

## The Use of Pig Manure Fertilizer on the Growth, Production, Protein Content, and TDN of Pakchong Grass

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### ABSTRACT

Manure is a fertilizer that comes from a mixture of livestock waste, urine, and leftover livestock feed. Pig manure can be used as fertilizer because it contains Nitrogen, phosphorus and potassium. Solid pig manure contains quite high Nitrogen nutrients of 0.95%, Phosphorus 0.35%, and Potassium 0.40%, so that pig manure is effective as an organic fertilizer that will be beneficial for plant growth. This study aims to see the effect of the use of pig manure fertilizer on the growth, production, nutritional quality and TDN of Pakchong Grass. A Randomized Block Design (RAK) was used with five treatments, namely without the use of pig manure fertilizer (P0), Grass Plants fertilized with 5 tons/ha of pig manure fertilizer (P1), Grass Plants fertilized with 10 tons/ha of pig manure fertilizer (P2), Grass Plants fertilized with 15 tons/ha of pig manure fertilizer (P3), and Grass Plants fertilized with 20 tons/ha of pig manure fertilizer (P4). The results of this study indicate that providing pig manure fertilizer of up to 20 tons/ha can increase the growth, production, quality and TDN of Pakchong Grass.

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## INTRODUCTION

Ruminant livestock feed has so far been obtained and sourced from pastures. In recent years, pasture productivity has decreased, this condition is influenced by the decreasing area of grazing fields due to changes in land use. One solution to meet livestock needs is to specifically cultivate green fodder. The criteria for green fodder plants are: preferred by livestock (palatable), tolerant of pruning, high nutritional content, high production, non-toxic, and have other benefits such as environmental conservation (Suherman and Herdiawan, 2021).

Provision of green fodder is an absolute requirement for the development of ruminant livestock, both small and large scale. Where green fodder is the main food for ruminant livestock. According to Sirait et al. (2005), almost 90% of ruminant livestock feed comes from green fodder with fresh consumption of 10-15% of body weight per day, while the rest is concentrate and additional feed (feed supplement). Green fodder is green fodder that comes from plants that can be consumed by livestock, for growth, reproduction, and activities as well as the basic living needs of livestock. Green fodder can be in the form of grass, legumes, or by-products from food crops, horticulture, and plantations (Suherman and Herdiawan, 2021).

Elephant Grass (*Pennisetum purpureum*) is one of the forages that is preferred by livestock and can grow well in tropical areas. All superior and newly developed varieties of Elephant grass (*Pennisetum purpureum*) for livestock forage and have high production include: Pakchong grass (*Pennisetum purpureum* cv Thailand), Zanzibar grass (*Pennisetum purpureum* cv Zanzibar) and Agrinak Bioglass (Nantasaksiri et al., 2021). Pakchong grass (*Pennisetum purpureum* cv Thailand) originating from Thailand, the result of crossing Elephant grass (*Pennisetum purpureum*) and Pear millet (*Pennisetum glaucum*) with very fast growth and has leaves that are almost the same size and length as King Grass (*Pennisetum purpurhoides*), the stems of the plant are softer/softer (tender) not hard, and morphologically both the stems and leaves are not covered with fine hairs, do not flower, so they are very popular with livestock (Wanagchuk et al., 2015; Samarawickrama et al., 2018). *Pennisetum purpureum* cv Thailand at the age of 59 HST (Days After Planting) this grass can reach a height of around 10 feet ( $\pm 3$  m), and production is quite high, namely 500 tons/ha/year of fresh material (Lounglawan et al., 2014), almost 2 times higher than ordinary elephant grass (*Pennisetum purpureum* schumach) which on average only produces between 250-275 tons/ha/year (Sarian, 2016).

Optimal production and high nutritional value of pakchong grass can be increased by proper engineering culture measures, especially in terms of good soil cultivation, seed selection, planting, irrigation and provision of nutrients needed by plants such as fertilizer application (Serli, & Harmoko, 2022). Continuous use of inorganic fertilizers without rules can disrupt the balance of soil properties, reduce land productivity and can affect crop production. Therefore, efforts need to be made to increase the use of fertilizers that are associated with supporting natural sustainability, namely the use of organic fertilizers. Organic fertilizers are fertilizers that come from organic materials

that have undergone a natural decomposition process by microorganisms. The use of organic fertilizers is useful as a soil conditioner, namely to improve soil structure, increase the soil's ability to retain water, increase soil biological activity and can increase complete nutrients (micro and macro). Manure is an organic fertilizer that comes from livestock waste, either in the form of solid waste (feces) mixed with leftover feed or urine. Feed has a very important influence in determining the nutrient content of livestock manure, if the feed given contains a lot of N, P and K nutrients, then the manure will also be rich in these substances (Hardjowigeno, 1995). Pig manure contains a lot of folic acid and sulfuric acid when compared to other livestock manure, but is low in lime and potassium (Nisa, 2016). Solid pig manure contains quite high Nitrogen nutrients of 0.95%, Phosphorus 0.35%, and Potassium 0.40%. Therefore, pig manure is very effective as an organic fertilizer that will be beneficial for plant growth (Ririn, 2022). Marliani (2010) stated that planting *Setaria* grass with types of chicken manure, pig manure and cow manure with a dose of 150 gr/polybag can increase fresh weight production, dry weight, number of shoots and ash content, but has not affected the content of crude protein, crude fiber, crude fat and extract materials without N. Bokashi fertilizer is organic materials that are fermented with the help of microorganisms so that they can improve soil that is poor in nutrients into productive soil through natural processes. Giving bokashi fertilizer is one way to improve the physical, chemical and biological properties of the soil and can suppress pests and diseases and increase the quality and quantity of plant production.

From the problems above, it is considered necessary to conduct research using pig manure as fertilizer for the growth, production, protein content and TDN of Pakchong Grass.

## LITERATURE REVIEW

### *Pakchong Grass*

Pakchong elephant grass has a wide adaptability so that it can grow in different agroecological conditions and can produce 0.75 kg of dry matter/plant (Wanagchuk *et al.*, 2015; Samarawickrama *et al.*, 2018). It has a good response to water and fertilizer and can be produced every year, can survive for 8-9 years after planting and can be cut at intervals of 45-60 days. Cutting at intervals of 45-60 days produces optimal results but cutting too often at intervals of 30 days can reduce yields (Lounglawan *et al.*, 2014). Pakchong elephant grass is a renewable energy source and provides a highly nutritious forage plant that can be fed to cattle, carabao and other livestock in Thailand (Sarian, 2016). This grass provides forage that has nutritional value and is palatable throughout the year. Pakchong 1 elephant grass contains 14.9% DM, 10-12% K, 35.8% NDF, 14.5% ash and 36.5% soluble carbohydrates at a harvest age of 45 days (Pitaksinsuk *et al.*, 2010).

### *Organic Fertilizer*

Organic fertilizer is the result of microbiological activity in breaking down organic materials, and has a slow release nature (slow availability) but can be available longer in the soil compared to inorganic fertilizers (Ameeta and

Ronak, 2017). The provision of organic fertilizer also plays a role in increasing soil microbial activity, suppressing the presence of plant diseases (Tonfack *et al.*, 2009) and increasing the efficiency of nutrient absorption (Ameeta and Ronak, 2017), so that it can maintain or increase soil and plant productivity. Organic fertilizer can be produced from agricultural waste by fermentation or composting methods to produce organic fertilizer in liquid or solid form.

### ***Pig Manure***

Pig manure is waste produced from pig production activities in addition to urine waste, floor coverings (husks, straw, and sawdust), leftover feed and water from washing pens (Sihombing, 2006). Pig farming developed in Minahasa Regency, North Sulawesi produces quite a lot of waste which if not processed can cause environmental pollution such as air and water so that further handling of the manure is needed. The application of organic fertilizer technology in agriculture is one of the efforts in sustainable agriculture. Organic fertilizer technology in this case is manure produced from pig manure. According to (Subekti 2005), manure is a fertilizer derived from animal waste, both solid and liquid, and food waste, such as cow, pig, horse, buffalo, goat manure. The decomposition that occurs in the manure will become good fertilizer and is very useful for plants. Awareness of the importance of sustainable agriculture and the difficulty in obtaining and the high price of inorganic fertilizers among farmers leads to the utilization of cheap, fairly available and environmentally friendly organic waste that can be used as organic fertilizer such as pig manure. Making organic fertilizer is one alternative to utilizing pig manure that can be processed as fertilizer for plants. Solid pig manure contains quite high levels of Nitrogen nutrients of 0.95%, Phosphorus 0.35%, and Potassium 0.40% (ririn, 2022). Therefore, pig manure is very effective as an organic fertilizer that will be beneficial for plant growth. Plants that obtain sufficient nitrogen nutrients from manure will stimulate vegetative growth such as roots, stems and leaves well.

## **METHODOLOGY**

### ***Time and Location of Research***

This research was conducted in the experimental garden of the Faculty of Agriculture, Warmadewa University. This experiment was conducted from February 6, 2024 to April 9, 2024.

### ***Experimental Design***

The research design used was a Randomized Block Design with 5 treatments and three groups/replications so that 15 research plots were obtained. The five treatments given were the level of pig manure fertilizer application, namely without the use of pig manure fertilizer (P0), grass plants fertilized with 5 tons/ha of pig manure fertilizer (P1), grass plants fertilized with 10 tons/ha of pig manure fertilizer (P2), grass plants fertilized with 15 tons/ha of pig manure fertilizer (P3), grass plants fertilized with 20 tons/ha of pig manure fertilizer (P4).

### Materials and Tools

The materials used in this study include 1). Pakchong grass seeds (*Pennisetum purpureum* cv Thailand) originating from the Balai Pembibitan Ternak Unggul dan Hijauan Pakan Ternak (BPTU-HPT) Denpasar. These seeds were taken in the form of cuttings, selected with a height of 25-30 cm with two segments and three buds.

The tools used in this research include: sickle, tractor hoe, hose, squat scale, meter, raffia rope, stationery, documentation camera, 70°C dry oven.

### Research Implementation

The implementation begins with 1) Preparation of the planting plot, after the plot is ready, the fertilizer dose is randomized for each group. 2) Planting, The selected seeds are then planted in the prepared plot with a depth of one segment in the soil. In 1 plot, one type of grass is planted with a planting distance of 60 cm x 60 cm, and 30 cm from the edge of the plot. 3) Application of organic fertilizer, the amount of organic fertilizer given is of various sizes in one hole and left for 1 week before planting. 4) Plant maintenance which includes watering and weeding and 5) Cutting, carried out when the grass is 75 days old, and cutting is carried out in the morning.

### Research Variables

The variables observed in this study included dry matter content, crude fiber, crude protein, crude fat and ash content.

### Data Analysis

The data obtained from the research results were analyzed using analysis of variance. If there were significantly different results ( $P < 0.05$ ) between treatments, then a multiple range test from Duncan was carried out (Stell and Torrie, 1989).

## RESEARCH RESULT

Table 1. Results of Growth, Production, Protein Content, and TDN of Pakchong Grass due to Pig Manure Treatment

Observation Variables	Treatment					SEM <sup>2)</sup>
	P0 <sup>3)</sup>	P1	P2	P3	P4	
Number of off spring	12.67 a <sup>1)</sup>	11.33 a	14.33 a	14.00 a	14.33 a	1.29
Plant Height	223.42 a	199.14 a	194.47 a	214.26 a	210.89 a	6.64
Fresh production tons/ha	111.56 a	112.39 a	115.25 a	117.36 a	118.33 a	6.07
Dry matter production	15.10 a	15.42 a	16.80 a	16.51 a	17.19 a	0.90
Protein Content	10.15 c	11.91 bc	12.17 b	13.36 ab	14.05 a	0.30
Fiber Content	28.08 a	25.52 ab	23.89 b	22.36 bc	19.26 c	0.68
TDN	45.96 d	48.87 cd	51.51 bc	55.02 ab	57.40 a	0.62
BETN	37.67 c	37.46 c	39.72 bc	41.42 ab	42.96 a	0.45

Information:

1. Values with the same letter in the same row indicate no significant difference ( $P > 0.05$ ).
2. SEM (Standard Error of the Treatment Means).
3. Treatment:

- P0 = Without use of pig manure fertilizer
- P1 = Grass plants fertilized with 5 tons/ha of pig manure
- P2 = Grass plants fertilized with 10 tons/ha of pig manure
- P3 = Grass plants fertilized with 15 tons/ha of pig manure
- P4 = Grass plants fertilized with 20 tons/ha of pig manure.

## DISCUSSION

### *Plant Height*

Based on the results of the study, the effect of pig manure fertilizer on the height of pakchong grass plants showed no significant effect ( $>0.05$ ). The highest results were shown in the P0 treatment without fertilizer doses (223.42 cm) followed by P3 15 tons/ha (214.26 cm), P4 20 tons/ha (210.89 cm), P1 5 tons/ha (199.14 cm), and P2 10 tons/ha (194.47 cm). Tarigan (2009) stated that plants will grow and produce optimally if planted in a place that meets the growing requirements such as environmental factors, namely climate factors and soil properties such as: soil pH, nutrient availability, volume of fertilizer given and others. Budiman and Nurjaya (2022) reported that the plant height obtained varied between 184.75 -195.75 cm which was caused by several factors including planting distance, light intensity, and climate. The use of livestock manure compost in the study resulted in additional nutrients in the planting medium, thus providing nutrients for the growth of elephant grass cv. Pakchong such as the growth of shoots and leaves. The many shoots that grow result in an increase in the number of leaves. The provision of livestock manure (cow, goat and chicken) results in additional nutrients in poor soil, such as the elements N, P and K needed for the growth of *Pennisetum purpureum* cv. Taiwan shoots (Sari *et al.*, 2021).

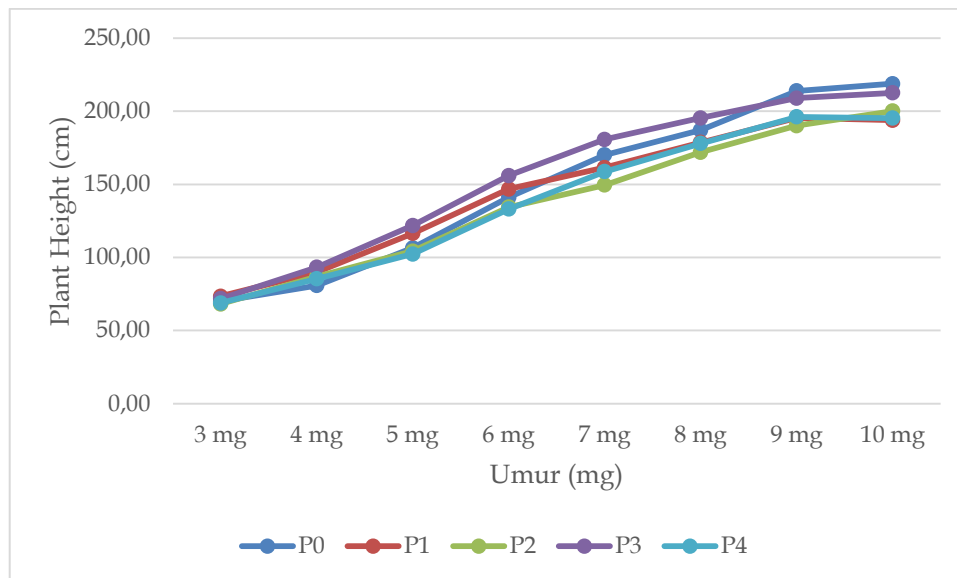


Figure 1. Effect of treatment on Pachong grass plant height

### *Number of Off Spring*

Based on the results of the study, the effect of pig manure fertilizer on the number of pakchong grass seedlings showed no significant effect ( $>0.05$ ). The highest results were shown in the P2 treatment of 10 tons/ha

and the P4 treatment of 20 tons/ha, namely (14.33 stems) followed by P3 15 tons/ha (14.00 stems), P0 without fertilizer dose (12.67 stems), and P1 5 tons/ha (11.33 stems).

Purbajanti (2013) stated that the formation of plant shoots will increase along with the addition of organic matter in the form of nutrients. In the vegetative growth phase, plants need nutrients to build meristem tissue, especially C and N. In agreement with Tando, (2019), who stated that increasing the availability of nutrients in the soil will result in better root growth, so that nutrient absorption will also be greater and meet plant needs.

The provision of manure containing complete macro and micro nutrients can meet the growth needs of king grass. The provision of manure makes the soil fertile physically, chemically and biologically (Suyitman, 2014). The highest number of *Pennisetum purpureum* grass shoots was obtained in the application of biopore infiltration holes + chicken manure (Rusmayadi *et al.*, 2020). The application of bokashi up to 30t/ha was able to increase the number of shoots and the number of leaves of *Pennisetum purpureum* grass (Kastalani *et al.*, 2017). The number of shoots and higher leaf levels in Pakchong 1 were produced in a 60-day cutting period (Ahmed *et al.*, 2021).

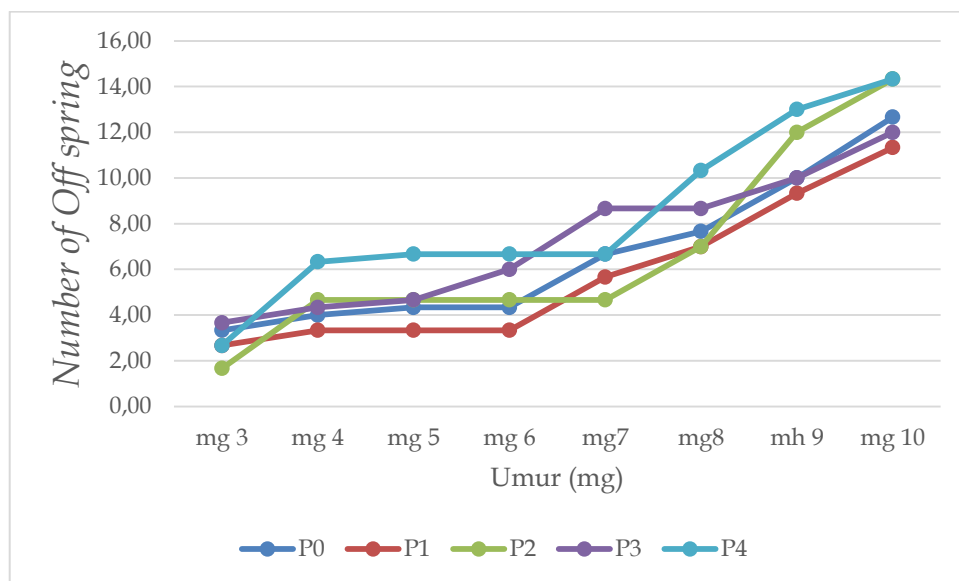


Figure 2. Effect of treatment on the number of Pachong Grass saplings

According to Ratnasari *et al.*, (2019), Increasing the number of plant shoots can be achieved by adding fertilizer to the plant plot. This is due to the fact that fertilization provides nutrients for plants. Compared to plants that are not given fertilizer, cow manure has a significant effect on growth and production of fresh and dry weight of feed. This is in line with Kusuma (2017), showing results that organic fertilizer is an excellent choice in soil that lacks nutrients because it can improve soil structure, which can increase plant root growth.

**Fresh Production**

Based on the results of the study, the effect of pig manure fertilizer on fresh pakchong production showed no significant effect ( $>0.05$ ). The results were shown in the P4 treatment of 20 tons/ha (118.33 tons/ha) followed by P3 15 tons/ha (117.36 tons/ha), P2 10 tons/ha (115.25 tons/ha), P1 5 tons/ha (112.39 tons/ha), and P0 without fertilizer dose (111.56 tons/ha).

This is in accordance with Purbajanti (2013), stating that fertilization can provide a higher fresh weight production of a plant. Ifradi *et al.* (2003) stated that the higher the soil water content, the better the elements and transportation of nutrients and water, so that the rate of photosynthesis to produce food reserves for plant growth is more guaranteed and production will increase.

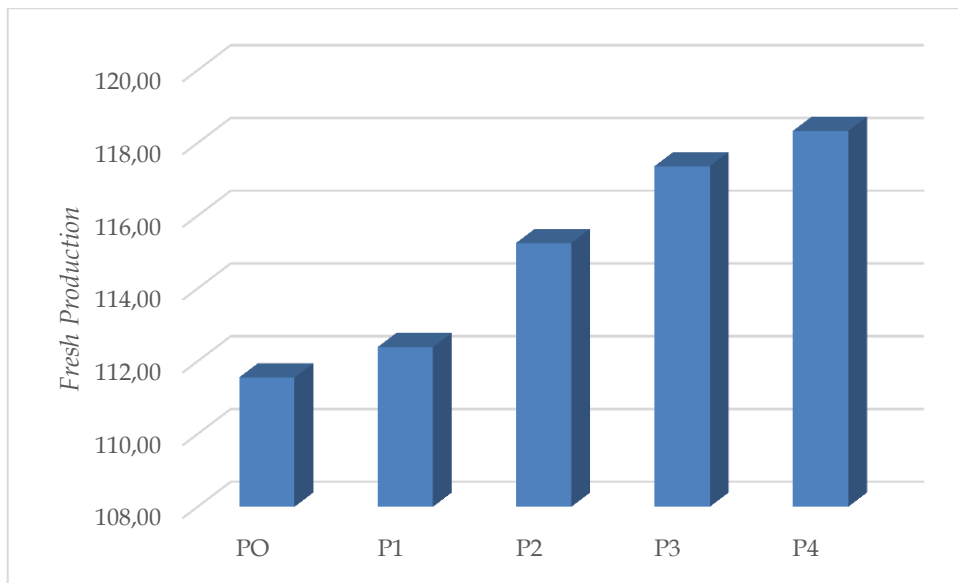


Figure 3. Effect of Treatment on Fresh Production of Pachong Grass (ton ha-1)

Increasing water availability will accelerate plants to absorb nutrients and distribute nutrients to the parts of the plant that need them. Ifradi *et al.* (2003) stated that the higher the soil water content, the better the elements and transportation of nutrients and water, so that the rate of photosynthesis to produce food reserves for plant growth is more guaranteed and production will increase. Farda *et al.* (2020) stated that an increase in the population of a plant will be followed by an increase in the yield per unit area. Another factor that can affect biomass production is the intensity of rainfall which decreased during the research period.

**Dry production (ton.ha-1)**

From the statistical analysis, it was obtained that the effect of pig manure fertilizer had no significant effect ( $P>0.05$ ) on the dry production of Pakchong Grass. The highest dry production was obtained in the P4 treatment (20 tons/ha) which was 17.19 tons/ha, followed by P2 (10 tons/ha) of 16.80 tons/ha, P3 (15 tons/ha) of 16.51 tons/ha, P1 (5 tons/ha) of 15.42 tons/ton and P0 of 15.10 tons/ha, but statistically there was no significant difference ( $P<0.05$ ).

Manure has the ability to improve soil fertility. Organic materials such as manure play a role in increasing water retention, improving soil structure to become loose, preventing soil hardening, and maintaining soil reactions from acidity, alkalinity, and salinity (Suryani, 2022). Organic materials can also encourage the rapid growth of soil microorganisms, improve soil aeration, provide energy for the life and activity of soil microorganisms so that they can increase the availability of nutrients which ultimately increase plant growth and production (Fagi and Las, 2007). Therefore, the production of elephant grass kate given manure is higher compared to that which is not given fertilizer.

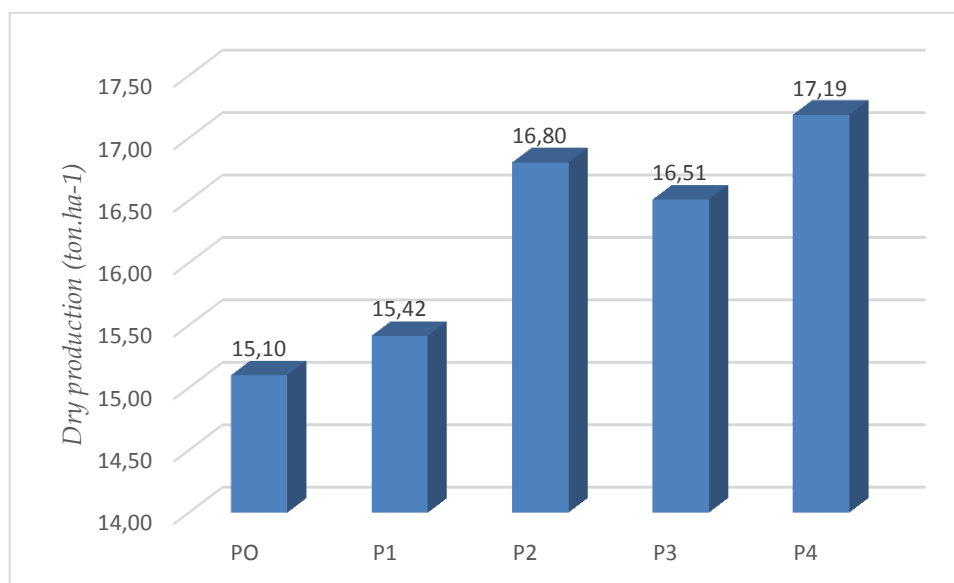


Figure 4. Effect of Treatment on Dry Production of Pakchong Grass (ton.ha<sup>-1</sup>)

#### **Crude Protein Content (%)**

The results of the analysis showed that the effect of giving organic pig manure fertilizer had a very significant effect ( $P < 0.05$ ) on the Crude Protein content of pakchong grass. The highest crude protein content was obtained in the P4 treatment, which was 14.05%, followed by P3 at 13.36%, P2 at 12.17%, P1 at 11.91% and P0 at 10.15%, and statistically showed a very significant difference ( $P < 0.01$ ).

Crude protein and crude fiber of feed ingredients are very important to know because they can be used to determine the value or quality of a feed ingredient. Different cutting heights and doses of nitrogen fertilizer are thought to affect the content of crude protein and crude fiber of grass, so that as a result it also affects the quality of the grass. The higher the dose until the P4 treatment, is caused by the increasing content of N elements due to the increased dose in P4 as the basis for the formation of Crude Protein. This result is in accordance with the statement Handayani *et al.*, (2020) which states that providing the element Nitrogen will increase the protein content of plants

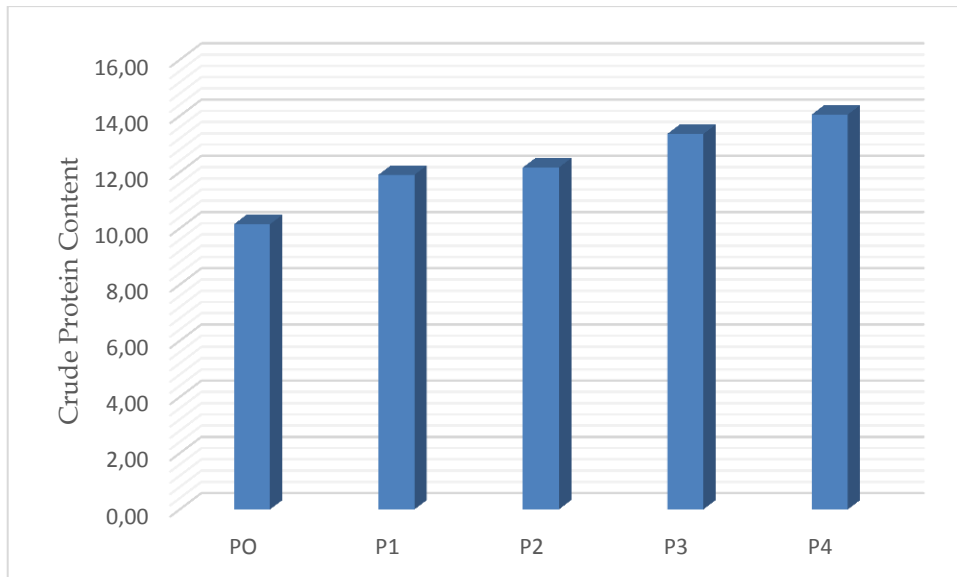


Figure 5. Effect of Treatment on Crude Protein Content of Pachong Grass

### **Crude Fiber Content**

The results of the analysis showed that the effect of giving organic pig manure fertilizer had a very significant effect ( $P < 0.01$ ) on the crude fiber content of pachong grass. The highest crude fiber content was obtained in the P0 treatment, which was 28.08%, followed by P1 at 25.52%, P2 at 23.89, P3 at 22.36% and P4 at 19.26%. However, statistically it showed a very significant difference ( $P < 0.01$ ). With the addition of fertilizer, grass growth will be better so that it can improve the quality of green fodder, especially the crude protein content, on the other hand it will reduce the crude fiber content. In addition, cutting is done at the age of 70 days so that not much crude fiber is formed.

The crude fiber content in Pakchong grass (*Pennisetum purpureum* cv. Thailand) can vary depending on various factors, including soil type, growing conditions, and agricultural management techniques. Pakchong grass has a fairly high crude fiber content, because crude fiber is mainly composed of cellulose, hemicellulose, and lignin, which are the main components of plant cell walls. The results of crude fiber tests can vary depending on many factors, including harvest time, climatic conditions, and agricultural management techniques.

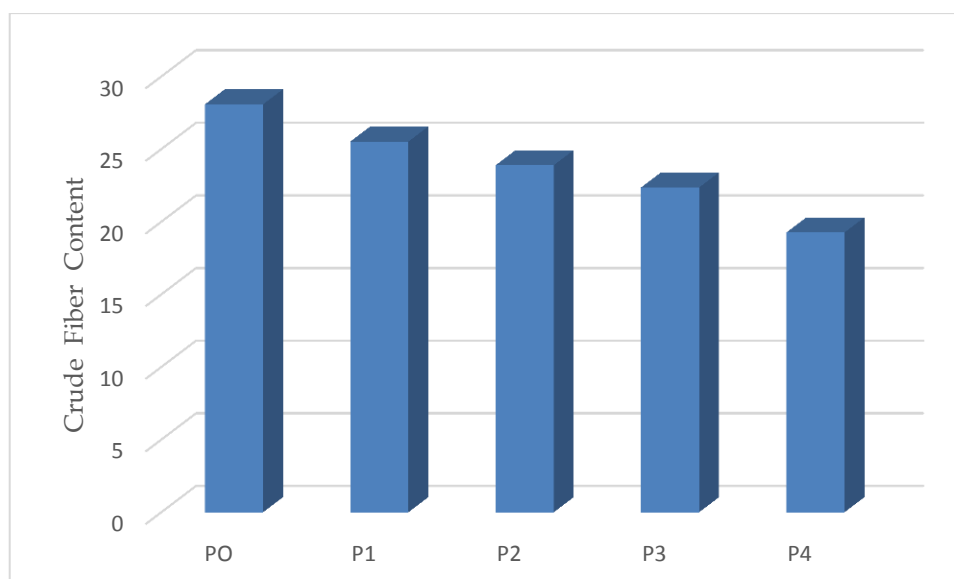


Figure 6. Effect of Treatment on Crude Fiber Content of Pachong Grass Greens

From the research results, it was found that the addition of organic fertilizers was able to reduce the crude fiber content of Pakchong Grass. It is suspected that the high crude fiber in plants is due to a lack of nutrients in the soil which results in no absorption of nutrients for the metabolic process of the plant. Plants that lack nutrients mature faster in cell walls and involve thickening of the secondary layer, along with lignification, resulting in an increase in wall density with maturity (Darmanti, 2015).

#### **Total Digestible Nutrient (TDN)**

The results of the analysis showed that the effect of giving organic pig manure fertilizer had a very significant effect ( $P < 0.01$ ) on the Total Digestible Nutrient (TDN) content of pakchong grass. The highest TDN content was obtained in the P4 treatment of 57.40, followed by P3 of 55.02, P2 of 51.51, P1 of 48.87 and P40 of 45.96. However, statistically it showed a very significant difference ( $P < 0.01$ ).

Several factors that affect the Total Digestible Nutrients (TDN) content in Pakchong grass include the age of cutting, water content, fertilizer treatment and environmental conditions. Proper fertilizer application can increase the nutrient content in grass, including TDN. Fertilizers containing nitrogen, phosphorus, and potassium can increase the growth and quality of grass (Nyambati et al., 2010). Environmental factors such as temperature, humidity, and soil type also affect the growth of Pakchong grass and, indirectly, its TDN content. Grass that grows in optimal conditions usually has better nutrient content (Abdullah, 2014). Increasing TDN is caused by an increase in Crude Protein content with increasing fertilizer doses, this is in accordance with research by Indah *et al.*, (2020), which states that TDN will increase according to the increase in crude protein of forage,

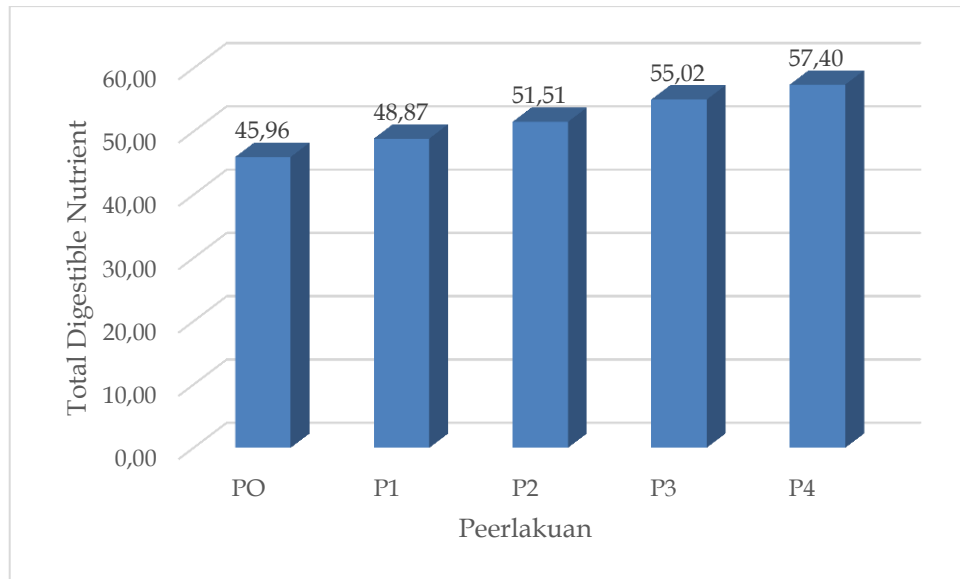


Figure 7. Effect of Treatment on TDN Content of Pachong Grass

### **BETN Content**

From the results of statistical analysis, it was obtained that the effect of the use of pig manure fertilizer showed a very significant difference ( $P < 0.01$ ). The highest BETN content of Pakchong Grass was obtained in the P4 treatment (20 tons/ha) which was 42.99, followed by P3 (15 tons/ha) of 41.42, P2 (10 tons/ha) of 39.72, followed by P0 (without pig manure fertilizer) of 37.67 and P1 (5 tons/ha) of 37.46 and statistically very significant difference ( $P < 0.01$ ).

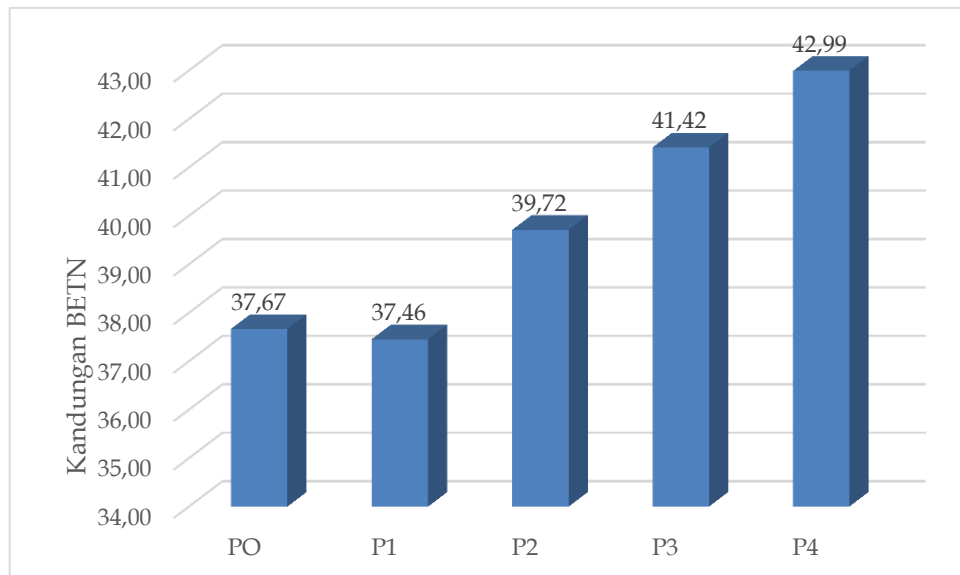


Figure 8. Effect of Treatment on the BETN Content of Pakchong Grass

Sutari, (2010) stated that the presence of organic materials in bio-urine is able to improve the physical, chemical, and biological properties of the soil. It is further explained that bio-urine is an alternative to increase the availability, adequacy, and efficiency of nutrient absorption for plants containing microorganisms so that it can reduce the use of inorganic fertilizers and increase plant quality to the maximum.

## CONCLUSIONS AND RECOMMENDATIONS

From the research results, it can be concluded that the provision of pig manure fertilizer in planting Pakchong grass can increase the growth, production, nutritional quality and TDN and BETN content of Pakchong grass. The results of this study indicate that providing pig manure fertilizer of up to 20 tons/ha can increase the growth, production, quality and TDN of Pakchong Grass.

## ADVANCED RESEARCH

It is recommended to conduct further research with increased doses of pig manure fertilizer.

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## REFERENCES

- Abdullah, L. (2014). Prospektif Agronomi dan Ekofisiologi Sebagai Tanaman Penghasil Indigofera zollingeriana jauan Pakan Berkualitas Tinggi. *Pastura: Journal of Tropical Forage Science*, 3(2), 79–83.
- Ahmed, S., Rakib, M. R. H., & Jalil, M. A. (2021). Forage growth, biomass yield and nutrient content of two different hybrid Napier cultivars grown in Bangladesh. *Bang. J. Anim. Sci.*, 50(1), 43–49.
- Ameeta, S. and C. Ronak. (2017). A review on the effect of organic and chemical fertilizers on plants. *International Journal for Research in Applied Science and Engineering Technology*, 5(2): 677-680.
- Budiman, Nurjaya. (2022). Pengaruh level pemberian pupuk eco farming (ef) terhadap pertumbuhan dan produksi rumput gajah (*Pennisetum purpureum* Cv. Pakchong). *Buletin Nutrisi dan Makanan Ternak*, 16 (1): 24-33
- Darmanti, S., (2015). Penebalan Dinding Sel Xilem Tanaman Kedelai [*Glycine Max* (L.) Merr.]Var. Grobogan Akibat Cekaman Ganda Interferensi Teki (*Cyperus Rotundus* L.) dan Kekeringan. *Buletin Anatomi dan Fisiologi*, 13(2), 23- 28.
- Fagi, A.M. & I.Las, (2007). Membekali Petani dengan Teknologi Maju Berbasis Kearifan Lokal pada Era Revolusi Hijau & IASA 1990. *Planting The Future: A Source Guide to Sustainable Agriculture in The Third Word*. Minneapolis.
- Handayani, F. E., S.R. Suparto dan J. Maryanto. (2020). Pengaruh Komposisi Media Tanam dan Dosis Pupuk Nitrogen Terhadap Pertumbuhan dan Hasil Tanaman Kailan (*Brassica oleraceae* var. *alboglabra*). *Jurnal Agrowiralodra*, 3(2): 36-45.

Hardjowigeno S. (1995). Ilmu Tanah. Jakarta: Akademik Pressindo.

Ifradi, M. Peto, Elsifitriana. (2003). Pengaruh pemberian pupuk kandang dan mulsa jerami padi terhadap produksi dan nilai gizi rumput raja (*Pennisetum purpuphoides*) pada tanah Podzolik Merah Kuning. *J. Peternakan dan Lingkungan*, 10: 31-40.

Indah., AS. Permana, IG. dan Despal. (2020). Model Pendugaan Total Digestible Nutrient (TDN) pada Hijauan Pakan Tropis Menggunakan Komposisi Nutrient. *Journal Sain Peternakan*, 18 (1): 38-43. <http://dx.doi.org/10.20961/sainspet.v%vi%i.35684>.

Kastalani, M., E. Kusuma, dan S. Melati. (2017). Pengaruh Pemberian Pupuk Bokashi Terhadap Pertumbuhan Vegetatif Rumput Gajah (*Pennisetum purpureum*). *Ziraa'ah*. 42(2): 123-127

Kusuma, M. E. (2013). Pengaruh pemberian bokashi terhadap pertumbuhan vegetatif dan produksi rumput gajah (*Pennisetum Purpureum*). *Jurnal Ilmu Hewani Tropika*, 2(2): 40-45.

Lounglawan, P., W. Lounglawan, and W. Suksombat. 2014. Effect of Cutting Interval and Cutting Height on Yield and Chemical Composition of King Napier grass (*Pennisetum purpureum x Pennisetum americanum*). *APCBEE Procedia*, 8(1): 27-31.

Marliani. (2010). Produksi dan kandungan gizi rumput setaria (*Setaria sphaceta*) pada pemotongan pertama yang ditanam dengan jenis pupuk kandang berbeda. Skripsi. Universitas Negeri Sultas Syarif Kasim. Riau.

Nantasaksiri, K., P. Charoen-Amornkitt, T. Machimura and K. Hayashi. (2021). Multi-disciplinary assessment of napier grass plantation on local energetic, environmental, and socioeconomic industries: A watershed-scale study in Southern Thailand. *Sustainability*, 13. DOI. 10.3390/su132413520

Nisa, K. (2016). Memproduksi Kompos dan Mikroorganisme Lokal (MOL). Bibit publisher. Jakarta Timur.

Nyambati, E. N., F. N. Muyekho, E. Onginjo and C. Lusweti. (2010). Production, characterization and nutrition quality of Naier grass (*Pennisetum purpureum Shum*) cultivars in Western Kenya. *African Journal of Plant Sci.* 4. (12): 496 - 502.

Pitaksinsuk, C., J. Boonjaracha, J. Wongpipat. (2010). Data collection of fodder nutritive. Bureau of Animal Nutrition, Department of Livestock Development.

- Purbajanti, E. D. (2013). Rumput dan Legum Sebagai Hijauan Makanan Ternak. Graha Ilmu. Yogyakarta.
- Ratnasari, D., S. Mulyani, dan Fridarti. (2019). Produktivitas Rumput Lapangan pada Lahan Bera yang Ditambahkan Beberapa Macam Feses Ternak. *Jurnal Embrio*. 11 (2): 58-68.
- Ririn, Y., Pioh D, D., dan Nangoi, R. (2022). Pengaruh inkubasi kotoran babi sebagai pupuk organik terhadap pertumbuhan tanaman selada (*Lactuca sativa* L.). *Journal Agroecotechnology Applied*, 3(2), 470–477.
- Rusmayadi, G., Zulhidiani, R., & Bahrani. (2020). Regrowth of Napier Grass (*Pennisetum purpureum* Schumach) with the Bio-pore Infiltration Hole in the Tropical Riparian Moonson Region. *Journal of Agriculture and Applied Biology*, 1(1), 18–24. <https://doi.org/10.11594/jaab.01.01.0>
- Samarawickrama, L. L., J.D.G.K. Jayakody, S. Premaratne, M.P.S.K. Herath, and S.C. Somasiri. (2018). Yield, Nutritive Value and Fermentation Characteristics of Pakchong-1 (*Pennisetum purpureum* x *Pennisetum glaucum*) in Sri Lanka. *SLJAP*, 10
- Sari, R. M., Akbar, S. A., Astuti, T., Afrini, D., & Harissatria. (2021). The influence of some type of manure on the growth and production of elephant grass (*Pennisetum purpureum*) CV. Taiwan in acid soil. IOP Conf. Ser.: Earth Environ. Sci. 709 012077
- Sarian, Z. (2016). Super napier gives amazing yield in trial. Available online at: <http://www.mb.com.ph/super-napier-gives-amazing-yield-in-trial>
- Serli, S., & Harmoko, H. (2022). Pertumbuhan Dan Produksi Rumput Gajah Mini Melalui Pemberian Pupuk Organik. *Jambura Journal Of Animal Science*, 5(1), 61–68. <https://doi.org/10.35900/jjas.V5i1.16703>
- Sihombing, D.T.H. (2006). Ilmu Ternak Babi. Penerbit Gadjah Mada University Press. Yogyakarta.
- Sirait, J., N. D. Purwantari dan K. Simanihuruk. (2005). Produksi dan Serapan Nitrogen Rumput pada Naungan dan Pemupukan yang Berbeda. *Jurnal Ilmu Ternak dan Veteriner*, 10 (3): 175 - 181.
- Subekti, H. F. D.. (2005). Pengaruh Jenis Pupuk kandang dan Konsentrasi Pupuk Pelengkap Cair terhadap Pertumbuhan Bibit Karet (*Hevea brasiliensis* Muell. Arg). Klon IRR 39 Asal Stum Mata Tidur dipolybag. Skripsi Fakultas Pertanian Universitas Muhammadiyah Palembang.

- Suherman, D., dan I. Herdiawan. (2021). Karakteristik, Produktivitas dan Pemanfaatan Rumput Gajah Hibrida (*Pennisetum purpureum cv Thailand*) sebagai Hijauan Pakan Ternak. *Maduranch*, 6, 37-45.
- Suryani, E. (2022). Pemanfaatan Kompos Organik Terhadap Pertumbuhan Tanaman Jagung Dan Sifat Fisik Tanah. *JUSTER: Jurnal Sains Dan Terapan*, 1(1).
- Sutari, N.W.S. (2010). Uji berbagai jenis pupuk cair biourine terhadap pertumbuhan dan hasil tanaman sawi hijau (*Brassica Juncea L.*). *Agritrop: Journal On Agricultural Sciences*, 29.
- Suyitman. (2014). Produktivitas rumput raja (*Pennisetum purpupoides*) pada pemotongan pertama menggunakan beberapa sistem pertanian. *Jurnal Peternakan Indonesia*, 16(2):119-27.
- Tando, Edi. (2019). Upaya Efisiensi Dan Peningkatan Ketersediaan Nitrogen Dalam Tanah Serta Serapan Nitrogen Pada Tanaman Padi Sawah (*Oryza sativa L.*). *Buana Sains*. 18. 171. 10.33366/bs.v18i2.1190.
- Tarigan, K. (2009). Pengaruh Pupuk Terhadap Optimasi Produksi Tanaman. Skripsi Universitas Sumatra Utara, Medan.
- Tonfack, L.B., A. Bernadac, E. Youmbi, V.P. Mbouapouognigni, M. Ngueguim, and A. Akoa. 2009. Impact of organic and inorganic fertilizers on tomato vigor, yield and fruit composition under tropical andosol soil conditions. *Fruits*, 64(3): 167-177.
- Wangchuk, K., K. Rai, H. Nirola, Thukten, C. Dendup and Durba, M. (2015). Forage growth, yield and quality responses of Napier hybrid grass cultivars to three cutting intervals in the Himalayan foothills. *Tropical Grasslands - Forrajes Tropicales*, 3, 142-150