Jambura Journal of Animal Science

(Animal Science Department, Faculty of Agriculture, State University of Gorontalo)

https://ejurnal.ung.ac.id/index.php/jjas/index

PISSN: 2655-4356

e-ISSN: 2855-2280

Research Article

ANALYSIS OF LEVEL SINGLE N-P-Ca AND COMPOUND NPCa FERTILIZER ON THE GROWTH AND BIOMASS PRODUCTION OF ELEPHANTGRASS (*Pennisetum purpureum*)

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Jambura Journal of Animal Science,Volume:6, Issue:2, May.2024

Keywords:
Biomass production; compound NPCa Fertilizer; Elephantgrass; growth;
single N-P-Ca fertilize

Abstract: The success of growing elephant grass (*Pennisetum purpureum cv. Merkeron*) is reflected in the high and low levels of production and quality. This is supported by the physical environment of the soil and ideal climate as well as the processing processes provided. The aim of this research was to determine the growth and biomass production of elephant grass (Pennisetum purpureum) resulting from single N-P-Ca and compound NPCa fertilizers. This research was conducted using a completely randomized design with 7 treatments and 3 replications. Fertilizer use were single N-P-Ca fertilizer and compound NPCa fertilizer. The dosage of single N-P-Ca fertilizer and compound NPCa fertilizer is adjusted to the rules stated on the label issued by the fertilizer factory. Treatment of single N-P-Ca fertilizer dose and compound NPCa fertilizer. The data were analyzed statically by analysis of variance and the difference in the mean value was calculated by the list significant difference method at 1% and 5% levels. The single N-P-Ca and compound NPCa fertilizer treatments obtained better compared to those without fertilizer application (control). Plant height growth, growth in the number of tillers, fresh material production and leaf percentage production obtained better results in the single N-P-Ca treatment compared to the compound NPCa treatment at various levels. It can be concluded that, if using inorganic fertilizer, it is better to use single N-P-Ca fertilizer compared to compound NPCa fertilizer.

Citation APA Style
Mukhtar M, Bahri S, Syahruddin. 2024. Analysis of Level Single N-P-Ca and Compound NPCa Fertilizer on The Growth and Biomass Production of Elephantgrass (Pennisetum Purpureum). Jambura Journal of Animal Science, 6 (2) 123-130

INTRODUCTION

The successful growth of elephantgrass (*Pennisetum purpureum cv.* Merkeron) is reflected in the high and low levels of forage production and quality. Successful growth of forage requires physical environmental support from ideal soil and climate as well as the treatment process provided. One of the physical environmental is the soil's nutrient content as well as fertilization to increase the renewability of soil nutrients (Adiaty, U., 2005). In tropical areas these physical factors become obstacles frequently, either separately or together or as a result of the both interactions.

Elephantgrass is a superior grass that has high productivity nutritional content and for ruminants. The development and amanagement growth of elephantgrass plants as a nutritious and sustainable animal feed ingredient is still poorly understood by farmers. Good planting of elephantgrass can be done by tilling the soil and balancing fertilizer (Ella, A., 2002; Mukhtar, 2023). Nowadays there are several types of fertilizer including organic fertilizer such as manure and inorganic fertilizer. In organic fertilizer is made by factories by changing natural resources through physical and/or chemical processes (Judge., 2005).

The productivity and quality of elephantgrass can be increased through fertilization. Fertilization is the addition of materials used to maintain, improve and maintain soil fertility. According to Rica (2012), planting forage on fertile land will also produce better forage productivity than on critical or less fertile land. Fertilization is generally defined as adding nutrients to the soil, proper fertilization is a way to improve the quality of forage for livestock (Wibawa, 2014).

Nowadays, chemical fertilizers is widely used on food crops, such as rice and corn, with different dosages than for green grass (Judge, 2005). Farmers think that plant grass as forage for animal feed, don't need fertilizer grow. This will have an impact on the production of forage grass, because every plant requires nitrogen, phosphorus and potassium intake for its growth (Mariono, R. E., 2007; Ruskandi, 2006). However, it is necessary to pay attention to the balancing of plant's fertilizer, needed. Apart from single fertilizers, now many compound fertilizers have been made which combine several single fertilizers so it is necessary to compare the use of single fertilizers with compound fertilizers at various levels to see the growth effect on elephantgrass plants.

Based on these conditions, it is necessary to carry out research regarding the input level of single N-P-Ca and compound N P Ca fertilizers on elephant grass production to determine the best level and how big the effect of treatment with different dosages is on elephantgrass using single N-P-Ca and compound NPCa fertilizer.

MATERIAL AND METHOD

This research was carried out during the rainy season in February – July 2022 at the experimental field of the Department of Animal Husbandry, Faculty of Agriculture, Gorontalo State University located in Bone Bolango Regency, Gorontalo Province.

The research materials used were elephantgrass cuttings, single N-P-Ca fertilizer and compound NPCa fertilizer. The fertilizers used as single N-P-Ca fertilizer are: Urea (N fertilizer), TSP (P fertilizer) and KCL (Ca fertilizer). Meanwhile, the Compound NPCa fertilizer used is the SP36 type. This research was conducted using a completely randomized design with 7 treatments and 3 replications. Fertilizer usedwere single N-P-Ca fertilizer and compound NPCa fertilizer. The dosage of single N-P-Ca fertilizer and compound NPCa fertilizer is used according to the rules stated on the label issued by the fertilizer manufacturer. Treatment doses of single N-P-Ca fertilizer and compound NPK fertilizer are shown in Table 1.

Table 1. Treatment of Single N-P-Ca fertilizer and Compound NPCa fertilizer doses for the growth of Elephantgrass plants.

No.	Treatments	Single fertilizer (Kg/Ha)			Compound NPCa Fertilizer
		N	P	Ca	
1.	Control (P0)	0	0	0	0
2.	Single N-P-Ca (P1)	300	100	100	0
3.	Single N-P-Ca (P2)	450	150	150	0
4.	Single N-P-Ca (P3)	600	200	200	0
5.	N- Base +Compound NPCa (P4)	100	0	0	150
6.	N-Base +Compound NPCa (P5)	100	0	0	300
7.	N-Base +Compound NPCa (P6)	100	0	0	450
8.	N-Base +Compound NPCa (P7)	100	0	0	600

Explanation: Providing 100 kg/Ha of Nitrogen at P5 – P7 as the basis for providing N content.

The use of Urea, TSP and KCL is 18.75 gr for every 100 gr of N, P and Ca, respectively. So the use of Urea, TSP and KCL in the treatment is as follows: P0 = No fertilization (control); P1 = Urea fertilizer 56.25 gr, TSP fertilizer 18.75 gr, KCL fertilizer 18.75 gr, NPCa compound fertilizer 0 gr; P2 = Urea fertilizer 84.375 gr, TSP fertilizer 28.125 gr, KCL fertilizer 28.125 gr, NPCa Compound fertilizer 0 gr; P3 = Urea fertilizer 112.5 gr, TSP fertilizer 37.5 gr, KCL fertilizer 37.5 gr, NPCa compound fertilizer 0 gr; P4 = Urea fertilizer 56.25 gr, TSP fertilizer 28.125 gr, KCL fertilizer 28.125 gr, NPCa Compound fertilizer 28.125 gr; P5 = Urea fertilizer 18.75 gr, TSP fertilizer 0 gr, KCL fertilizer 0 gr, NPCa compound fertilizer 56.25 gr; P6 = Urea fertilizer 18.75 gr, TSP fertilizer 0 gr, KCL fertilizer 0 gr, NPCa Compound fertilizer 84.375 gr; P7 = Urea fertilizer 18.75 gr, TSP fertilizer 0 gr, KCL fertilizer 0 gr, NPCa Compound fertilizer 112.5 gr.

The data were analyzed statically by analysis of variance and the difference in the mean value was calculated by the least–significant difference (LSD) method at 1% and 5% level by following (Adli et al., 2023; Ardiansyah et al., 2022).

RESULT AND DISCUSSIONS

The results of the analysis of variants of plant growth and biomass production of elephantgrass given different levels of single N-P-Ca fertilizer and compound NPCa fertilizer which were defoliated at 90 days after planting are shown in Table 2.

Table 2. Plant growth and biomass production of elephant grass given different levels of single N-P-Ca and compound NPCa fertilization which were defoliated at the age of 90 days.

Variables	Treatments								F Count	F Table	
	P0	P1	P2	P3	P4	P5	P6	P7		0.05	0.01
Plant heigth	165	212	224	237	189	191	209	211	34.5**	15.5	20.0
Tiller Number	45	51	56	51	46	47	49	56	28.5**		
Fresh Matter Weight	11.5	19.9	21.9	22.8	13.9	14.7	15.9	20.3	73.8**		
Leaf Percentage (%)	28	31.5	33.5	37.8	29	30.6	29.8	31	21.8**		

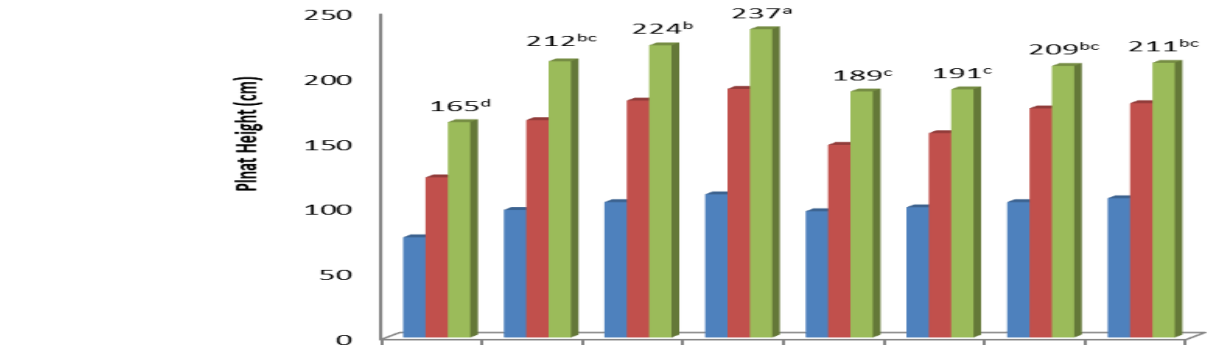
*Explanation: ** very significant effect (P<0.01), P0, P1, P2, P3, P4, P5, P6 and P7 refer to Table 1.*

The results of the analysis of variance showed that all treatment levels had a very significant effect (P<0.01) from P1 – P7 as well as all treatment variables, namely plant height, tiller production, fresh material production and leaf percentage. Comparing the Anova results between the single N-P-Ca fertilizer treatment and the compound NPCa fertilizer showed significantly higher results for the single N-P-Ca fertilizer. To see the significant difference in values between the two groups of fertilizers, it will be seen in the results of the smallest real

difference test which can be seen in all tables of growth and production measurement results or the variables of this research. Especially in the results of the analysis of fresh material production, both the single N-P-Ca fertilizer level treatment and the linear compound NPCa fertilizer level showed very real results.

Growth of Elephantgrass Plants

The growth parameters of elephantgrass plants measured in this study were plant height and number of tillers measured at 30 days, 60 days and 90 days after planting using single N-P-Ca fertilizer and compound NPCa with different levels which can be seen in Fig. 1 and Fig. 2, respectively.



	P0	P1	P2	P3	P4	P5	P6	P7
PLANT OF HEIGHT 30 hst	77	98	104	110	97	100	104	107
PLANT OF HEIGHT 60 hst	123	167	182	191	148	157	176	180
PLANT OF HEIGHT 90 hst	165	212	224	237	189	191	209	211

Figure 1. Growth of elephant grass plants aged 30 days, 60 days and 90 days treated with single N-P-Ca fertilizer and compound NPCa with different levels. Explanation: P0, P1, P2, P3, P4, P5, P6 and P7 refer to Table 1.

The height growth of elephant grass plants showed that the overall treatment obtained better growth results compared to the control, both in the single N-P-Ca fertilizer treatment and the compound NPCa fertilizer treatment (Figure 1). The single N-P-Ca fertilizer treatment showed better results compared to the compound NPCa fertilizer treatment. Both the single N-P-Ca fertilizer treatment and the compound NPCa fertilizer experienced a linear increase in plant height growth along with increasing doses or levels of fertilizer application. At the single N-P-Ca fertilizer level, the peak of plant height production was achieved by the P3 treatment (600 N, 200 P and 200 Ca) and the lowest was in the P1 treatment (300 N, 100 P and 100 K), while at the compound NPCa fertilizer level, the peak High plant production was achieved in treatment P7 (600 NPCa) and the lowest in treatment P4 (150 NPCa).

These results show that plants that are fertilized will have a good growth effect because the plant's nutrition is fulfilled by the elements nitrogen, phosphorus and potassium. This is in accordance with what Seseray et al (2013) stated that the use of single N-P-Ca fertilizer at a dose of 200 kg/ha urea, 100 kg/ha TSP, 100 kg/ha KCL provides better plant height growth. Sugandi (2009) stated that the use of single N-P-Ca fertilizer at a dose of 100 kg/ha urea, 50 kg/ha TSP, 10 tons of manure can significantly increase the growth of elephant grass plants. If we compare the achievement of plant height growth results between the single N-P-Ca fertilizer level and the compound NPCa fertilizer level in this study, the highest average yield achievement is at the single N-P-Ca fertilizer level.

The increase in plant height also clearly shows the influence of the role of the nutrient content N, P, Ca and micro nutrients contained in single N-P-Ca fertilizer and compound NPCa fertilizer. Setiawan (2005) stated that the element nitrogen functions to stimulate overall plant growth, especially plant stems. The phosphorus element for plants functions more to stimulate root growth, especially the roots of young plants. The element potassium plays a role in forming proteins and carbohydrates for plants.

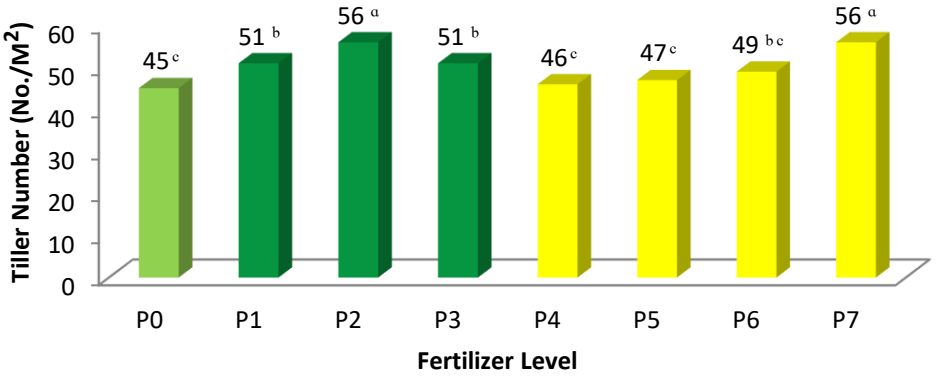


Figure 2. Growth of tiller number of elephantgrass plant saplings aged 90 days treated with single N-P-K fertilizer and compound NPK with different levels. Explanation: P0, P1, P2, P3, P4, P5, P6 and P7 refer to Table 1.

The growth in the number of elephant grass saplings shows that the overall treatment obtained better growth results compared to the control, both in the single N-P-Ca fertilizer treatment and the compound NPCa fertilizer treatment (Figure 2). The single N-P-Ca fertilizer treatment on average showed better results compared to the compound NPCa fertilizer treatment. The growth of tiller number in the single N-P-Ca fertilizer treatment showed a tendency to increase, while the compound NPCa fertilizer treatment experienced a linear increase along with increasing doses or levels of fertilizer application. At the single N-P-K fertilizer level, the peak growth of tiller number of elephant grass plants was achieved by the P2 treatment (450 N, 150 P and 150 Ca) and the lowest was in the P1 treatment (300 N, 100 P and 100 Ca), while at the compound NPCa fertilizer level, The peak production of plant height was achieved in treatment P7 (600 NPCa) and the lowest in treatment P4 (150 NPCa).

The results of this research are almost the same as the research treatment model conducted by Seseray et al (2013) which states that the use of single N-P-Ca fertilizer at a dose of 200 kg/ha urea, 100 kg/ha TSP, 100 kg/ha KCL provides fresh production of 2.84 kg /m2. And Sugandi (2009) stated that the use of single N-P-Ca fertilizer at a dose of 100 kg/ha urea, 50 kg/ha TSP, 10 tons of manure can increase elephant grass production by 0.27 kg/m2.

Based on the calculation of tiller number per week, not all plants experience an increase in tiller number. This is thought to be because plants that experience an increase in the number of tillers have good root system growth so that the formation of tillers occurs more quickly. Saplings that grow from a plant come from the growth of rhizomes in the soil through a good root system (Manauw, 2005). Jayadi (2001), states that with good care and maintenance of plants, namely carrying out watering and weeding, it will speed up the formation of saplings which will later grow and produce plants that can be used as animal feed.

Biomass Production of Elephantgrass Plants

The biomass production of elephantgrass plants measured in this study was the production of fresh matter weight and the percentage of leave blade, which were harvested at 90 days after planting using single N-P-Ca fertilizer and compound NPCa fertilizer with different levels which can be seen in Figure 3 and Figure 4, respectively.

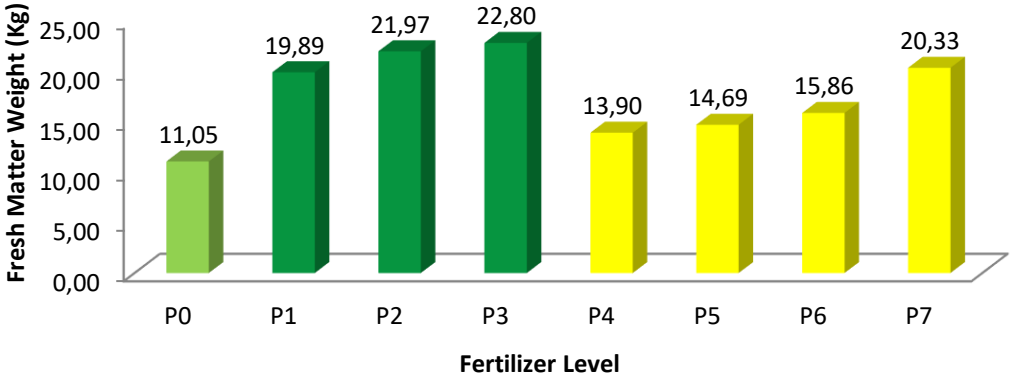


Figure 3. Biomass production of elephantgrass plants harvested at the age of 90 days treated with single N-P-K fertilizer and compound NPK with different levels. Explanation: P0, P1, P2, P3, P4, P5, P6 and P7 refer to Table 1.

Biomass production results show that the overall treatment obtained better fresh material production results compared to the control (Fig. 3) and linearly increased along with increasing fertilization levels in both the single N-P-Ca fertilizer treatment and the compound NPCa fertilizer treatment. The single N-P-Ca fertilizer treatment showed better average results compared to the compound NPCa fertilizer treatment, except that the P1 value was almost the same as P7.

The single N-P-Ca fertilizer level treatment showed higher fresh material production compared to the compound NPCa fertilizer level treatment. At the single N-P-Ca fertilizer level, production linearly increased from level P1 to level P3, and at the compound NPCa fertilizer level group, production also increased linearly from level P4 to P7.

The results of fresh material production above show the same results regarding plant height production and tiller number production stated by Seseray et al (2013) stating that the use of single N-P-Ca fertilizer at a dose of 200 kg/ha urea, 100 kg/ha TSP, 100 kg/ha ha KCL provides fresh production of 2.84 kg/m2. Sugandi (2009) stated that the use of single N-P-Ca fertilizer at a dose of 100 kg/ha urea, 50 kg/ha TSP, 10 tons of manure can increase elephant grass production by 0.27 kg/m2.

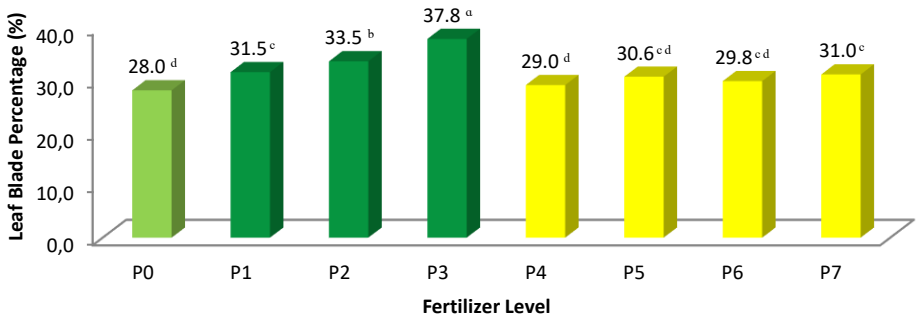


Figure 4. Percentage of leaves of elephant grass plants harvested at the age of 90 days that were treated with single N-P-Cafertilizer and compound NPCa fertilizers at different levels. Explanation: P0, P1, P2, P3, P4, P5, P6 and P7 refer to Table 1.

All fertilizer treatments obtained good leaf percentage results compared to the control (Figure 4) in both the single N-P-Ca fertilizer treatment and the compound NPCa treatment group. In the single N-P-Ca fertilizer level treatment, the leaf percentage was seen to be higher than the compound NPCa fertilizer level. In the single N-P-Ca fertilizer level treatment, production linearly increased from level P1 to level P3, and in the treatment of compound NPCa fertilizer levels, production also increased from level P4 to P7, but the percentage difference was very small.

The nitrogen element is one of the building blocks of protein which forms tissue in living creatures, while in soil the nitrogen element really supports and determines plant growth. The nitrogen element is needed for the formation or growth of vegetative parts of plants such as leaves, stems and roots. Sumarsono, et.al. (1993) stated that the element nitrogen plays a role in accelerating the vegetative phase because the main function of the element nitrogen is to synthesize chlorophyll. Chlorophyll functions to capture sunlight which is useful for the formation of food in photosynthesis. Sufficient chlorophyll content can form or stimulate plant growth, especially stimulating the vegetative organs of plants.

The percentage of nitrogen uptake shows the high and low levels of nitrogen content absorbed by elephant grass plants. The absorption of nitrogen from both air and soil is assimilated in the reduction and assimilation process. Air nitrogen is absorbed from free N2 through root nodule bacteria and NH3 is absorbed through plant stomata, while nutrient absorption is carried out by plant roots and taken from the soil absorption complex or from the soil solution. in the form of cations and anions.

CONCLUSION

The treatment of single N-P-Ca fertilizer levels and compound NPCa fertilizer levels had a very significant effect on plant growth and elephant grass biomass production. The single NPCa fertilizer level treatment was higher than the compound NPCa fertilizer level for all variables, namely plant height, tiller number, fresh material production and leaf percentage. The growth performance and biomass production of elephant grass is better when using single N-P-Ca fertilizer compared to compound NPCa fertilizer.

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