

# The Effect of Different NPK Fertilizer on Butterfly Pea (*Clitoria ternatea*) Production on the First Harvest

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## ABSTRACT

This study aimed to determine the growth and production of butterfly pea (*Clitoria ternatea*) with NPK fertilizer. This research used a completely randomized design one-way ANOVA. The treatments were the 3 levels provision of NPK fertilizer of 0 kg/ha, 80 kg/ha, 160 kg/ha. This research used 30 days old butterfly pea. The growth variables observed were plant length, plant height, number of branches, number of flowers, number of pods, and forage biomass production. The data obtained were analyzed using a completely randomized design one-way ANOVA. The growth of butterfly pea with NPK 80 kg/ha was higher than the unfertilized plant, including plant height (72.58 cm vs 60.50 cm), number of branches (47.58 cm vs 38.35 cm), tendril length (9.31 cm vs 8.94 cm), and number of pods (62 vs 44). The forage production of butterfly pea with fertilizer 80 kg/ha and 160 kg/ha application was higher than the unfertilized plant, including fresh production (17.80 ton/ha vs 13.78 ton/ha), dry matter production (5.30 ton/ha vs 3.50 ton/ha), organic matter production (16.69 ton/ha vs 12.12 ton/ha). Therefore, the fertilizer application of NPK 80 kg/ha increased forage production in the butterfly pea plant.

**Keywords:** Butterfly Pea, NPK Fertilizer, Production

## 1. INTRODUCTION

Butterfly pea is a plant that is currently popular in Indonesia. Butterfly pea is increasingly popular in Indonesia because they provide many health benefits. Many studies have been conducted to find the advantages of the butterfly pea flower for food and human health. The butterfly pea flower contains suitable compounds for human health. Thus it is widely used as traditional medicine. It is also used as a natural blue to purple dye in food and tea [1]. Butterfly pea flowers are usually served in the form of drinks or processed into various foods. It contains antioxidants and had anti-inflammatory, anti-diabetic, and anti-obesity effects.

The butterfly pea flower is known in the field of food and health. Other parts of the plant, such as the stems and leaves, have not been utilized properly. The stems and leaves of butterfly pea have the potential to be used as forage for livestock. It is because the butterfly pea is a legume plant. Legume is a plant that performs symbiosis with rhizobium bacteria in the soil. So, it can bind and use free nitrogen plant growth. Rhizobium bacteria can

bind free nitrogen from the air and convert it to nitrogen compounds needed by plants for their growth [2].

The use of butterfly pea plants as animal feed has not been widely used in Indonesia. Hence it still has great potential to be developed as a forage plant. Butterfly pea contains a high crude protein content. It is also a plant that is easily found around the house. The butterfly pea regrowth ability is excellent, thus becoming the added value used as forage for livestock. Butterfly pea leaves contain crude protein between 18% and 25%, while the combination of stems and leaves contains crude protein between 9% and 15%, with dry matter digestibility values reaching 70% [3]. The butterfly pea is a shrub that is easily found in the open field with vine properties. Butterfly pea is suitable for ground cover because it has fast plant development and is easy to cultivate [4]. More and more people are planting butterfly pea in their homes [1].

Increasing the growth and production of forage can be done by applying fertilizers to plants. Fertilizer is a material that is added to the soil. It aims to fulfill the plant nutrient needs, then meets the maximum production. Fertilizers contain nutrients in both organic and inorganic

forms to comply with plant nutrient requirements [5]. Several planting system were important to increase biomass productivity such us planting density [6] [7] [8] [9], level defoliation [10], planting material [11], planting space [12], harvesting age [13] [14] [15] and regrowth management [16]. One of the crucial factors in determining plant growth and productivity is the complete and balanced nutrient availability that can be absorbed by the plant [17]. Fertilization is carried out to increase the soil's nitrogen, phosphorus, and potassium content to increase crop production [18]. Fertilization could increase crop yield and changed chemical composition [19]. Several research results informed the effect of nitrogen fertilizer can improve productivity in *Pueraria javanica* [20], *Azolla piñata* [21], *Shorghum sp.* [6], and *Chicorium intybus* [22] [23] [16]. One type of fertilizer is a compound fertilizer containing N, P, and K. The correct fertilizer dosage will affect the growth and yield of plants. This study reported the use of several levels of NPK fertilization on the growth and production of forage biomass of the Butterfly Pea plant.

## **2. 2 MATERIAL AND METHODS**

### **2.1. Research Design**

The research was conducted in regosol soil in Malangrejo, Wedomartani, Ngemplak, Sleman Yogyakarta, by planting butterfly pea on a research plot with 2 x 2 m, with 5 replications per level. The study used three levels of NPK fertilizer treatment. They were 0 kg/ha, 80 kg/ha, and 160 kg/ha. The plant spacing in the plot was 75 x 75 cm. This research used NPK Mutiara fertilizer with a balanced content (16-16-16). Fertilizer treatment modifies [3], namely the need for fertilization of the Butterfly Pea was 40 kg N / ha. This study used the NPK compound fertilizer. Fertilizer was applied twice, at the third week and fifth week after planting. Plant measurements were carried out one day before harvesting, at 65 days after planting (DAP). Harvesting was done when the plants reached the age of 65 DAP by cutting the stems 20 cm from the ground in the edible portion at the first harvest.

### **2.2. Observed Variables**

#### **2.2.1. Plant Height**

Plant height was measured from the stem above the ground to the highest part of the plant. Plant height was measured one day before harvesting. All plants in the research plot were measured in height and then recorded.

#### **2.2.2. Number of branches**

The number of branches was counted one day before harvesting the crop. All plants in the research plot were counted for the number of branches and then recorded.

#### **2.2.3. Tendrils length**

The tendrils of the plant were straightened so that the maximum length of the plant was known. The length of the tendrils was measured from the stem above the ground to the highest part of the plant after straightening the plant. The length of the tendrils was measured one day before harvesting. All plants in the research plot were measured for their tendril length and then recorded.

#### **2.2.4. Number of pods and flowers**

The number of pods and flowers was calculated by counting all the pods and flowers in the plant. The number of plants was counted at the time of harvesting. All plants in the research plot were counted for the number of pods and flowers and then recorded.

#### **2.2.5. Fresh production**

Forage in the form of stems and leaves were weighed in kg/m<sup>2</sup> units. The weighing results were then converted into ton/ha.

#### **2.2.6. Dry matter production**

The forages were analyzed for dry matter content than converted to ton/ha.

#### **2.2.7. Organic matter production**

The forages were analyzed for organic matter content than converted to ton/ha.

### **2.3. Data Analysis**

The research data in plant height, tendril length, number of branches, number of flowers, number of pods, forage biomass production, dry matter production, organic matter production was analyzed using a completely randomized design one-way ANOVA. Testing was done with the help of the application software statistical product and service solution version 16.0.

## **3. RESULT AND DISCUSSION**

### **3.1. Butterfly pea growth**

The growth of butterfly pea harvested at the age of 60 DAP with organic and inorganic fertilizers application is presented in Table 1.

**Table 1.** Butterfly pea growth with NPK (kg/ha) fertilizer.

Variable	Fertilizer		
	0	80	160
Plant height	60.50±3.5 0 <sup>a</sup>	72.58±3. 93 <sup>b</sup>	74.60±3. 30 <sup>b</sup>
Number of branches	38.35±5.4 0 <sup>a</sup>	47.58±4. 30 <sup>b</sup>	48.58±3. 38 <sup>b</sup>
Tendrils length <sup>s</sup>	8.94±5.35	9.31±3.05	9.33±2.3 0
Number of flower <sup>ns</sup>	80.28±5.2 9 <sup>a</sup>	96.95±3. 46 <sup>b</sup>	99.23±3. 46 <sup>b</sup>
Number of pods <sup>ns</sup>	43.30±5.2 0 <sup>a</sup>	53.43±9. 50 <sup>b</sup>	55.34±7. 46 <sup>b</sup>

<sup>ab</sup> different superscriptions on the same line indicate significant differences (P <0.05)

<sup>ns</sup> not significant, not significantly different (P > 0.05)

Table 1 shows that NPK fertilizer gave significantly different results (P > 0.05) on plant height, number of branches, number of flowers, and number of pods of the butterfly pea plant. This indicated differences in nutrient absorption, especially macronutrients (NPK) contained in fertilizers, resulting in further plant growth. The vegetative growth of plants, such as plant height, is primarily influenced by the availability of nitrogen and potassium when viewed from the aspect of growth support available in the soil [24]. Additional of NPK fertilizer can increase the amount of nitrogen available to the plant growth [25].

The plant will use the nitrogen element to accelerate plant growth by increasing plant height and the number of branches. Plants use potassium to help absorb water and nutrients in the soil [26]. Water is used in various metabolic processes that occur in plant cells and the process of photosynthesis. Plants use the metabolism and photosynthetic product for growth and development [27]. Water and nutrients absorbed by plants will affect plants' growth [28].

The formation of flowers and pods in the Butterfly Pea plant was influenced by the phosphorus provided by NPK fertilizer. Plants use phosphorus to accelerate flower growth, fruit ripening and increase grain production [29]. The NPK fertilizers contained phosphorus function to encourage flower growth and ripeness of fruit or seeds and increase the percentage of flower formation into seeds [30].

### 3.1. Butterfly pea plant production

The production of butterfly pea plants harvested at the age of 65 DAP with NPK fertilizer is presented in Table 2.

**Table 2.** Butterfly pea plant production with NPK (kg/ha) fertilizer.

Variable	Fertilizer		
	0	80	160
Fresh production (ton/ha)	13.78±1.2 4 <sup>a</sup>	17.80±1.1 6 <sup>b</sup>	18.28±2.1 6 <sup>b</sup>
Dry matter production <sup>ns</sup>	3.65±0.32 a	5.14±0.52 b	5.46±0.4 3 <sup>b</sup>
Organic matter production <sup>ns</sup>	12.22±1.4 7 <sup>a</sup>	16.79±1.1 2 <sup>b</sup>	17.32±0. 63 <sup>b</sup>

<sup>ab</sup> different superscriptions on the same line indicate significant differences (P <0.05).

Table 2 shows that fertilizer application gave significantly different results (P <0.05) in fresh production's dry matter and organic matter. It was influenced by the growth of the butterfly pea plant. Production is a result that describes the growth and development of a plant [31]. Water and nutrients absorbed by plants reflect the plant fresh weight. Water and nutrients absorbed by plants will affect growth, such as plant height and leaves, which shows in fresh weight. Better plant growth causes the increased production of fresh plants [32].

Butterfly pea plants with NPK fertilizer 80 kg/ha produced higher dry matter production compared with unfertilized butterfly pea plants. The application of organic fertilizers performed a higher dry matter production. It was influenced by the higher dry matter content of the butterfly pea plants with the application of fertilizer 160 kg/ha (30,1%), 80 kg/ha (28.9%) than the unfertilized butterfly pea plant (26.5%), as well as the fresh production, so the plant's dry matter production was higher where the amount of plants' chemical compounds is projected from biomass production [33]. Organic fractions in the plants can increase the dry matter content of plants [34]. The higher the biomass in plants, the higher the chemical compound content in it to increase the dry weight of the plant.

The data in Table 2 shows that NPK fertilizer gave significantly different results (P <0.05) in organic material production for the butterfly pea plant. Butterfly pea plants with NPK fertilizer 80 kg/ha and 160 kg/ha resulted in higher organic matter production compared with unfertilized butterfly pea plants (12.22 ton/ha). It can be caused by the content of organic matter in the plants. Giving additional nitrogen to plants is necessary because the increased nitrogen absorption can increase dry matter and organic matter production in plants [35]. According [36], NPK fertilizer spurs growth and increases nutrient content, thus increases plants' organic matter.

#### 4. CONCLUSION

Based on the research result and discussion, it can be concluded that the use of NPK fertilizer 80 kg/ha and 160 kg/ha can increase the growth and forage production of Butterfly Pea plants at the age of 65 days.

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