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## Macro minerals (Ca, P, Mg and K) concentration mixed of elephant grass (*Pennisetum purpureum*) CV. Taiwan and Legume *Indigofera zollingeriana*

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**Abstract.** This study aims to determine the content of macro minerals (Ca, P, Mg and K) of Elephant grass CV. Taiwan and Legumes of *Indigofera zollingeriana* are grown mixed with different doses of N fertilizer on land that was given Fungi Mycorrhizae of Arbuskula (FMA). This research was conducted by planting grass and *Indigofera* in the land by different N fertilizer: 0% N, 25% N, 50% N, 75% N. The measured parameters are macro mineral contents of Ca, P, Mg and K. Statistical Analysis calculated by the method of randomized block design with 4 treatments and 3 replications. The results showed that the treatment effect is not significant ( $P > 0.05$ ) on the content of macro minerals (Ca, P, Mg and K) of elephant grass CV. Taiwan and Legume *Indigofera*. The mineral content of elephant grass CV. Taiwan ranged from of Ca: 5.6 to 6.6, P: 3.2 to 3.6, Mg: 2.9 to 3.5, K: 5.0 to 5.8 g/Kg DM, respectively. While, macro minerals of legume *Indigofera* was ranged from of Ca: 4.1 to 4.9, P: 4.0 to 4.3, Mg: 2.8 to 3.0, K: 4.4 to 5.4 g/Kg DM, respectively. From the results of this study concluded that different doses of fertilizer N up to a dose of 75% gives the same result by giving N 0% to macro mineral (Ca, P, Mg and K) of elephant grass CV. Taiwan and Legume *Indigofera*.

**Keywords** – *Pennisetum purpureum*, *Indigofera zollingeriana*, macro minerals, N fertilizers and Mycorrhizae.

### 1. Introduction

One important factor in the improvement of farm-related livestock productivity, which is necessary to improve in terms of quality, quantity and sustainability is feed. Lack of feed, could be contribute to low livestock production. Therefore, it is necessary to attempt to improve forage feed especially in terms of quality and quantity. Forage is required by ruminants, because 74-90% of food consumed comes from good forage in the form of fresh or in dried form [1]. Forage for livestock feed can be sourced from the type of grass and legumes. Forage used are elephant grass. Elephant grass (*Pennisetum purpureum*) is an annual plant (*perennial*) which can be grown on a wide range of soil types that exist in Indonesia. This plant is suitable developed by breeders who have limited land area for production of elephant grass plants are known to have high production, but the grass has the disadvantage of nutrient and low mineral and nutrient content.

The nutritional content of elephant grass is relatively low due to this plant content high in fiber and low protein, while the mineral content of elephant grass lower than livestock needs. Efforts to improve nutrient and mineral content of grass that can be planted in a mixture of grasses and legumes for *Indigofera*. *Indigofera* resistant to drought stress and could be fixation Nitrogen from the moisture. *Indigofera* used is *zollingeriana*. Crude protein and high mineral potential make this plant as a source



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of replacement protein concentrates as well as mineral resources. The weakness of elephant grass in addition to the content of nutrients and low mineral content that is greedy for nutrients, so as to meet the nutrient needs of the elephant grass needs to be done tillage. For optimum soil treatment it is necessary intensive fertilization. Therefore, grass needs nitrogen fertilizer. Nitrogen is the main nutrient required by all plants for optimum growth and production. However, excessive N fertilizer and in the long term can damage the quality of the land, so that the soil needs to be enriched with *Mycorrhizae*. Mycorrhizal fungi used type of Mycorrhizal Fungi of Arbuskula (FMA). FMA can stimulate rooting in the soil. FMA hyphae association with the roots are able to absorb soil nutrients more so that fertilizer use can be reduced.

*Indigofera* and elephant grass are planted with mixed systems could be improved the nutritional value of plants and is expected to increase the mineral content. The mineral content should be available in sufficient quantities in the plant because of the animal's body can not make its own minerals. Minerals have an important role in the animal body. The early symptoms caused by deficiency of minerals in the form of reproductive decline of about 20-75%, retention of the placenta, the child born to be weak, and high child mortality [2]. Other diseases that arise are pneumonia, diarrhea, stomatitis, anorexia, and decreased milk production in dairy cows. Other symptoms are more severe fractures, dry and scaly skin, as well as a great emaciation. In the living body's own mineral is a constituent component of the body, 4-5% body weight consists of minerals, about 50% of the body's mineral composed of calcium, 25% phosphorus, and another 25% made up of other minerals. Therefore, minerals are needed for the survival of livestock due to the mineral content in forage fodder needs to be considered. The function of some minerals are calcium (Ca) as the formation of bones and teeth, blood clotting, activation of enzymes, and the contraction of tendons, phosphorus (P) as the formation of bones and teeth, part of many enzymes, the release of the body's energy, a part of DNA and RNA, magnesium (Mg) as an enzyme activator, part of a network framework and potassium (K) as the guardian of electrolyte balance, enzyme activators, the function of the tendon [3].

Based on the above a few information regarding the content of macro mineral (Ca, P, Mg and K) mixed by Elephant Grass (*Pennisetum purpureum*) CV. Taiwan and *Indigofera* which is grown contained of *Mycorrhizae* with different doses of N fertilizer in Padang, West Sumatra, Indonesia.

## 2. Materials and methods

### 2.1. Land preparation and planting

Land used for field trial research is the Technical Implementation Unit of Faculty of Animal Unand the top area of 300 m<sup>2</sup>. The land is divided into three plots. Each plot consists of four sub-plots. Each sub plot was given 18 holes then given FMA. Planting grass and *indigofera* is a mixture of the hole that has been enriched FMA. Elephant grass seeds that are used in the form of cuttings and seedlings *indigofera* used is *indigofera* who are 2 months old.

### 2.2. Fertilizing and plant maintenance

Elephant grass and planted *indigofera* given at a dose of N fertilizer 0% N, 25% N, 50% N, 75% N. Fertilization is done at age 15 HST (the day after grown) half-dose and half dose 30 days after planting. Plants maintained for 60 days for grass and legume *indigofera* for 120 days. During maintenance and cleaning watering crops from weeds regularly.

### 2.3. Harvesting and sample preparation

Harvesting is done at age 60 HST. Samples were separated between grass and *indigofera*, then weighed fresh weight, then chopped plant with a size of 2-3 cm and put into containers. Foliage along the container is dried in an oven 60 °C for 24 hours. After drying weighed so that the data get dry weight. Forage dried and then ground into powder and prepared for analysis.

#### 2.4. Parameters

The parameters measured were the content of macro minerals are calcium (Ca), phosphorus (P), Magnesium (Mg) and potassium (K) of elephant grass (*Pennisetum purpureum*) CV. Taiwan and *Indigofera zollingeriana*.

#### 2.5. Data analysis

This study used a randomized design with 4 rations treatments and 3 replications. All data obtained were analyzed by one way analysis and the differences between treatments were tested by Duncan's Multiple Range Test (DMRT), with  $p < 0.05$  indicating a significant difference.

### 3. Results and discussion

In Table 1 are presented the data minerals and *Indigofera* elephant grass planted in a mixture and were given different doses of N fertilizer. This analysis results showed that the treatment effect is not significant ( $P > 0.05$ ) on the mineral content of grass and legume *Indigofera*. While, significant effect between the forage species grass and legume ( $P > 0.05$ ).

**Table 1.** Macro minerals of Elephant Grass (EG) CV. Taiwan and Legume *Indigofera zollingeriana* (g/kg DM).

No	N Doses	Ca		P		Mg		K	
		EG	IZ	EG	IZ	EG	IZ	EG	IZ
1	0 %	5,6	4,9	3,6	4,3	2,9	2,8	5,0	4,5
2	25 %	6,6	4,4	3,4	4,0	3,5	3,0	5,1	4,4
3	50 %	5,6	4,8	3,2	4,2	3,3	2,7	5,5	5,4
4	75 %	6,3	4,1	3,5	4,2	3,0	2,9	5,8	4,9
	Rataan	6,0	4,6	3,4	4,2	3,2	2,9	5,3	4,8
	SE								
	EG vs IZ	*	*	*	*	*	*	*	*

Note: Between the N doses, macro minerals have not significantly different of ( $P > 0.05$ ).

SE = Standart of Error; EG vs IZ: Between species of the macro mineral have shown that significantly different ( $P > 0.05$ ).

Table 1 showed that the mineral content of macro minerals namely of Ca was ranged from 5.6 to 6.6 g/kg DM with the average of 6.0 g/kg DM, P content ranged from 3.2 to 3.6 g/kg DM with average 3.4 g/kg DM, Mg content ranged from 2.9 to 3.5 g/kg DM with average of 3.2 g/kg DM and K content ranged from 5.0 to 5.8 g/kg DM with average 5.3 g/kg DM, respectively. While, the mineral content *Indigofera* namely Ca ranged from 4.1 to 4.9 g/kg DM with the average 4.6 g/kg DM, P content ranged from 4.0 to 4.3 g/kg BK with the average of 4.2 g/kg DM, Mg ranged from 2,7 to 3,0 g/kg BK with the average of 2.9 g/kg DM and K content ranged from 4.4 to 5.4 g/BK kg with the average of 4.8 g/kg DM, respectively.

A comparison between the mineral content of elephant grass and *Indigofera*. *Indigofera* P content is higher than grass, whereas the content of Ca, Mg and K content of *Indigofera* lower than on grass. The high content of P in *Indigofera Zollingeriana* caused by the high content of P in the soil, while the low content of Ca, Mg and K *Indigofera* tend to caused by soil acidity and drought stress. On acid soils will decrease the ability of root nodules to fix N from the moisture. Also, it is could be seen planted crops where soil pH ranged from 4.81 to 4.98. Packaging of land does not affect the grass because grass is a plant that is resistant to soil acidity. Including tolerant crops on acid soils [4]. When compared with the research reported that the mineral content of legumes is higher than on grass this is in line with the content of P but is inversely proportional to the content of Ca, Mg and K [5].

The mineral content of elephant grass when compared with the results which reported mineral content (g/kg DM) for Ca ranged from 2.1 to 3.1, P 1.1 to 2.1, and K 3.6 to 5.3, respektivelt [6]. While the Mg content compared with the elephant grass research at 2.8 g/kg DM [7]. The mineral content of



elephant grass in this study is higher. The high content of Ca, P, Mg and K in this study due to the N, FMA and planting a mixture of grasses and legumes. N fertilization aimed at creating a high nutrient levels, so as to improve the quality of the crop. FMA aims to conserve the use of N fertilizer because FMA is able to extend hyphae - hyphae roots so that the absorption of nutrients in the soil can be improved. Planting a mixture of grasses and legumes can improve the nutritional content of the grass as the ability of legumes to fix N from the moisture and transfer it to the grass.

*Indigofera* mineral content compared with the results of research [8] reported *Indigofera* mineral content (g/kg DM) for Ca 3.4, P 1.0 and K 1.7. The content of Ca, P and K *Indigofera* in this study is higher, while the Mg content in research [8] 3.2 g/kg DM did not differ much from the results of 2.9 g/kg DM. The high mineral content of *Indigofera* in this study thought to be due to fertilizer N and FMA content. N fertilizer that serves to stimulate root growth and FMA that can help the absorption of nutrients in the soil.

If connected macro mineral contents of Elephant Grass and *Indigofera* in this study with the needs of cattle which has a weight of 300 kg [9], the cattle which consume 100% grass shortage (g/kg BS) Ca 20.7, P 33.1, 20.7 Mg and K 203.1. The giving of 100% *Indigofera* shortcomings (g/kg BS) Ca 8.3, P 5.5, 8.3 Mg and K 120.9. Giving 50% of elephant grass + 50% *Indigofera* (g/kg BS) Ca 13.4, P 19.2, 14.3 Mg and K 159.4, respectively.

#### 4. Conclusion

From these results it could be concluded that the content of macro minerals (Ca, P, Mg and K) in the elephant grass CV. Taiwan and Legume *Indigofera zollingeriana* planted with mixed system in mycorrhizal soil with different N fertilizer dose to dose 75% gave the same results with control.

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