AGRIWAR JOURNAL
MASTER OF AGRICULTURAL SCIENCE WARMADEWA UNIVERSITY
E-ISSN: 2808-1137, **P-ISSN**: 2808-1323
Vol. 1, No. 2, Dec 2021, Page 51-56
DOI: https://doi.org/10.22225/aj.1.2.4313.51-56

Effect of Planting Distance and Dosage of Chicken Manure on Production and Botanical Composition of Taiwan Elephant Grass (*Pennisetum purpureum* cv. Taiwan) at Different Cutting Phases

Marselina Ngongo*, I Dewa Nyoman Sudita, Ni Ketut Mardewi

Animal Husbandry Study Program, Faculty of Agriculture, Warmadewa University
*Corresponding author: selinngongo9@gmail.com

Abstract
Availability of forage fodder both in quality and quantity is an important factor in determining the success of the ruminant livestock business. The purpose of this study was to determine the effect of plant spacing and fertilizer dosage on the production of Taiwan Elephant Grass (Pennisetum purpureum cv. Taiwan) at different cuts. The field research was conducted using a Randomized Block Design (RAK) with a 3 x 4 factorial pattern, where three treatments were plant spacing (Factor A), and four treatments were dosed with fertilizer (Factor B). Each treatment combination was repeated three times so that there were 36 plots of treatment combinations. (Factor A) which consists of 3 types of spacing, namely (J1) 30 x 50 cm, (J2) 40 x 50 cm, (J3) 50 x 50 cm and 4 doses of fertilizer treatment (Factor B) which consists of 4 doses of fertilizer namely without fertilizer (D0), 10 tons//ha (D1), 20 tons/ha (D2), 30 tons/ha (D3). The variables measured were total plant production, botanical composition, and air dry weight (DW). Based on the study results, the spacing treatment had a significant effect (P<0.05) on the total production of Taiwan Elephant Grass stems at the first cutting. In contrast, the total plant weight, % stem, % leaf, air-dry weight (DW) had no significant effect (P> 0.05) on all observed variables. All the variables observed at the second and third cuts were not significantly different (P>0.05), but the total crop production at the third cut was higher than the second cut. The type of fertilizer had no significant effect (P>0.05) on all observed variables such as total plant weight, % stem, % leaf, total stem weight, total leaf weight.

Keywords: *fertilizer dosage; planting distance; Taiwan elephant grass.*

1. Introduction

Forage fodder usually given to livestock is derived from grasses (*Gramineae*) and nuts (*Leguminosae*). Superior grass (introduction) is the grass imported from outside and has advantages over local grass, especially in production and quality, one of which is Taiwan Elephant Grass (Pennisetum purpureum). Forage is a vital feed ingredient in the livestock business, especially ruminants. The availability of feed, mainly forage feed, both quality, quantity, and continuity, is an important factor in determining the success of the ruminant livestock business. Adequacy of feed must be supported by efforts to provide feed continuously and meet the needs of livestock [1]. Increasing the production and quality of forage can be done by domesticating new plants with high nutrient content and are easy to obtain. One type of fodder plant developed is the Taiwan Varieties of Elephant Grass [2]. The composition feed to cattle consists mainly of field grass, so it is necessary to provide feed ingredients from good quality grass that is one *Pennisetum purpureum* [3]. One type of fodder plant developed is the Taiwan Varieties of Elephant Grass [2]. Research by [3] stated that in raising cattle in a populist pattern in the simantri group in Bali, the botanical composition of feed given to cattle consists mainly of field grass. The use of superior grass is small, so it is necessary to provide feed ingredients from grass that is one of which is the Taiwan Elephant Grass. One type of fodder plant developed is the Taiwan

Varieties of Elephant Grass [2]. Research by [3] stated that in raising cattle in a populist pattern in the simantri group in Bali, the botanical composition of feed given to cattle consists mainly of field grass. The use of superior grass is small, so it is necessary to provide feed ingredients from grass that is one of which is the Taiwan Elephant Grass.

Taiwan Elephant Grass is an animal feed plant that is very responsive to fertilization [4]. Fertilizer is required to support Taiwan Elephant Grass production. Organic fertilizer is an important component in increasing forage production. Planting management is needed in developing fodder crops to obtain forage production that is always available. Maintenance management can include spacing, fertilization, and timing of cutting. Spacing arrangement determines the density of plants per unit area of planting. Plants planted at a more sparse distance reduce competition in utilizing growth factors compared to plants planted at a close distance [5]. Soil fertility support for plant growth is important for increasing crop productivity. The provision of chicken manure can add macro and micronutrients, increase water holding capacity, increase cation exchangeability, and increase soil pH [6]. Chicken manure is one of the wastes produced by laying hens and broilers with great potential as organic fertilizer [7]. Chicken manure has high levels of nutrients and organic matter and low water content. Chicken manure contains 1.5% Nitrogen, 0.7% Phosphorus, and 0.89% Potassium.

Spacing arrangements are very supportive of plant growth and production. Planting distance determines the efficiency of growing space utilization, facilitates other cultivation actions, the level and type of technology used, which can be determined by: Types of plants, soil fertility, soil moisture [8]. The best plants selected from wide spacing do not necessarily show their good qualities. However, if planted at a narrow spacing, the plants will be in a competitive situation so that the selected plants can still show their good characteristics [9]. According to [10], spacing arrangements in forage cultivation allow optimal forage productivity. The availability of feed-in terms of quality and quantity can be fulfilled and available throughout the year.

2. Materials and Methods

The field research was carried out using a Randomized Block Design (RBD) with a 3 x 4 factorial pattern, where three treatments of plant spacing (Factor A) were J1 (30 x 50), J2 (40 x 50), J3 (50 x 50) and 4 Fertilizer dosage treatment (Factor B) was D0 (without fertilizer), D1 (10 tons/ha), D2 (20 tons/ha), D3 (30 tons/ha). Each treatment combination was repeated three times, so there were 36 plots of treatment combinations.

This research was conducted at the Experimental Garden of the Faculty of Agriculture, Warmadewa University, located at Jalan Terompong No. 24 Tanjung Bungkak Denpasar Bali. This research was conducted from December 13, 2020, to April 13, 2021.

1. The variables observed in this study were, Total fresh weight production was obtained by weighing all Taiwan Elephant Grass plants at the first, second, and third cuts with an interval of one month.
2. Botanical composition, by taking grass samples and weighing them, then separating the leaves and stems
3. Air dry weight production (*Dry Weight*/DW was carried out by drying plant samples in an oven at 70°C.

3. Results and Discussion

First Cut (I)

From the results of the research on the first cutting, it can be seen that only at the spacing there is a significant difference ($P<0.05$), especially on total stem weight, and there was no interaction between plant spacing and fertilizer dose on the percentage of stems and leaves.

Table 1. Effect of Planting Distance and Fertilizer Dosage on Wet Weight Production and Botanical Composition of Taiwan Elephant Grass on Cutting (I).

Treatment	Total plant weight (kg)	% Stem	% leaves	Total weight of rod (kg)	Total weight of leaves (kg)
J1	8.28 a*	71.65 a	28.35 a	5.97 b	2.30 a
J2	7.00 a	72.38 a	27.62 a	5.08 b	1.91 a
J3	7.00 a	70.34 a	29.66 a	4.20 a	2.04 a
D0	8.36 a	73.04 a	26.96 a	5.14 a	2.21 a
D1	6.86 a	70.72 a	29.28 a	4.88 a	1.98 a
D2	6.87 a	70.89 a	29.11 a	4.92 a	1.95 a
D3	7.62 a	71.16 a	28.84 a	5.42 a	2.21 a
J_1D_0	8.93 a	73.26 a	26.74 a	6.55 a	2.39 a
J_1D_1	7.77 a	68.39 a	31.60 a	5.35 a	2.41 a
J_1D_2	8.27 a	74.01 a	25.99 a	6.22 a	2.05 a
J_1D_3	8.13 a	70.94 a	29.06 a	5.76 a	2.37 a
J_2D_0	7.13 a	74.81 a	25.19 a	5.36 a	1.77 a
J_2D_1	7.27 a	75.44 a	24.56 a	5.55 a	1.71 a
J_2D_2	5.73 a	70.82 a	29.18 a	4.04 a	1.70 a
J_2D_3	7.87 a	68.43 a	31.56 a	5.40 a	2.47 a
J_3D_0	9.00 a	71.06 a	28.94 a	3.50 a	2.48 a
J_3D_1	5.53 a	68.34 a	31.66 a	3.73 a	1.80 a
J_3D_2	6.60 a	67.85 a	32.15 a	4.50 a	2.10 a
J_3D_3	6.87 a	74.11 a	25.89 a	5.09 a	1.78 a

*The same letter behind the numbers in the same column shows a non-significant difference (P>0.05)

The research above in the first cutting (I) only at the spacing there was a significant difference (P<0.05), especially on the total weight of stems (Table 1), due to the number of plants in the study plot in treatment J1 (30 x 50 cm) more (12 plants) compared to treatment J2 and J3 the number of plants only (9 plants) with a distance (40 x 50 cm and 50 x 50 cm). The total production was higher with more plots, but there was no significant difference (P>0.05). Due to the higher total production, the botanical composition (stem percentage and leaf percentage) was the highest but not significantly different (P>0.05). Similarly, judging from the total weight of the stems, it was significantly higher in treatment (J1). This is due to the higher total number of plant production and absorption of nutrients for photosynthesis to produce more carbohydrates for the formation of stem cells. In contrast, the number of leaves in treatment (J1) remained the highest but not significantly different. The decomposition of organic matter is overhauling organic matter by microbes under controlled conditions [11]. According to [12] that the spacing used for elephant grass is 50 cm x 50 cm.

First Cut (II)

The effect of different planting distances and fertilizer doses on the production of Taiwan Elephant Grass in the second cutting shows no significant difference between treatments (P>0.05), and there is no interaction between planting distance and fertilizer dose established in Table 2.

Table 2. Effect of Planting Distance and Fertilizer Dosage on Taiwan Elephant Grass Production on Cutting (II)

Treatment	Total plant weight (kg)	% Stem	% Leaves	Total weight of rod (kg)	Total weight of leaves (kg)
J1	2.18 a*	46.46 a	53.54 a	1.00 a	1.18 a
J2	2.12 a	48.41 a	51.59 a	1.01 a	1.10 a
J3	1.90 a	45.03 a	54.97 a	0.87 a	1.03 a
D0	2.20 a	48.04 a	51.96 a	1.05 a	1.18 a
D1	2.08 a	45.66 a	54.34 a	0.94 a	1.10 a
D2	1.87 a	46.18 a	53.82 a	0.84 a	1.03 a
D3	2.11 a	46.65 a	53.35 a	1.00 a	1.11 a
J_1D_0	2.40 a	46.26 a	53.74 a	1.08 a	1.32 a
J_1D_1	2.23 a	45.46 a	54.54 a	0.99 a	1.24 a
J_1D_2	1.67 a	46.34 a	53.66 a	0.75 a	0.91 a
J_1D_3	2.40 a	47.76 a	52.24 a	1.16 a	1.24 a
J_2D_0	2.07 a	53.74 a	46.26 a	1.12 a	0.94 a
J_2D_1	2.27 a	46.76 a	53.24 a	1.05 a	1.21 a
J_2D_2	1.80 a	46.02 a	53.98 a	0.77 a	1.03 a
J_2D_3	2.33 a	47.10 a	52.90 a	1.10 a	1.24 a
J_3D_0	2.13 a	44.12 a	55.88 a	0.95 a	1.19 a
J_3D_1	1.73 a	44.76 a	55.24 a	0.78 a	0.96 a
J_3D_2	2.13 a	46.16 a	53.84 a	1.01 a	1.13 a
J_3D_3	1.60 a	45.09 a	54.91 a	0.74 a	0.86 a

*The same letter behind the numbers in the same column shows a non-significant difference (P>0.05).

In the second cutting, all the variables observed were total plant weight, % stem, % leaf, total stem weight, and total leaf weight. There was no significant difference (P>0.05) both on the effect of plant spacing, fertilizer dose, and interactions. However, the total weight of the plants tended to be at a larger spacing (J1), showing the highest yield but not significantly different (P>0.05). At the same time, the interaction between plant spacing and the dose was also seen in the treatment (J1D0), the highest total plant weight.

The time interval of cutting also influences the size of the total crop production, so the total production of plants will be less. The shortcutting interval causes slow plant growth. The opportunity to grow is also short, while the longer cutting the chance to grow longer so that the plant can grow optimally. According to [13], vaster growth opportunities allow plants to absorb more nutrients for plant growth. The older the cutting age, the higher the production but inversely proportional to the nutritional quality (increased crude fiber content, decreased crude protein). These arrangements need to be made to ensure optimal, healthy regrowth and not interfere with quantity and quality productivity. The older the cutting age, the higher the production but inversely proportional to the nutritional quality (increased crude fiber content, decreased crude protein). These arrangements need to be made to ensure optimal, healthy regrowth and not interfere with quantity and quality productivity. The older the cutting age, the higher the production but inversely proportional to the nutritional quality (increased crude fiber content, decreased crude protein). These arrangements need to be made to ensure optimal, healthy regrowth and not interfere with quantity and quality productivity.

A Cutting (III)

In the three cutting measurements, plant spacing and fertilizer dose did not show a significant difference (P>0.05) in total plant weight, % stem, % leaf, total stem weight, and total leaf weight, as presented in Table 3. In the third cutting, the same thing is seen in the second cutting, where the spacing tends to be the highest total plant weight and % stem. Likewise, the combination of plant spacing treatment and fertilizer dose tends to be influenced by plant spacing. Still, if it is seen that the average total crop production in the third cutting is higher than the second cutting, this shows that the time of cutting affects the total production of Taiwan Elephant Grass. The higher total crop production at the third cutting compared to the second cutting may be due to the growth of new tillers on the plant after the second cutting. At longer cutting intervals, forage production was higher due to more optimal plant root formation so that the absorption of nutrients and water was optimal. This is also stated by [14], with the increasing age of plants, the formation of roots and stems continues to increase to carry out the function of absorption of nutrients more optimally. Then [15] also reported that cutting affects root production that occurs in plants.

Table 3. Effect of Planting Distance and Fertilizer Dosage on Taiwan Elephant Grass Production on Cutting (III)

Treatment	Total plant weight (kg)	% Stem	% Leaves	Total weight of rod (kg)	Total weight of leaves (kg)
J1	3.53 a*	60.35 a	39.65 a	2.14 a	1.39 a
J2	3.20 a	56.22 a	43.78 a	1.80 a	1.40 a
J3	3.07 a	58.39 a	41.61 a	1.80 a	1.27 a
D0	3.58 a	61.48 a	38.52 a	2.21 a	1.37 a
D1	3.03 a	59.06 a	40.94 a	1.80 a	1.23 a
D2	3.16 a	58.04 a	41.96 a	1.86 a	1.30 a
D3	3.29 a	54.70 a	45.30 a	1.77 a	1.52 a
J_1D_0	3.80 a	64.16 a	35.84 a	2.44 a	1.36 a
J_1D_1	3.17 a	57.79 a	42.21 a	1.83 a	1.33 a
J_1D_2	3.33 a	57.65 a	42.35 a	1.93 a	1.40 a
J_1D_3	3.80 a	61.81 a	38.19 a	2.35 a	1.45 a
J_2D_0	3.47 a	62.49 a	37.51 a	2.17 a	1.30 a
J_2D_1	3.37 a	60.18 a	39.82 a	2.05 a	1.32 a
J_2D_2	2.43 a	56.81 a	43.19 a	1.45 a	0.98 a
J_2D_3	3.53 a	45.40 a	54.60 a	1.52 a	2.01 a
J_3D_0	3.47 a	57.79 a	42.21 a	2.02 a	1.44 a
J_3D_1	2.57 a	59.22 a	40.78 a	1.52 a	1.05 a
J_3D_2	3.70 a	59.68 a	40.32 a	2.20 a	1.50 a
J_3D_3	2.53 a	56.89 a	43.11 a	1.45 a	1.09 a

*The same letter behind the numbers in the same column shows a non-significant difference (P>0.05)

4. Conclusion

It was concluded that the plant spacing treatment had a significant effect on the total production of Taiwan Elephant Grass stems at the first cutting. In contrast, the total plant weight, % stems, % leaves, had no significant effect and air-dry weight had no significant impact on all observed variables. All the variables observed at the second and third cuts were not significantly different, but the total crop production at the third cut was higher than the second cut.

Acknowledgments

The author is very grateful to all those who have helped. Hopefully, this article is helpful for readers.

Reference

[1] Seseray, D. Y., Santoso, B., dan Lekitoo, M.N. (2013). Produksi Rumput Gajah (*Pennisetum Purpureum* cv.Mott) Yang Diberi Pupuk N, P Dan K Dengan Dosis 0,50 Dan 100% Pada Devoliasi Hari Ke-45. *Sains Peternakan* 11(1): 49-55.

[2] Novieata, I.D, (2016). Kualitas Taiwan grass (*pennisetum purpureum* cv. Taiwan) pada umur defoliasi dan konsentrasi effective microorganisms (EM4) yang berbeda. *Jurnal Galung Tropika*, 5(3) Desember 2016, hlmn. 171-177.

[3] Sudita, I.D.N, Mahardika, Suarna, I.G.I.W, Partama, I.B.G, (2015). Analysis of Feed for Digestibility Bali Cow in Group "Simantri" Program in Bali on Different Topographic. *International Journal On Advanced Science Engineering Information Technology*. Vol.5 No. 6

[4] Lugiyo dan Sumarto. (2000). Teknik Budidaya Rumput Gajah cv Hawaii (*Pennisetum purpureum*). Prosiding Temu Teknis Fungsional Non Peneliti. *Diterbitkan Pusat Penelitian dan Pengembangan Pertanian. Departemen Pertanian* : 120 – 125.

[5] Probowati, R.A., Guritno, B., dan Sumarni, T. (2014). Pengaruh tanaman penutup tanah dan jarak tanam pada gulma dan hasil tanaman jagung (*Zea mays* L.). *Jurnal Produksi Tanaman* Vol 2 , No 8 2014. Publisher: Jurusan Produksi Tanaman Fakultas Pertanian Universitas Brawijaya.

[6] Subowo, G. (2010). Strategis Efisiensi Penggunaan Bahan Organik untuk Kesuburan dan Produktifitas Tanah Melalui Pemberdayaan Sumberdaya Hayati Tanah. *Jurnal Sumberdaya Lahan*. Vol. 4 No.1

[7] Purbayanti, E.D. (2013). Rumput dan Legum sebagai Hijauan Makanan Ternak. Graha Ilmu. Yogyakarta.

[8] Mahdi, R. (2011). *Teknik Budidaya*. Serial online (http://rizalmahdi.files .wordpress.com/2011/01/ bab-9.pdf). Diakses pada tanggal 28 Maret 2021.

[9] Poespodarsono. (2006). *Pengantar Ilmu Pemuliaan Tanaman. Pusat Antar Universitas*. IPB. Bogor.

[10] Sirait, J., Tarigan, A dan Simanihuruk, K. (2015). Karakteristik Morfologi Rumput Gajah Kerdil (*Pennisetum Purpureum* cv. Mott) Pada Jarak Tanam Berbeda Di Dua Agroekosistem Di Sumatra Utara. *Prosiding Seminar Nasional Peternakan dan Veteriner* : 643 -649.

[11] Misra, R.V., Roy, R.N., Hiraoka, H., (2003). On-farm Composting Methods. *Food and Agriculture Organization of the United Nations* (FAO), Rome, pp. 1–35.

[12] Aromdhana, G. (2006). Respon Rumput Gajah (Pennisetum purpureum) terhadap pemberian asam humik pada tanah latosol. *Skripsi*. Fakultas Perternakan. IPB. Bogor.

[13] Hobir (2002). Pengaruh selang panen terhadap pertumbuhan dan produksi Nilam. *J. Littri*. 8: 103-107.

[14] Charles, A.L., Sriroth, K., and Huang, T.C. (2005). Proximate composition, mineral contents, hydrogen cyanide, and phytic acid of 5 cassava genotypes. *Food Chemist*. 92: 615-620.

[15] Limsila, A., S. Tungsakul, P. Sarawat, W. Watanaronta, A. Boonsing, S. Pichitport And R.H. Howeler. (2002). Cassava leaf production Research in Thailand. *Royang Field Crops Research Center*. Huai Pong. Royang Thailand. pp. 472-480.