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Effects of Fertilizer Type and Harvesting Times on the Production and Nutritive Values of Odot Grass (*Pennisetum purpureum* cv. Mott)

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***Abstract*—** *The aim of this research was to find out the production and quality of odot grass (Pennisetum purpureum cv Mott) based on different type of fertilizer and cutting age. The research was conducted to experimental method with completely randomized design factorial pattern. First factor was the treatment of harvest age which includes 45 days of harvest (P45) and 60 days of harvest (P60). The second factor was fertilization which includes, control or without fertilization (P_0), cattle bio-slurry (P_1), N fertilizer (P_2), and NPK fertilizer (P_3). Each treatment was repeated 10 times. The best result, grass production and quality aspect shown by P_2. In term harveting time factors increase herbage bioamass production but decline in herbage quality with increasing plant age from 45 days to 60 days.*

***Keywords*—** *Odot grass, herbage quality, production, harvesting times, fertilizer type*.

I. INTRODUCTION

Odot grass is one of the varieties of elephant grass that grows well in tropical regions. Odot grass was widely planted by smallholder dairy farmers to meet their forage needs. Talking about odot grass as a fooder, things to consider are the production and quality of the odot grass. The quality and production of grass were very fluctuative. Some factors which influence these two things include the availability of soil nutrients related to fertilization and the age of harvest. Therefore in this study, an evaluation was carried out related to the effect of fertilizer type and harvest age on the production and quality of odot grass.

II. MATERIAL AND METHOD

The study conducted on grasslands owns by Sumber Makmur Dairy Cooperative, Ngantang Village, Malang Regency, Indonesia. The study was conducted from January to March 2017. The study was conducted with an experimental method with a completely randomized design factorial pattern. The material in this study includes the odot grass, with the first factor was the treatment of harvest age which includes 45 days of harvest (P45) and 60 days of harvest (P60). The second factor was fertilization which includes, control or without fertilization (P_0), cattle bio-slurry (P_1), N fertilizer (P_2), and NPK fertilizer (P_3). Each treatment was repeated 10 times.

N fertilizer used from urea fertilizer at a dose of 300 kg N/Ha/year. NPK fertilizer comes from a mixture of urea as a source of N at a dose of 300 kg N/Ha/year, SP36 as a source of P at a dose of 250 kg P_2O_5/Ha/year and KCL as a source of K at a dose of 350 Kg K_2O /Ha/year. The biogas liquid waste from dairy cattle feces is given as much as 25 tons /Ha/year. Odot grass used as research material was odot grass that has been harvested many times with a 5-year age of clump. As for each plot in 1 treatment at each test is 0.5 m x 2 m.

Data collection was carried out at 45 days and 60 days. Data on plant height and number of shots taken before the plants harvested. The cutting of plants was carried out 5 cm from the ground [1]. The grass samples then dried at the temperature of 60^0C for 48 hours [2]. Samples that have been dried and milling and then analyzed DM, OM, CP content [3] and CF [4].

III. RESULT AND DISCUSSION

Herbage Production

The best result, grass production aspect shown by P_2, but statistically, P_2 and P_3 show the same results. DM production in P_2 and P_3 (Table 2) shows a higher value compared to some existing researchers. [5] in his research found that the production of DM odot grass could reach 1.76 tons/ha/harvest. The high production in this study to high compared to existing research. This cause the age of plant clumps was relatively older so that the possibility of the number of clumps formed was also large. The high number of tillers in one clum what influences the high production. [6,7] states that one of the factors affecting the production of the number of tillers.

The DM production value in P_2 and P_3, when compared with other treatments, shows a higher value. This closely related to the treatment of fertilizers containing N in treatment P2 and P3. The availability of unsure N in the soil will provide nutrients needed for plant growth. Some studies mention that the application of N fertilization on elephant grass can improve production aspects [8,9].

In terms of harvest age, harvesting time at 60 days shown the best results in terms of production, compared to harvesting at 45 days. The increase in production along with the increase in harvest age due to plant growth activities, which include the development and increase in the number of plant cells or often called proliferation [10,11]. The development of these plant cells will increase some plant growth profiles, such as increased plant height [12,13]. The results of the study (Table 1) showed that plants at 60 days more higher than plants at 45 days. Similar research results were also found in studies [5].

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Some studies also mention that all the higher elephant grass cultivars will have higher biomass production [6]. This evidence that the higher the plant with increasing plant age has a higher biomass production as well.

Herbage Quality

The results showed that a decline in plant quality with increasing plant age from 45 days to 60 days. This decrease in quality characterized by a decrease in crude protein content and an increase in crude fiber content. Similar results were also found in studies [5,14]. The decrease in the quality of grass caused by an increase in stem percentage and a decrease in leaf percentage. this can be seen in the results of this study in Table 1. A similar opinion was also raised by [14, 15] that there decrease in leaf percentage and higher steam proportion than the leaf with increasing maturity. This situation has an impact on the grass nutritional content because it is known that the leaf nutritional content higher than nutrition stems. [14] stated that the crude protein elephant grass leaves contain was able to reach 12.22%, while the crude protein content in the stem only reached 6.18%. Besides, the stem more dominant in crude fiber content [4]. So, the high crude fiber and the decrease in crude protein in plants harvested at 60 days one of the contributing factors the stem and leaf balance. Some studies also mention that grass in the maturity stage has decreased the ability of nutrients uptake from the soil [16]. This situation will certainly inhibit N supply from root to shot and has an impact on decrease quality due to insufficient nutritional needs of plants to produce some metabolic compounds, especially protein. Reviewed from fertilization factors, the best results shown by P2. Increase in plant nutrient content, especially crude protein content with N fertilization. [17,18] in his research also mentioned the same thing. This increases due to the availability of N in the soil which can be uptake by plants and used for metabolic activities. Known that N in the plant was a major component in the protein biosynthesis process [19].

TABLE 1. Effects of Harvesting Times on Production and Quality of Odot Grasses

No	Parameter	45	60	SEM	Sig.
1	DM (%)	10.22^{a}	13.56^{b}	0.49	P< 0.01
2	OM (%)	82.04^{b}	80.21^{a}	0.39	P< 0.01
3	CP (%)	12.79^{b}	10.79^{a}	0.23	P< 0.01
4	CF (%)	32.21^{a}	34.83^{b}	0.27	P< 0.01
5	Fresh Yield (Ton/Ha/Cut)	67.44	73.84	4.14	P> 0.05
6	DM Yield (Ton/Ha/Cut)	6.71^{a}	10.18^{b}	0.65	P< 0.01
7	OM Yield (Ton/Ha/Cut))	5.49^{a}	8.14^{b}	0.51	P< 0.01
8	CP Yield (Ton/Ha/Cut)	0.86^{a}	1.11^{b}	0.08	P< 0.01
9	Stem Percentage (%)	29.84^{a}	31.90^{b}	0.57	P< 0.01
10	Leaf Percentage (%)	69.85^{b}	67.41^{a}	0.61	P< 0.01
11	Plant Height (cm)	88.48^{a}	98.10^{b}	1.42	P< 0.01

TABLE 2. Effects of Fertilizer Type on Odot Grass Production and Quality

No	Parameter	P_0	P_1	P_2	P_3	SEM	Sig.
1	DM (%)	11.42	11.94	12.17	12.02	0.70	P> 0.05
2	OM (%)	80.53^{a}	80.07^{a}	83.00^{b}	80.92^{a}	0.56	P< 0.01
3	CP (%)	10.77^{a}	10.97^{a}	12.97^{c}	12.44^{b}	0.32	P< 0.01
4	CF (%)	33.33^{a}	33.25^{a}	34.04^{b}	33.45^{ab}	0.39	P< 0.01
5	Fresh Yield (Ton/Ha/Cut)	57.08^{a}	60.08^{ab}	79.34^{b}	86.07^{b}	5.85	P< 0.01
6	DM Yield (Ton/Ha/Cut)	6.35^{a}	7.12^{a}	9.79^{b}	10.53^{b}	0.92	P< 0.01
7	OM Yield (Ton/Ha/Cut))	5.08^{a}	5.68^{a}	8.07^{b}	8.44^{b}	0.72	P< 0.01
8	CP Yield (Ton/Ha/Cut)	0.68^{a}	0.78^{a}	1.23^{b}	1.27^{b}	0.11	P< 0.01
9	Stem Percentage (%)	32.37^{b}	32.17^{b}	28.97^{a}	29.98^{a}	0.81	P< 0.01
10	Leaf Percentage (%)	66.62^{a}	67.51^{a}	70.64^{b}	69.75^{b}	0.87	P< 0.01
11	Plant Height (cm)	88.95^{a}	91.50^{a}	92.85^{a}	99.85^{b}	2.01	P< 0.01

TABLE 3. Interaction of Fertilizer Type and Harvesting Times on Odot Grass Production and Quality

N0	Parameter	45 P_0	60 P_0	45 P_1	60 P_1	45 P_2	60 P_2	45 P_3	60 P_3	SEM	Sig.
1	DM (%)	10.69^{ab}	12.15^{bc}	11.09^{ab}	12.80^{bcd}	9.47^{a}	14.87^{d}	9.64^{a}	14.40^{cd}	0.99	P< 0.05
2	OM (%)	81.41	79.65	81.07	79.07	83.72	82.28	81.98	79.85	0.79	P> 0.05
3	CP (%)	11.23^{b}	10.31^{a}	11.85^{c}	10.09^{a}	14.34^{e}	11.60^{c}	13.74^{d}	11.15^{b}	0.46	P< 0.01
4	CF (%)	32.23^{a}	34.43^{c}	33.23^{b}	33.27^{b}	31.82^{a}	36.26^{e}	31.56^{a}	35.35^{d}	0.55	P< 0.01
5	Fresh Yield (Ton/Ha/Cut)	56.46	57.69	61.73	58.42	76.06	82.61	75.49	96.66	8.28	P> 0.05
6	DM Yield (Ton/Ha/Cut)	5.79^{a}	6.91^{a}	6.78^{a}	7.46^{a}	7.08^{a}	12.50^{a}	7.21^{b}	13.85^{b}	1.30	P< 0.05
7	OM Yield (Ton/Ha/Cut))	4.68^{a}	5.48^{a}	5.48^{a}	5.89^{a}	5.91^{a}	10.22^{b}	5.89^{a}	10.99^{b}	1.02	P< 0.01
8	CP Yield (Ton/Ha/Cut)	0.65^{a}	0.71^{ab}	0.80^{b}	0.75^{b}	1.02^{b}	1.45^{c}	0.99^{b}	1.54^{c}	0.15	P< 0.05
9	Stem Percentage (%)	29.73^{abc}	35.01^{d}	32.53^{cd}	31.80^{bc}	28.32^{a}	29.61^{abc}	28.80^{ab}	31.17^{abc}	1.15	P< 0.05
10	Leaf Percentage (%)	68.19^{b}	65.05^{a}	70.28^{b}	64.74^{a}	71.26^{b}	70.03^{b}	69.69^{b}	69.82^{b}	1.23	P< 0.05
11	Plant Height (cm)	84.20	93.70	89.00	94.00	87.80	97.90	92.90	106.80	2.85	P> 0.05

Besides, this increase in protein as a result of the effects of fertilization on plant development, especially leaf development, increasing the proportion of leaves. A higher leaf percentage contributes to an increase in herbage crude

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protein content. This because known that leaf has better nutritional content than stems [4]. Some studies suggest that leafs are sinks for the vegetative stage [20].

IV. CONCLUSION

An increase in production and a decrease in herbage quality as an increase in harvest age. In terms of fertilization, there an increase in herbage production and quality with the use of N fertilizer. In general, harvesting at 60 days with the application of N fertilizer shows the best results.

REFERENCES

[1] Wijitphan. S., P. Lorwilai, and C. Arkaseang. 2009. Effect of cutting height on productivity and quality of king napier grass (*Pennisitum purpureum* cv. King grass) under irrigation. Pakistan journal of nutrition 8 : 1244-1250.

[2] Hasyim.H., Y. Ishii, A. Wadi and S. Idota, 2014. Effect of digested effluent of manure on soil nutrient content and production of dwarf napier grass in Southern Kyusu, Pajan. Journal of Agronomy,13: 1-11. doi:10.3923/ja.2014.1.11

[3] AOAC. (1995). Official Methods of Analysis of Association of Official Analytical Chemist. AOAC International. Virginia USA.

[4] Van Soest. P.J. 1994. Nutrition Ecology of the Ruminant. Cornel University Press. USA. p.337-553

[5] Budiman, R. D. Soetrisno, S. P. S. Budhi and A. Indrianto. 2012. Morphological characteristics, productivity and quality of three napier grass (Pennisetum purpureum Schum) cultivars harvested at different age. .Indonesian Trop.Anim.Agric. 37(4).

[6] Halim, R.A., Shampazuraini. S. And A.B. Idris. 2013. Yield and Nutritive Quality of Nine Napier Grass Cultivars in Malaysia. Mal. J. Anim. Sci. 16(2):37-44.

[7] Wangchuk,K., K. Rai, H. Nirola, Thukten, C. Dendup, and D. Mongar, 2015. Forage growth, yield and quality responses of Napier hybrid grass cultivars to three cutting intervals in the Himalayan foothills," Trop. Grasslands 3, 142−150. doi:10.17138/TGFT(3)142-150

[8] Kumar. B.S., R.V. Singh, A. Singh, B.P Dhyani and P. Chand. 2017. Effect of nitrogen levels and cutting management on economic studies of fodder oat (*Avena sativa* L). Journal of Medicinal Plants Studies. 5(5): 33-35.

[9] King. C., J. McEniry, M. Richardson and P. O'Kiely. 2012. Yield and chemical composition of five common grassland species in response to nitrogen fertilizer application and phenological growth stage. Acta Agriculturae Scandinavica Section BSoil and Plant Science. 62: 644-658. doi:10.1080/09064710.2012.687055

[10] Fujikura. U., G. Horiguchi, M. R. Ponce, J. L. Mico, and H. Tkaya,2009. Coordination of cell proliferation and cell expansion mediated by ribosome-related processes in the leaves ofArabidopsis thaliana. The Plant Journal 59: 499–508, doi:10.1111/j.1365-313X.2009.03886.x

[11] Maeda. S., S. Gunji, K. Hanai, T. Hirano, Y, Kazama, I. Ohbayashi, T. Abe, S. Sawa, H. Tsukaya, and A. Ferjani, 2014. The Conflict Between Cell Proliferation and Expansion Primarily Affects Stem Organogenesis in Arabidopsis, Plant Cell Physiol. 55 (11): 1994–2007, doi:10.1093/pcp/pcu13.

[12] Ferjani. A., K. Hanai, S. Gunji, S. Maeda, S. Sawa and H. Tsukaya, 2015. Balanced cell proliferation and expansion is essential for flowering stem growth control, Plant Signaling & Behavior 10:4, e992755. doi: 10.4161/15592324.2014.992755

[13] Czesnick. H and M. Lenhard, 2015. Size Control in Plants—Lessons from Leaves and Flowers. Cold Spring Harb Perspect Biol. 7:1-16, doi: 10.1101/cshperspect.a019190

[14] Ansah. T., E.L.K Osafo and H.H. Hansen. 2010. Herbage Yield and Chemical Composition of Four Varieties of Napier (*Pennisetum purpureum*) Grass Harvested at Three Different Days After Planting. Agric. Biol. J. N. Am., 1(5): 923-929 doi:10.5251/abjna.2010.1.5.923.929

[15] Giacomini. A. A., S. C. da Silva, D. O. D. Sarmento, C. V. Zeferino, S. J. S. Júnior, J. K. Trindade, V. Guarda and D. D. N. Júnior, 2009. Growth of marandu palisadegrass subjected To strategies of intermittent stocking. Sci. Agric. (Piracicaba, Braz.).66(6):733-741.

[16] Crowder. L.V and H. R. Chheda. 1982. Tropical grassland Husbandry. Logman. Inc. New York. USA . p: 62-96

[17] Ullah. M. A., M. Anwar, and A. S. Rana.2010. Effect of nitrogen fertilization and harvesting intervals on the yield and forage quality of elephant grass (pennisetum purpureum) under mesic climate of pothowar plateau. Pak. J. Agri. Sci., Vol. 47(3), 231-234

[18] Ayub.M., M.A. Nadeem, M. Tahir, M. Ibrahim and M.N. Aslam. 2009. Effect of Nitrogen Application and Harvesting Intervals on Forage Yield and Quality of Pearl Millet (Pennisetum americanumL.). Pak. j. life soc. sci.7(2): 185-18.

[19] Khan. M. I. R., A. Trivellini, M. Fatma, A. Masood, and A. Francini, N. Iqbal, A. Ferrante, N.A. Khan, 2015. Role of ethylene in responses of plants to nitrogen availability. Front. Plant Sci. 6:927. doi:10.3389/fpls.2015.00927

[20] Griffiths. C.A., M.J. Paul and C.H. Foyer. 2016. Metabolite transport and associated sugar signalling systems underpinning source/sink interactions. Biochimica et Biophysica Acta 1857:1715–1725. doi:10.1016/j.bbabio.2016.07.007

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