Introduction of Centro Legume (*Centrosema Pubescens*) and dwarf napier grass (*Pennisetum purpureum cv.mott*) in improving production and quality of Grassland

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Abstract- The aim of this study is to identify the forage growth, production and quality of dwarf napier grass. The study is conducted for 4 months from August to November 2018. The object of the study is centro legume (*Centrosema Pubescens*) and dwarf napier grass (*Pennisetum Purpureum cv.mott*) with various percentages. The study is arranged by using Completely Randomized Design (CRD) consisted of 4 treatments and 3 replications. As for the treatments, P1: 100% centro and dwarf napier grass; P2: 75% centro and dwarf napier grass; P3: 50% centro and dwarf napier grass; P4: 25% centro and dwarf napier grass; P5: 0% centro and dwarf napier grass. The parameters of the study are plant height, leaf area, chlorophyll, number of tillers, dry matter of leaf and stem, *Acid Detergent Fibre* (ADF), *Neutral Detergent Fibre* (NDF), crude protein of leaf and stem. Based on the study, it is identified that the intercropping of centro legume and dwarf napier grass is able to affect on the production, quality of dwarf napier grass.

Key Words- Grass, Legume, Nitrogen, Production, Quality

I. INTRODUCTION

Grasslands in Indonesia specifically in South Sulawesi experience decline in productivity due to the land use change and the decrease of grassland nutrient supply [1]. Grassland that plays important roles in providing high-quality and sustainable forage feeds are enormously important. However, it is constrained by the soil nutrient supply. Grassland with low nutrient content ranges from V to VIII class. If nitrogen is insufficient in the soil, it will affect the plant growth and production.

Nitrogen is an important material for amino acid, amide, nucleotida and nucleoprotein constituents. Additionally, It is important for cell division, enlargement and growth. Plants require supply of nitrogen in all growth stages, especially at the beginning of growth. Therefore, the availability of efficient nitrogen source will be conducive to cost reduction (Pasaribu, 1989). Research [3] stated that in the tropical region, including Indonesia, the shortage of nitrogen in soil is the primary constraint in the productivity improvement of grassland. The use of chemical fertilizers (inorganic) is able to contaminate the soil by reducing soil nutrient value if it is performed constantly. In fact, the use of chemical fertilizers is possible to be reduced by intercropping of grass and legume. [4]

Superior grass that is already widely known and developed by farmers is dwarf napier grass (*Pennisetum Purpureum cv). Mott*). Sandiah [5] stated that dwarf napier grass is one of the forages, which is widely and intensively used in dairy farming, fattening and breeding. This is very reasonable because dwarf napier grass has productivity, quality, adaptability, palatability advantage as a forage. Furthermore, dwarf napier grass is useful as a groundcover plants and the roots can loosen the soil. As a forage, a dwarf napier grass contains high nutritional value and it is sufficient to use it as forage. [6] [7]

Ibrahim [6] suggested that in order to improve the productivity of the elephant grass, intercropping of grass and legume can be one of the alternatives. Centro (*Centrosema pubescens*) is a legume used as a forage that can be grown on dry land, under the shade and on waterlogged land. Legumes have the ability to fix nitrogen in the air due to the presence of root nodules on the legume, subsequently, the nitrogen will be released to the soil and it can be utilized by the grass as a nutrient. Therefore it is important to perform intercropping of grass and legume in order to provide sufficient nitrogen supply for the grass and to provide mutual advantage between the grass and the legume. [8]

According to Hasan [9], the use of the Biological Nitrogen Fixation combination between the grass and legume is capable of producing nitrogen as a substitute for the nutrient elements in the soil because the legume is able to supply nitrogen. Legume can improve the quality of grass in the grassland because nitrogen supply in the legume can be absorbed by the grass when nitrogen deficiency is occurred. Nitrogen in the soil will decrease as it is absorbed by the grass to constantly grow, but it will not occur if intercropping of legume and grass is performed. [10] Chemical fertilizer may damage the quality of the soil and lower the nutrient materials in the soil if it is used constantly. In order to improve the production and quality of grass, land or soil, nutrients are necessary. Therefore, the available soil nutrients should be taken into advantage by intercropping of legume and

dwarf napier grass. This study aims to identify the growth, production and forage quality of dwarf napier grass.

II. Research Methods

A. Material and Method

The study was conducted for 4 months starting from August to November 2018 In Laboratory of Forage Science and Pasture Crop. Chemical analysis was carried out in Laboratory of Chemical livestock Feed, Faculty of Animal Husbandry, Hasanuddin University. The materials of the study were sentro legume (Centrosema Pubescens) and dwarf napier grass (Pennisetum purpureum cv.mott). The treatments of the study consisted of P1: 100% centro and dwarf napier grass; P2: 75% centro and dwarf napier grass P3: 50% centro and dwarf napier grass; P4: 25 % centro and dwarf napier grass; P5: 0% centro and dwarf napier grass.

B. Study Procedure

The Study observation of the growth and production of dwarf napier grass was arranged by several steps as follows :

1. Sampling of plants were performed at the 60 days of planting
2. Plant height (cm) was measured from the rootstock above the soil surface to the growing point
3. Fresh weight was measured by analytical scales.
4. The number of tillers was calculated by counting all the tillers that grow in the beds.
5. Leaf area(cm^2)is observed at the end of the study by measuring the length and width of the leaves using Leaf Area Meter tools.
6. Chlorophyll was calculated by using the chlorophyll meter.
7. The content of crude Protein (%) was calculated by using Kjeldahl method with the following formula:

$$\% \text{ Crude Protein} = \{(\underline{V.T \times N \times 14 \times 6{,}25 \times P})\} \times 100\% \} \, 100/DM$$
$$B.S \ (mg)$$

Description: V. T = Volume of Sample Titration
N = Normality of H_2SO_4
P = Diluent Factor

8. Production of dry matter of leaves and stems was obtained from dry weight in oven with temperature of 70^0 C

C. Data Analysis

The study was designed by completely Randomized Design (CRD) consisting of 4 treatments and 3 replications and continued by Analysis of Variance The comparison among means was performed using Duncan/Duncan Multiple Range Test (DMRT) Data were processed with the SPSS software version 20.

III. Results

A. Growth of Dwarf Napier Grass

The grass growth measured in this study is presented in Table 1.

Table. 1. The Average of Plant Height, Leaf Area, Number of Tillers, Dry Weight of leaf and stem

Description : Different Superscript [abc] showed significant difference (P<0.05); P1: 100% centro and dwarf napier grass; P2: 75% centro and dwarf napier grass P3: 50% centro and dwarf napier grass; P4: 25 % centro and dwarf napier grass; P5: 0% centro and dwarf napier grass

Parameters	Treatment				
	P1	P2	P3	P4	P5
Plant Height	756.80 [b]	733.06 [b]	690.26 [a]	673.96 [a]	665.06 [a]
Leaf Area	242632.00 [c]	207538.66 [bc]	202640.00 [bc]	195976.00 [ab]	158010.66 [a]
Chlorophyll	48.36 [a]	43.86 [a]	41.96 [a]	41.03 [a]	40.33 [a]
Number of Tillers	168.00 [c]	138.66 [b]	128.00 [b]	112.00 [b]	82.66 [a]
Dry Matter of leaf	486.80 [a]	473.90 [a]	464.08 [a]	494.40 [a]	468.767 [a]
Dry Matter of Stem	419.10 [b]	415.56 [b]	370.06 [ab]	355.03 [ab]	298.56 [a]
ADF	38.61 [c]	38.08 [bc]	36.97 [abc]	36.75 [ab]	36.33 [a]
NDF	59.39 [b]	58.93 [ab]	58.24 [ab]	57.87 [ab]	57.56 [a]
Crude Protein of Leaf	20.35 [b]	20.13 [b]	17.81 [a]	17.45 [a]	17.12 [a]
Crude Protein of Stem	20.78 [c]	17.98 [b]	17.38 [b]	17.01 [b]	15.38 [a]

IV. Discussion

The result showed that intercropping of centro legume and dwarf napier grass significantly affected (P<0.05) plant height, leaf area, number of tillers, dry matter of leaves and stem, Acid Detergent Fibre (ADF), Neutral Detergent Fibre (NDF), crude protein of leaves and stem**.** The result of the study is presented as follows ;

1. Plant Height

Analysis of variance in Table 2 showed that intercropping between dwarf napier grass and centro legume had significantly affected (P<0.05) on plant height of dwarf napier grass. The result of the Duncan Multiple Range Test showed a significant difference (P<0.05) on plant height. The highest and the lowest plant height of dwarf napier grass is on P1 treatment and P5 treatment respectively. It showed that the more legume is supplied to dwarf napier grass, the higher the plant height is. The more Legume is planted, the more nodules grow. Nodules are root nodules found on nitrogen-producing legume. The formation of nodules is more able to increase further nitrogen fixation to form chlorophyll and enzymes [11][12].

The produced nitrogen is resulted from the biological fixation of symbiotic bacteria. The symbiotic nitrogen-fixing bacteria are Rhizobium mutualistic bacteria that presents in the root nodules of legume. The Nitrogen produced is used as fertilizer in improving plant growth [13] Churriyah [14] reported that the higher the legume is supplied, the higher the growth of dwarf napier grass is. This positive growth occurred because the legume performed bacterial symbiosis to produce nitrogen in the soil.

Nitrogen is major nutrient for plant growth that is required in growth or formation of vegetative plants such as leaves, stems and roots. Nutrient supply will increase the growth of the plant. if the plant is in nutrient deficiency, the signs can be identified on the growth [13]. Legume can provide fertilizer N and fertilizer N

can be absorbed by other plants. [15] [16] [17]. Legume can supply nitrogen that can be absorbed by other plants if it performs symbiosis with the *rhizobium* bacteria [18]. *2.*

Leaf Area

Analysis of variance in Table 2 showed that intercropping of dwarf napier grass and centro legume had significantly affected (P<0.05) on leave area of dwarf napier grass. The results of Duncan Multiple Range Test (P<0.05) showed difference in leaf area of treatment P1 with P2,P3,P4 and P5. However, there is no difference in leaf area in both treatments of P2 and P3. The lowest number of leaves is on treatment P5 and the highest number of leaves is on P1. This is due to environmental factors, including the influence of solar radiation (the ability of photosynthesis in plants), the supply of nutrient elements to plants. The more frequently the plants perform photosynthesis, the more energy is produced and it is similar to plants that absorb more nitrogen nutrient. Lestari [19] stated that the additional number of leaves and leaf area is in accordance with the growth of the plant height. If the plant grow higher, it will grow more leaves and the leaf area will be more extensive. The decrease of leaves and leaf area is caused by low nitrogen content that cannot provide sufficient nutrients for the plant nutritional needs.

Chlorophyll

Analysis of variance in Table 2 showed that intercropping of centro legume and dwarf napier grass had not significantly affected (P>0.05) on chlorophyll. This is possibly due to unstable lighting during the time of the measurement of leaf chlorophyll. Plants absorbing light had a little impact on the chlorophyll content of the leaves. Ogedegbe and Ehizogie [20] stated that centro legume has high nitrogen content and therefore, it can stimulate the leaf growth and chlorophyll. Increased fertilizer N inputs along with continued high intake of animal protein [21] [22]. The increase of chlorophyll and enzymes can improve photosynthesis that can increase the vegetative and generative growth of the plant. If N element is available enough for plants so the chlorophyll content in the leaves will be increased and photosynthesis process is also increased that will result in more assimilation and consequently, in better plant growth [23].

Number of Tillers

Analysis of variance in Table 2 showed that the number of tillers in intercropping of centro legume and dwarf napier grass had not significantly affected (P<0.05). The result of Duncan Multiple Range Test showed a significant difference in the number of tillers on treatment P1 and P5, while there were no difference in the treatments of P2, P3, and P4. The lowest number of tillers was in treatment P5 and the highest was at the treatment P1. This is caused by nitrogen subtitution from intercropping of centro legume and dwarf napier grass. Legumes can support intensification of organic crop production [24]. In addition, nitrogen is also contained in the hormone cytokinin,and auxin. In addition, good roting also able to produce tillers. Hasan [25] stated that the dwarf napier grass has the highest tiller production due to good root formatting system. The growing tillers appear from the rhizome's growth inside the soil through good root formatting system.

Dry matter of leaves and stems

Analysis of variance in Table 2 showed that intercropping of grass and legume had affected significantly (P<0.05) on dry matter of leaves and stems. Duncan Multiple Range Test showed that there was no difference of dry matter of leaves on each treatment. However, there were differences on dry matter of stems to those treatments. The highest and the lowest production of stem dry matter was P1 treatment and P5 treatment respectively Dry weight production of stems increased along with along with substituting treatment of centro legume The differences in dry matter production were caused by different proportion of legume used in each treatment. Therefore, it can affect the substitution of nitrogen that causes different grass growth generating dry weight differently. The research [26] mentioned that legume intrercropped on pasture affects growth and quality plant significantly Therefore, the improvement of pasture affected by nitrogen fixation can improve forage production. In the case of N2 fixing crops, the potential N fixation is assumed to be proportional to dry matter increase. Fixation has an associated energetic cost, reducing the daily dry matter accumulation [27]. Intercropping of grass and legume is one alternative to improve forage production as well as to avoid the use of inorganic fertilizer N [28]. The dry matter content of forage increase along with subtitution of centro legume in intercropping system [29]. Research [30] stated that the average dry matter of leaves and stems is different. It indicates that the adaptability of each plant is different so that the proportion of leaves and stems produced is different as well. The proportion of leaves and stems produced will have an impact on each dry matter plant. Stems are supporting part of structural plants. They have higher lignin content

Acid Detergent Fibre (ADF) and Neutral Detergent Fibre (NDF)

Analysis of variance in Table 2 showed that the results of the *Acid Detergent Fibre*(ADF) content had significantly affected (P>0.05) on every treatment. *Neutral Detergent Fibre* (NDF) had no significant difference (P<0.05) on P2, P3, and P4 treatment and significantly affected (P>0.05) on P1 and P5 treatment It showed that the content of NDF and ADF can be identified due to centro legume supply. Centro legume contributed nitrogen to other plants Brady and Weil [31] mentioned that the function of nitrogen is to fulfill plant nutritional need in growth formation.

Fat and Protein Formation

The content of NDF in forages represents the content of the cold cell which is composed of lignin, cellulose, hemicellulose and proteins associated with the cell wall. The lower the value of the ADF the more digestible a feed material. The lower the fraction of ADF and NDF, the higher the digestibility of the feed [32]. Decline in the NDF content NDF due to increased levels of lignin resulted in reduced hemicellulose content. Hemicellulose and cellulose are two components of the cell wall that can be digested by microbe. The high lignin content causes the microbe are unable to dominate the hemicellulose and cellulose perfectly. The higher *Acid Detergent Fibre* is, the lower the quality or the

forage digestibility of the forage are [33]. For that, the content of both fractions should be as minimum as possible to acquire optimal use of forages in feeding the ruminants. According to a research [34], it is stated that the dwarf napier grass has not given effect to the composition of NDF and ADF of dwarf napier grass.

Crude Protein of leaves and stems

Analysis of variance in Table 2 showed that intercropping of centro legume and dwarf napier grass had affected significantly ($P<0.05$) on crude protein content of leaves and stems. Duncan Multiple Range Test showed a difference between treatment P1 and treatment P2, P3, P4, P5 on crude protein of leaves and stems. The highest and the lowest on crude protein of leaves and stems are P1 and P5 treatment respectively. This is due to the Contribution of nitrogen in legume Centro. As is known that the content of crude protein of a forage is influenced by the availability of nitrogen in the soil solution [35]. The addition of organic matter such as organic fertilizer, legume intercropped can fixate nitrogen through symbiosis with *Rhizobium sp* affecting growth, plant survival, and metabolic activity in bacterial nitrogen fixation [36] [37].
Nutrient deficiency in crops results in low quality plant due to the absence of nutrient absorption for metabolic processes. The more nitrogen nutrient is supplied on the plant, the higher the crude protein content crude is obtained [38]. The function of legume is to provide or supply better nutrients, primarily in the form of the protein [7]. Furthermore [39], it is stated that intercropping of grass and legume is generally more productive than single-crop. The improvement in crude protein content will occur if nitrogen fixation performed by rhizobium bacteria functions effectively.

CONCLUSION

Based on the study, it is identified that intercropping of centro legume and dwarf napier grass can affect the production and quality of dwarf napier grass, such as on plant height, leaf area, number of tillers, dry matter of stem, crude protein of leaves and stems.

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