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Dynamics Effect of Compost Fertilizer Dose and Enrichment of Azolla on the Growth of King Grass

Adi Fathul Qohar*[1], Eko Hendarto[1], Munasik[1], Harwanto[1], Nur Hidayat[1], Bahrun[1]

[1]Faculty of Animal Science, Universitas Jenderal Soedirman, Indonesia.

Corresponding Author: adifathul96@gmail.com

Abstract

King grass (*Pennisetum purpureophoides*) is a grass that can be developed for ruminant animal feed. King grass is a perennial plant that is responsive to fertilization. Fertilization with compost alone has low nutrient quality so that enrichment with *Azolla microphylla* is required. Azolla can provide the macronutrient needs needed by plants so that using organic/chemical fertilizers can be reduced and impact, reducing the cost of producing forage plants. This study aims to determine the dynamics of compost fertilization and *Azolla microphylla* enrichment on king grass growth. The research was conducted using experimental methods with a completely randomized design with a 3x3 factorial pattern with three repetitions. The first factor is the dose of compost, namely K1 = 10 tons ha^{-1} defoliation^{-1}, K2 = 20 tons ha^{-1} defoliation^{-1}, K3 = 30 tons ha^{-1} defoliation^{-1} and the second factor is the enrichment of *Azolla microphylla*, namely A1 = 10 percent, A2 = 20 percent, K3 = 30 percent. The results of the analysis of variance showed that the single effect, namely the dose of compost, had a very significant effect (P<0.01). The enrichment of *Azolla microphylla* had a very significant effect (P<0.01) on plant height, number of leaves, number of plants, and king grass diameter stem at 14, 28, and 42 days at the second defoliation. The interaction between the two factors tested had no significant effect (P> 0.05). There is a relationship between compost fertilization and *Azolla microphylla* on the growth parameters of king grass, the best fertilization is the application of fertilizer is 7 days after defoliation.

Keywords: *Azolla microphylla* enrichment, compost fertilizer, influence dynamics, growth, king grass

Introduction

Forage is the foundation for the development of ruminant farms because the initial plan was the availability of forage in the form of a forage source plant expanse to determine livestock production level (Hendarto & Suwarno, 2013). The provision of forage in terms of quality, quantity and continuity is an obstacle to ruminant farms' development (Sari et al., 2016). Indonesia is a tropical area where more extended sunlight will affect forage nutrients' quality (Suyitman, 2014). The introduction and development of forage as the primary source of feed for ruminants has been carried out to overcome forage shortages during the dry season.

King grass (*Pennisetum purpureophoides*) is a grass that can be developed for ruminant animal feed. Raja grass was first introduced and developed in Indonesia in the late 80s (Aminudin &

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Hendarto, 2000). The king grass plant is the result of a cross between elephant grass (*Pennisetum purpureum*) and pearl millet grass (*Pennisetum thyphoides*) (Suyitman, 2014; Suyitman et al., 2003). King grass is an annual or perennial plant, grows upright, and forms clumps. The root system that spreads (root fibres), strong, and deep. The shape is almost similar to sugar cane, there are rough hairs on the leaves and stems, reaching 2-4 meters high. Raja grass production is very high, reaching 1076 fresh tons/ha/year (Suyitman, 2014).

King grass with high growth and production can be maintained utilizing fertilization management (Lasamadi et al., 2013). Inorganic fertilizers are not recommended when used continuously because they can damage the soil's physical, chemical and biological properties (Hendarto et al., 2019). The use of organic fertilizers can correct problems caused by inorganic fertilizers. One of the organic fertilizers is compost that comes from beef cattle dung but has low nutrient quality (Dewanto et al., 2017). Therefore, compost nutrient enrichment is needed by adding *Azolla microphylla*. *Azolla microphylla* has good nutritional quality characterized by nitrogen, potassium and phosphorus content (Ismoyo et al., 2013). Azolla as a source of essential macronutrients in plant cultivation to reduce chemical fertilizers and increase soil fertility (Sudjana, 2013). According to Handajani (2011) states that *Azolla microphylla* biomass production for three weeks can produce 21.68 tons/ha. Various essential minerals such as: dry wet N 2.80 - 3.04% (dry 5-6%), P2O5 2.02 - 2.10%; K2O 9.06 - 9.72%. *Azolla microphylla* can multiply itself for two to ten days, depending on nutrient availability and environmental conditions (Malyan et al., 2019). The use of Azolla as compost can provide many benefits from various sides. Azolla can provide the macronutrient needs needed by plants so that the use of organic fertilizers can be reduced and impact, reducing the cost of producing forage plants. It is hoped that a sustainable agricultural system can be achieved (Sudjana, 2013). In this regard, it is necessary to research to determine the dynamics of the effect of compost enriched with *Azolla microphylla* on the growth of king grass.

Materials and methods

The material to be used in this research is the king grass planted on 27 treatment plots on a total area of 400 square meters, with an area of each plot is 3 square meters, the distance between the plots is 1 meter, and the spacing is 30 cm x 80 cm. Observations were made on the second defoliation. The first cutting was done at the age of 60 days, and the second defoliation was done at the age of 42 days. This research used experimental methods with a completely randomized design with a 3x3 factorial pattern repeated three times. These two factors are the first factor, the dosage of compost, namely K1 = 10 tons ha^{-1} $defoliation^{-1}$, K2 = 20 tons ha^{-1} $defoliation^{-1}$, K3 = 30 tons ha^{-1} $defoliation^{-1}$ and the second factor is the enrichment of *Azolla microphylla*, namely A1 = 10 percent, A2 = 20 percent, K3 = 30 percent. There were nine treatment combinations, namely K1A1, K1A2, K1A3, K2A1, K2A2, K2A3, K3A1, K3A2, K3A3, and it was repeated three times. Fertilizer is applied on the day to the destination of the first cutting. Watering and weeding are done once a week. Measurements of plant growth included stem diameter, number of leaves, number of plants, and plant height measured on days 14, 28, and 42 after the first cutting. The effect of compost dosage and *Azolla microphylla* enrichment was determined by analysis of variance (ANOVA) according to Stell & Thorie (1994) with the application of SPSS version 25. The treatment that had a significant effect was further tested with orthogonal polynomials to determine the relationship between compost dose and *Azolla microphylla* enrichment on response. king grass growth.

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Result and Discussion

Research location conditions

The king grass plant's research location is located on Beji Village, Kedungbanteng District, Banyumas Regency at coordinates 7º39 'South Latitude (LS) and 109º21' East Longitude (BT). The land in the research location has an altitude of 120 meters above sea level (masl) with 80 percent humidity (BPS, 2019). The research land used island has taken its topsoil, which has a fertility level that is good enough to support plant growth. The results of soil analysis at the research location are shown in Table 1.

Table 1. Soil Analysis Results at the Study Site

Number	Parameters	Unit	Test Result	BPT Criteria(2012)
1	C-Organic	%	1,137	1 – 2 low
2	Total Nitrogen	%	0,260	0,21– 0,5 low
3	C/N ratio		7,11	5 – 10 low
4	pH H_2O		6,7	6,6 – 7,5 netral
5	Organic Matter	%	1,96	
6	P_2O_5 total	%	0,007	>0,06 very high
7	K_2O total	%	0,250	>0,06 very high
8	Cation-Exchange Capacity (CEC)	me %	19,598	10 -20 low

Source: Soil Laboratory, Faculty of Agriculture, Jenderal Soedirman University, 2020

Dynamics of Effect of Dosage and Enrichment of *Azolla microphylla* on the growth of king grass

Table 2. Growth Average of King Grass

Treatment	Growth											
	Stem Diameter (mm)			Number of Leaves (blade)			Number of Plants (stem)			Plant Height (cm)		
	14 days	28 days	42 days	14 days	28 days	42 days	14 days	28 days	42 days	14 days	28 days	42 days
K1A1	8,93	11,1 9	16,0 0	37,0 0	66,3 3	98,3 3	11,0 0	11,2 7	15,0 0	67,0 0	100, 33	162, 67
K1A2	9,17	11,9 1	17,4 8	41,0 0	80,0 0	124, 33	12,0 0	15,0 0	16,0 0	72,0 0	110, 33	175, 00
K1A3	10,2 6	12,6 0	18,1 9	50,3 3	82,6 7	138, 67	14,0 0	13,0 0	17,0 0	80,3 3	113, 33	178, 33
K2A1	9,17	12,1 3	18,3 0	38,6 7	79,6 7	103, 00	10,6 7	13,0 0	14,0 0	73,3 3	110, 67	182, 67
K2A2	10,3 0	12,2 4	19,6 3	44,6 7	82,6 7	133, 67	12,0 0	15,0 0	19,0 0	86,0 0	131, 00	185, 00
K2A3	10,4 3	13,7 3	20,6 3	51,6 7	95,3 3	153, 33	14,0 0	16,0 0	18,0 0	94,3 3	135, 67	194, 00

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K3A1	10,42	13,18	17,36	40,33	94,00	121,33	13,67	14,00	17,00	86,33	121,33	195,33
K3A2	10,54	14,51	21,63	49,33	99,33	141,33	15,00	16,67	17,00	92,33	136,67	197,00
K3A3	11,07	16,36	22,05	57,67	111,00	170,67	18,00	17,67	21,00	94,00	146,00	205,33
Average	10,03	13,09	19,03	45,63	87,89	131,63	13,37	14,62	17,11	82,85	122,81	186,15

Source : Proseced Data, 2020

Profitable plant growth can be supported by the availability of adequate nutrients, by fertilizing with compost enriched with *Azolla microphylla*. It is hoped that the Azolla enriched compost treatment will improve growth performance in the agronomic aspects of king grass. The results of the analysis of variance showed that the effect of compost dose and *Azolla microphylla* enrichment had a very significant effect (P <0.01) on stem diameter, number of leaves, and the number of king grass plants on the second cut. The interaction between the two factors that were tested had no significant effect (P>0.05).

The treatment's plant height showed that the mean value increased on the 14th, 28th, and 42nd-day measurements of the second defoliation. In the second cut, the plant height was 168 cm (Shen et al., 2012). Hendarto (2005) added that the king grass plants' height ranges from 166-198 cm. The results showed that the average plant height was higher than in previous studies. This is because, with compost, the soil's nutrients will increase, significantly when the compost is enriched with *Azolla microphylla*. Compost and Azolla are waste that will increase the compost's practical value to create sustainable agriculture when combined for fertilization. Compost enriched with Azolla contains more nitrogen, phosphorus and potassium than compost without Azolla (Lestari et al., 2019).

The study results showed that the average number of leaves was more than (Ariyati et al., 2020). King grass had 32 leaves. These results explain that the application of compost enriched with *Azolla microphylla* affects the number of leaves. The greater the number of leaves produced, the more photosynthetic results will be produced (Budiman et al., 2012). A large number of leaves allows a large amount of chlorophyll present. Other research states that the number of king grass plants is 7-8 stems (Suyitman, 2014). Added by (Hanifa et al., 2012)the number of king grass plants is 6-8 stems. The research results are more than the research that has been previously mentioned. These results explain that the application of compost enriched with *Azolla microphylla* affects the number of plants. The higher the dosage of compost fertilization and *Azolla microphylla* enrichment will increase the significant effect on the number of king grass leaves on the second defoliation. The greater the number of plants produced, the king grass production will increase.

The results of further tests using orthogonal polynomials showed that the dose of compost and *Azolla microphylla* enrichment had a linear effect on plant height, stem diameter, number of leaves, and number of king grass plants at the age of 14, 28, and 42 days (Figures 1 and 2). The effect of compost application on plant height on day 14, 28, and 42, respectively, was 50.91, 52.82, and 69.31 percent. The research carried out has an effect of 69.31 percent, more significant than the research (Qohar et al., 2019) that the provision of manure affects the height of the third defoliated odot grass plant 34.33 percent. The effect of compost application on stem diameter on days 14, 28,

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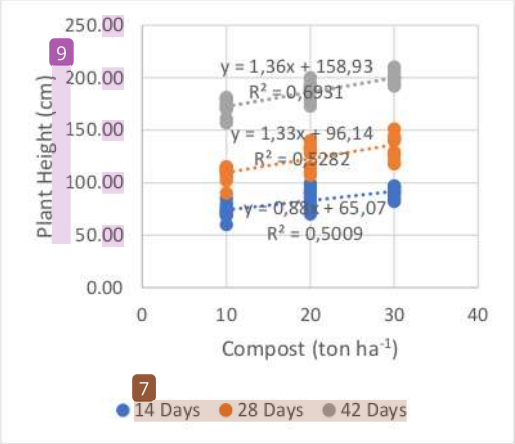
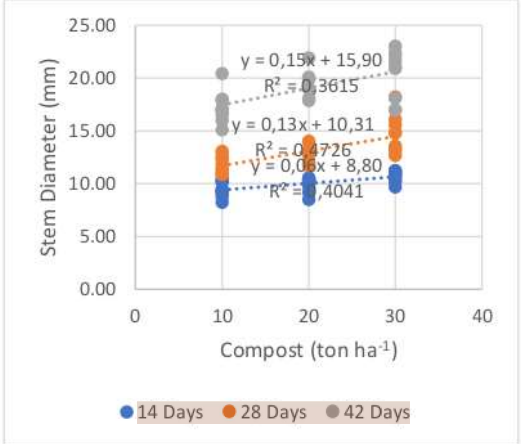
and 42, respectively, was 40.41, 47.26, and 36.15 percent. The effects of compost on the number of leaves on days 14, 28, and 42 were 11.25, 60.49, and 39.51 percent, respectively. The effect is more significant than previous studies (Qohar et al., 2019) that the provision of manure affects the number of third defoliated odot grass leaves on the 42nd day by 24.34 percent. The effect of compost application on the number of plants on day 14, 28, and 42, respectively, was 26.81, 25.98, and 19.51 percent.

The effects of *Azolla microphylla* enrichment on day 14, 28, and 42 were 31.06%, 32.41%, and 14.23 percent, respectively. The effects of azolla enrichment on stem diameter on day 14, 28, and 42 were 31.39, 25.98, and 34.97 percent, respectively. The effects of azolla enrichment on the number of leaves on day 14, 28, and 42 were 59.43, 25.59 and 73.76 percent, respectively. The effect is more significant than previous research (Qohar et al., 2019). The application of NPK fertilizer affects the number of third defoliated odot grass leaves on the 42nd day by 10.96 percent. The difference is possible due to differences in place, type of grass and others. The effect of Azolla enrichment on the number of plants on day 14, 28, and 42, respectively, was 32.64, 22.30, and 13.77 percent. There is a dynamic effect of compost fertilization and *Azolla microphylla* enrichment, possibly due to several factors, namely the decomposition process of organic matter, temperature, humidity, rainfall, and vegetation around the research a contributor to organic matter, and other management. This is under Jha et al. (2014) statement that absorption dynamics occur due to decomposition, pH, rainfall, vegetation, and other management.





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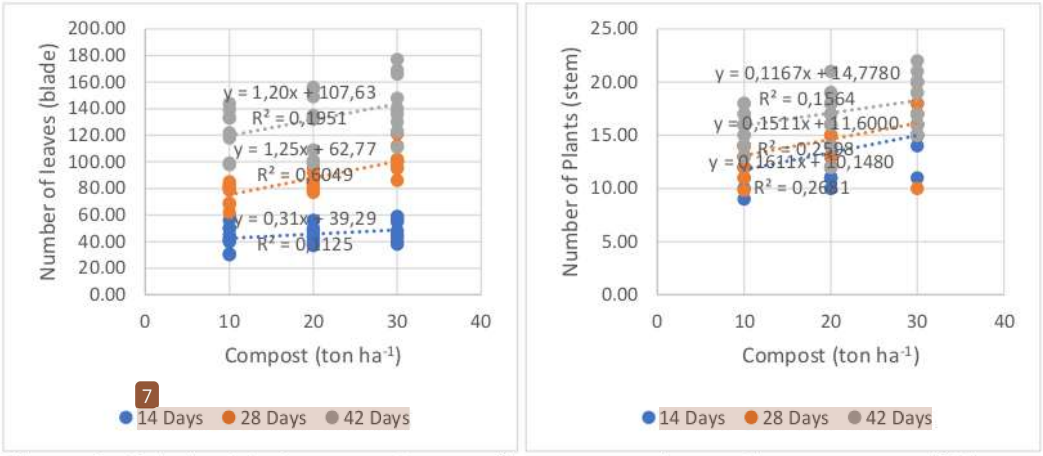

Figure 1. Relationship between dosage of compost and growth parameters of king grass

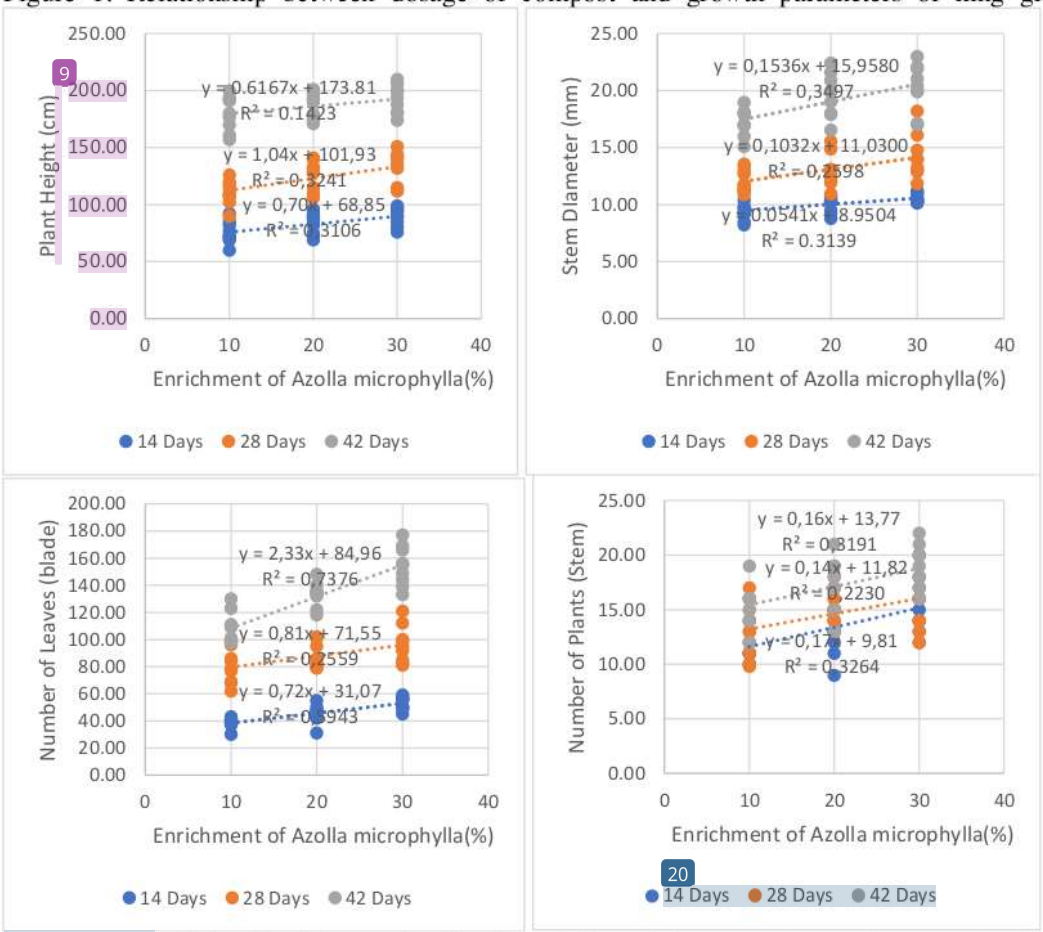

Figure 2. The relationship between *Azolla microphylla* enrichment and growth parameters of king grass

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Conclusion

There is a relationship between compost fertilization and *Azolla microphylla* on the growth parameters of king grass, the best fertilization is the application of fertilizer is 7 days after defoliation.

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