) increasing the age of a plant causes it to enter a renaissance phase where the plant is in a period of senescence, causing plant parts to contain high levels of cellulose and lignin.

Forage quality variables, dry matter in cropping patterns R, Rc, and Rs showed significantly different results ($P<0,05$) on benggala grass (Tabel 2). Improved dry matter lies in the increase in inorganic matter. Inorganic matter consists of ash, lignin, mineral and various elements. Increasing dry matter may be due to the association between grass and legumes. The combination planting pattern of Benggala grass with *Centrosema pubescens* is lower than the monoculture and combination planting patterns Benggala grass with *Macroptilium atropurpureum*. Widjajanto (1998) legumes in mixed crops is not always the case improves nitrogen status in the soil but sometimes suppresses availability nitrogen, this may occur if legumes act as strong competitors in N requirements or if the addition of organic material actually increases the rate immobilization. Dumadi *et al*. (2021) dry matter which may be caused by season, age, soil fertility and crop cultivation management.

All forage quality variables, dry matter and organic matter in the interaction of cropping patterns R, Rc, and Rs with fertilization concentrations of P2, P4, and P6 showed significantly different results ($P<0,05$) on benggala grass (Tabel 2). Monoculture planting has lower forage quality compared to combination planting. Interaction between the presence of legumes which will fixation N in the atmosphere to become available N in the soil so that the increased N in the soil will be utilized by plants for photosynthesis. N is important in plant growth and the formation of leaf chlorophyll so that it can stimulate the process of photosynthesis. The higher the amount of photosynthate means the more dry matter can be stored (Jumin, 2010). Yoku (2010) provides an additional N very necessary, because of the absorption of N elements shows things that are in line with dry matter and organic matter production green grass. Besides that, dry matter on monoculture planting pattern with P6 fertilizer concentration has the lowest value of 87,902%, while organic matter has the lowest value of 86,833% in monoculture planting patterns with P4 fertilizer concentration. The increase in dry matter in P4 compared to organic matter is due to increased levels of inorganic matter in the grass. Tillman *et al*. (1998) inorganic matter consist of ash, lignin, a mineral with various elements, organic matter which include protein, carbohydrate and fat. The difference in the results of each quality of forage regarding the nutrients provided is caused by the sunlight received by the plants. Hardjadji (2002) says sunlight is used for the photosynthesis process to produce plant organic matter. Salisbury and Ross (1995) states that a plant's ability to photosynthesize can be seen from how wide the leaves can receive full sunlight. Increasing the proportion of leaves will increase the carbohydrate and protein content.

CONCLUSIONS

Fertilization with a concentration of fermented green bean soaking waste water of 2 to6 liters of water had no effect grass productivity. Monoculture planting gives the highest value for plant height but low value for grass root length. There is an interaction on root length, dry matter and organic matter of Benggala grass between the application of fertilizer from fermented green bean soaking water waste and the planting pattern of grass with legumes.

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