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Abstract. The objective of this study is to examine the quality of liquid fertilizer from water hyacinth and Siam weed and to identify its effect on Taiwan napier grass quality and growth. This study was performed from November 2019 to January 2020. This study was designed according to a completely randomized design employing 4 treatments and 5 replicates. The treatments encompassed: T0=Taiwan napier grass without organic liquid fertilizer supplementation (control; T1= Taiwan napier grass + 20 L/ha = 300 mL/ plot; T2= Taiwan napier grass + liquid organic fertilizer 30 L/ha = 450 mL/ plot; T3= Taiwan napier grass + liquid organic fertilizer 40 L/ha = 600 mL/plot. The observed parameters were plant height, number of the tiller, number of leaves, chlorophyll index in each treatment. The result of the analysis of variance indicated that the liquid organic fertilizer had a significant effect on the plant height, number of the tiller, number of leaves, and chlorophyll index. From this study, it can be concluded that the combination of 50% water hyacinth and 50% Siam weed is the most optimal combination at the dosage of 450 mL/plot (T2) for Taiwan napier grass.

1. Introduction

One inhibiting factor of forage production and quality is the weed invasion, both aquatic weed and land weed. The presence of weed invasion would also affect environmental pollution agricultural economic losses [1,2]. Land weed invasion may contribute to the soil nutrient decline which, in turn, results in lower plant quality and quantity [3]. Hasan (2015) explained that if essential nutrient soil is insufficient, the plant metabolism will be hindered [4]. This hindered metabolism is visually apparent from the plant's abnormalities during the growth and from its low quality indicated by high crude fibre content due to intense sunlight.

Water hyacinth (*Eichornia crasspie*) is an invasive aquatic weed found in almost all tropical and sub-tropical areas. Its rapid growth rate is problematic as it causes environmental damage [5]. Another type of invasive land weed is Siam weed (*Chromolaena odorata*). It also harmed reducing land productivity and difficulty to control [6]. Siam weed is widely spread and can be found in pasture and farmlands without appropriate weed control. Siam weed causes gradual loss when interacts with other plants [7]. Yield losses may occur when weed-crop competition is present in absorbing soil nutrient, water, light and CO_2. The allelopathic substance contained in weed could prevent optimal growth in plants.

However, apart from its invasive characteristic, weed has great potential to be used as organic liquid fertilizer. Converting the weed function as a material for liquid organic fertilizer could be a solution to anticipate an insufficient soil nutrient issue [3]. Several studies on water hyacinth chemical analysis indicated that its chemical composition included 1.30% N, 0.24 % P and 12,25 C/N ratio [8]. A study performed by Hasan et al [3] reported that palisade grass (*Urochloa brizantha*) and guinea grass (*Megathyrsus maximus*) supplemented with liquid organic fertilizer from Siam weed containing 2,30% N, 0,32% P_2O_5 and 0,15% K_2O could contribute a better growth. Similarly, another study performed by Nompo et al [9] also indicated a liquid organic fertilizer supplementation at the dosage of 20, 30, 40 litres per hectare in dry pasture could promote better growth. This confirmed the effectiveness of forage production improvement.

Taiwan napier grass is considered to be a superior species of grass due to several reasons 1) growth flexibility at various types of lands due to high responsiveness towards nitrogen fertilizer (excluding wet pasture), 2) high palatability, 3) high production, 4) storability in the form of hay and 5) high quality. Based on the above description, it is encouraging to perform research on the use of liquid organic fertilizer from water hyacinth and Siam weed to supply Taiwan napier grass. To observe the effect of liquid organic fertilizer from water hyacinth and Siam weed on Taiwan napier grass quality and growth.

2. Material and Method

2.1. Material and methods

This study was conducted from March to July 2019 at Forage Crop Science and Pasture Laboratory, Faculty of Animal Science, Universitas Hasanuddin. The analysis of fertilizer quality was performed at Soil Chemistry and Fertility Laboratory, Faculty of Agriculture, Universitas Hasanuddin.. The following phase was to process, cultivate, measure the plant's growth at the farmland of Agricultural development Polytechnic of Gowa. This study employed a completely randomized design with 4 treatments and 5 replicates for each treatment [10]. The treatments in this study encompassed: T0 = Taiwan napier grass without organic liquid fertilizer supplementation (control; T1 = Taiwan napier grass + 20 L/ha = 300 mL/plot; T2 = Taiwan napier grass + liquid organic fertilizer 30 L/ha = 450 mL/plot; T3 = taiwan napier grass + liquid organic fertilizer 40 L/ha = 600 mL/plot. The overall total experimental units were 20.

2.2. Research implementation

Before the cultivation initiated, the land was prepared and cleared from any competitive weeds. After that, the land was ploughed. The prepared land area of 31 x 17 m was divided into 20 plots. Each plot had a size of 5 x 3 m. The stem cuttings of Taiwan napier grass were obtained from Takalar and were planted in each prepared plots. The soil texture in this study was lotosol soil. The soil nutrient content of the used soil in this study was presented in table 1.

Table 1. Soil nutrient content

pH	C (%)	N (%)	C/N	P_2O_5 (mg 100 g^{-1})	K_2O (mg 100 g^{-1})
6.3	2.11	0.19	19	11.5	0.52

Chemical and Soil Fertility Laboratory, Faculty of Agriculture, Universitas Hasanuddin, 2019

The ploughed land was divided into 20 plots. After that, the stem cuttings of Taiwan napier grass with 20 cm stem height was spaced at 100 cm x 100 cm. 15 stem cuttings were planted in each plot. After the cultivation, the stems were watered daily (depending on the environmental circumstance) with a constantly equal amount of water in two weeks. After the growth started, liquid organic fertilizer from water hyacinth and Siam weed was applied twice to the grass. The first fertilizer application was at week 2 after cultivation and the second was at one month after cultivation. Weed control was also performed to avoid any presence of competition in soil nutrient absorption.

2.3. Measurement and cutting

The plants were harvested after 60 days of cultivation and the plants were cut when their height reached 10 cm from the soil surface. Before the cutting was performed, plant height, leaf chlorophyll and several tillers were measured. The measurement system of the observed parameters was presented as follows: (1) plant height (cm) was measured every 7 days by measuring plant height from the rootstock above the soil surface to the growing point by using a measuring tape; (2) number of tillers was identified by calculating all grown tillers in one plot during the harvest; (3) number of leaves were calculated in every 7 days; (4) the chlorophyll content (unit) was measured during defoliation by using chlorophyll meter-Konica Minolta SPAD 502.

2.4. Data analysis

Data were analyzed using software, SPSS 16 based on the Completely Randomized Design consisting of 5 treatment and 4 replications [10]. Any significant effect identified will be further tested with the Duncan test.

3. Results

The average growth and the quality of Taiwan napier grass supplemented with liquid organic fertilizer from water hyacinth and Siam weed were presented in table 2.

Table 2. The average growth of Taiwan napier grass supplemented with liquid organic fertilizer from water hyacinth and Siam weed.

Parameter	Treatment			
	T0	T1	T2	T3
Plant height (cm)	122.06±1.57^{a}	143.20±1.32^{b}	166.04±1.60^{d}	146.60±2.86^{c}
Number of tillers (stem)	3.00±0.40^{a}	6.80±1.05^{b}	11.20±1.20^{d}	7.00±2.74^{c}
Number oflLeaves (Blade)	42.80±1.21^{a}	77.00±2.04^{b}	149.00±3.03^{d}	74.20±4.08^{c}
Leaf Chlorophyll (unit)	51.96±1.74^{a}	53.38±0.49^{b}	61.24±4.43^{d}	55.86±1.20^{c}

^{abcd} different superscript in a column are significantly different (P<0.05); T0 = control, T1 = 300 mL liquid organic fertilizer/plot, T2 = 450 mL organic fertilizer liquid/ plot, T3 = 600 mL organic fertilizer liquid/plot

It can be observed from table 2 that the control treatment of liquid organic fertilizer or T0 and the supplementation of liquid organic fertilizer from water hyacinth and Siam weed at different dosage (T1, T2 and T3) on Taiwan napier grass had a significant effect (P<0.05) on plant height, number of tillers, number of leaves, and leaf chlorophyll.

4. Discussion

4.1. Plant height

Plant height in table 2, it can be observed that the combination of 50% Siam weed and 50% water hyacinth at the dosage of 450 mL/ plot (T2) generated the most optimum result. This was most probably caused by the sufficient application of liquid organic fertilizer from water hyacinth and Siam weed in fulfilling the plant's nutrient needs. The nutrient content of water hyacinth and Siam weed are considered to be mutually complementary. This is in line with that the supplementation of organic liquid fertilizer could provide both necessary macro and micronutrients for plants to sustain plant's growth [3,11]. It is also supported by the study performed Sema et al [12] indicated that the application of liquid organic fertilizer (*Chromolaena odorata*) in tropical grasses was capable of boosting plant growth especially plant height.

From the average plant height, the T2 treatment achieved the best result compared to the other treatments. This was due to the greater nutrient availability of N and P that accelerate the stem growth. Fageria [13] also supported this by confirming that N and P nutrients are very important components in

improving the vegetative growth of a plant. The sufficient N nutrient availability could trigger a plant's cell growth. On the other hand, P nutrient played an important role in the cell division process to boost plant growth [14].

Taiwan napier grass with T2 treatments demonstrated a significant response of a better growth component through liquid organic fertilizer absorption on the plant's root. Gutschick [15] reported that the well-developed plant's root could absorb necessary soil nutrient to produce dry matter from leaf photosynthesis, photosynthate, which, in turn, translocated to other plant's organs such as seed. Furthermore, Razak at al [16] stated that plant height growth and the number of leaves were highly affected by the nitrogen nutrient which stimulates vegetative growth.

4.2. The number of tillers

From the results of several s tillers in table 2, the supplementation of liquid organic fertilizer from 50% water hyacinth and 50% Siam weed at 450 ml/ plot dosage contributed to the most optimum number of tillers (11 stems). This was most probably because of the nutrient balance between the soil nutrient and fertilizer combination. One effect that resulted from the use of fertilizer with balanced nutrient is the increase inthe number of tillers.

Bindraban et al [17] suggested that the dosage increase of fertilizer on the grass is one of the aspects in determining the plant growth that contributes to high production. A study performed by Luik [18] on corn indicated that the supplementation of liquid organic fertilizer from Siam weed could contribute to the NPK nutrients in the soil and the plant's cell. The application of the fertilizer, therefore, was capable of improving the corn production accounted for 4.83 kg/16 m^2 compared to corn production without liquid organic fertilizer use achieving only 4.09 kg/16 m^2. The supplementation of Siam weed liquid organic fertilizer could ensure the availability of nutrients in the soil. Both the application of liquid and solid organic fertilizer are undoubtedly able to increase the production of vegetables and fruits. N and K content in Siam weed is very high, while its P content is medium. A study performed by Sutedjo [19] reported that in terms of Siam weed key roles on soil physical characteristic, the soil structure was significantly affected by the anti-nutrient content of Siam weed.

Supplementation of liquid organic fertilizer can increase the availability and absorption of important nutrients for the organic compound forms such as carbohydrates, proteins and lipids. These compounds play an important role in forming the plant's organ. Moreover, organic fertilizers have raised not only their impact on soil quality but also because of their role in carbon sequestration [20]

4.3. The number of leaves

From the results of the number of leaves in table 2, the application of liquid organic fertilizer from the combination of 50% Siam weed and 50% water hyacinth at the dosage of 450 mL/ plot (T2) was the most optimum treatment. The liquid organic fertilizer from water hyacinth and Siam weed contained macronutrients primarily the balanced nitrogen. Therefore, it could improve the vegetative growth including stimulating the young developing leaves. High rates of chlorophyll absorption by the leaves would lead to high production. Similarly, Perchlik and Tegede [21] also stated that nitrogen contributes to the amino acid formation (protein), nucleus acid, nucleotide and chlorophyll in plants. As the consequence, through the availability of nitrogen, the plants will receive advantages including keeping the plant's greener, boosting the plant's growth, height, number of tillers and number of stems, and plant's protein.

Nitrogen from the liquid organic fertilizer mixed with the soil will form a structure of humus and cannot be directly absorbed by the plants. It will require a process of mineralization involving amination, ammonification, and nitrification The available nitrogen will be quickly drained into the soil and cause a quicker carbohydrate synthesis in the soil. The produced carbohydrate through photosynthesis with greater nitrogen was used to help vegetative organ formation [22]. Therefore, the plants are stimulated to grow taller, to grow more leaves and more tillers.

Gutschick [15] in his study also predicted that the greater the leaf area, the higher the photosynthates will be produced. The photosynthates will be translocated for plant's growth including size, height, shoot

and stem growth. The formation of the leaves is determined by the cell's number and size where the cell's number and size are highly affected by the nutrient absorbed by the root for storing food.

4.4. Leaf chlorophyll

From the results of leaf chlorophyll in table 2, the application of liquid organic fertilizer from the combination of 50% Siam weed and 50% water hyacinth at the dosage of 450 mL/ plot (T2) was the most optimum treatment. This was due to the sufficient soil nutrient availability in the fertilizer combination. The liquid organic fertilizer contained nitrogen as the primary source for chlorophyll formation. Low chlorophyll content was indicated by the yellowish color on leaves. An adequate chlorophyll content will result in dark green color on the leaf. This is confirmed by Boussadia (2010) stating that nitrogen sufficiency was indicated by intense photosynthesis activity, good vegetative growth and dark green color on the leaves [23].

High chlorophyll content was identified because of the combination of P treatment and water. This combination helped the plants in synthesizing chlorophyll and consequently, it improved the photosynthesis rate. Li *et al.,* (2018) reported that the affecting factors of chlorophyll formation on plants included gene, light andMg, Fe nutrient as the sustainer and the catalyst in chlorophyll synthesis [24].

The higher the nitrogen content, the higher the chlorophyll content will be formed. This was supported by a study performed by Sema *et al.,* (2019) revealing that the chlorophyll content in *Brachiaria brizantha* had a higher rate when supplemented with the high dosage of nitrogen [12]. Nitrogen is a key component for a plant's organ in nucleic, amino acid, and protein formation. Nitrogen is absorbed by the root and translocated to the plants in a form of nitrate (NO_{3-}), ammonium (NH_{4+}) and amino acid. Therefore, the supplementation of liquid organic fertilizer could improve leaf chlorophyll content.

The supplementation of nitrogen fertilizer will improve the growth of the plant's organ. The treatment combination of urea and compost fertilizer resulted in the most optimum leaf chlorophyll. Higher plant height will stimulate more node appearances. The distribution of leaf is majorly affected by the number of nodes [25]. The greater the number of nodes, the more leaves will grow. A considerable number of leaves will improve the amount and expand the sunlight absorption for energy production as a photosynthesis requirement. Subsequently, the number of tillers will also increase. The number of tillers will consistently in line with the number of leaves. A plentiful number of leaves and a wider leaf area have a greater sunlight absorption through stomata and this will stimulate a higher chlorophyll content. The supplementation of liquid organic fertilizer from water hyacinth and Siam weed contributed effectively to the growth of Taiwan napier grass. The combination of 50% water hyacinth and 50% Siam weed at 450 mL/ plot dosage (T2) was the most optimal combination.

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