The Effect of Basic Fertilizer Doses On Soybean Growth And Production

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Abstract. The research aimed at examining the impact of fertilizer dose treatments on soybean yield. This study hypothesized that basic fertilizer effectively influenced soybean yield. The research was conducted in Randomized Complete Block Design (RCBD) with basic fertilizer doses as treatments. Three basic fertilizer doses were applied (P1, P2 and P3). P1 was fertibio application, 450 kg.ha\(^{-1}\); P2 was manure application, 750 kg.ha\(^{-1}\); and P3 was mixture of ½ doses of fertibio + ½ doses of manure (210 kg.ha\(^{-1}\) + 375 kg.ha\(^{-1}\)) and each treatment was performed in triplicate, totalling 9 experimental plots. The results showed that basic fertilizer doses had significant effect on soybean growth and production, while P2 treatment at 75 DAP (days after plant) gave better result on soybean plant height and branch number (89.388 cm and 19,600). For production of soybean, the better result for pod number in P2 treatment (20,029). Therefore, it can be concluded that manure can increase soybean growth and production.

1. Introduction

Soybean is one of the food sources of protein that favored by Indonesian society [1]. It became an important food commodity in food security program as functional food for human health [2] [3]. The growth of soybeans demand has been very significant for recent years especially for consumption and raw material. The need of soybeans nowadays is reaching 2.3 ton per year, while the soybeans production only reach 35-40% from the whole soybeans needed, so the rest is fulfilled by importing the soybeans from another country [2]. The Central Statistics Agency (BPS) noted that Indonesia’s soybean imports during 2019 reached 2.67 million tons and 2.51 million tonnes of which came from the United State. Meanwhile, the domestic soybean production in 2015 was 963,183 ton, about 40% of the national demand [4].

Efforts to increase soybean production, among others, through the acceleration of the intensification improvement and integrated crop management, optimization of land use, planting area expansion, breeder development, and quality seeds between fields. Increasing land use can be increased, one of which is the addition of organic matter which is applied as base fertilizer. Base fertilizer with macronutrient content is needed in the early stages of soybean growth. Nitrogen (N) is one of the most important elements needed for plant growth, and manure offers a potential source [5, 6]. Livestock waste also contributes high concentrations of N and P, and has been used as manure for thousands of years [7]. In addition, livestock manure is a good source of potassium (K), sulfur (S), and many trace minerals that are needed for crop growth [8]. Farmers directly apply many base
fertilizers available in the market, manures, and base fertilizer from the factory. This study then use base fertilizer to examine the impact of fertilizer doses treatment on soybean yield.

2. Materials and Method

The research was conducted at the trial field of Santilik Village, Mentaya Hulu Sub-District, East Kotawaringin Regency (112.62531 east longitude and -01.95808 south latitude), using a Randomized Complete Block Design (RCBD) with three replications, with basic fertilizer doses as treatments. The size of the trial plot was 1.500 m²; it was studied in 2018. Three basic fertilizer doses were applied (P1, P2 and P3). P1 was fertibio application, 450 kg/ha⁻¹; P2 was manure application, 750 kg/ha⁻¹; and P3 was mixture of ½ doses of fertibio + ½ doses of manure (210 kg/ha⁻¹ + 375 kg/ha⁻¹). The research materials consisted of Anjasmor soybean genotypes. Pests and diseases were controlled optimally. Drainage was applied to maintain optimum soil moisture. Fertilization with 50 kg Phonska/ha + 100 kg Urea + 100 kg TSP + 50 kg/ha KCl. The data was collected on plant height in 25, 35, 45, 55, 65, and 75 days after planting (DAP), number of branches in 25, 35, 45, 55, 65, and 75 days after planting (DAP), number of pods (taken from averages of 5 randomly plants’ samples), number of seeds in pod (taken from averages of 5 randomly samples plants), and yield (randomly taken from the seed yield per plot and converted to t/ha).

3. Results and Discussion

3.1 The Characteristics of The Research Area

The characteristics of the research area describe the geographical location, physical characteristics and administration of the area. In general, Santilik village is one of the 16 villages in the regional administration of Mentaya Hulu Sub-District, East Kotawaringin Regency. Its area reaches 10.20 km². The distance between Santilik village and Mentaya Hulu sub-district is about 15 km. The distance from the district capital of East Kotawaringin is about 145 km, and the distance from the provincial capital is about 199 km. Administratively, it has the following boundaries, in the north with village of Bawan, south with village of Santiung, west with village of Tangkarobah, and east with village of Kabuau. The population is 1,154 people, consisting of 639 male and 515 female. The community's livelihood is from farming of coconut, palm oil, rubber, food crops and horticulture, plantations, and palm oil company labor. Santilik is one of village designated by the local government as a model for integrated dryland agriculture development, because in 2018 there were a series of activities from East Kotawaringin Regency Agriculture Office, including development of 300 ha of upland rice. The number of farmer groups there are around 90 groups, but only about 8 active farmer groups, and there are 15 farmer group associations (Gapoktan).

The biophysical aspect of the environment is a part that cannot be examined in the finished system unit. This aspect affects the process of running the farming system and cultivation. Based of the results of the opinion there are 2 components of environmental biophysical aspects that affect the development of agricultural company that will be cultivated namely land resources and climate. Before the general activity, the condition of the land was still in the form of shrubs with natural vegetation that grew on oil palm areas that had previously been managed. The appearance of Imperata plants illustrates the relatives low level of soil fertility (Figure 1). So it is necessary to add organic materials and inorganic fertilizer.
The location of assessment activity is included in the dryland agro-ecosystem cone with a humid climate. The dryland conditions in dryland typology mostly consist of old soils that have undergone high leaching and are exacerbated by the absence of reformers, so they have low fertility levels. The general nature of the lands in this area is characterized by acidity and susceptibility to erosion, so this has an impact on low levels of fertility due to poor nutrients. The results of identification, soil types found at the location of the study activities are from utilisols order with association of typic palaeduts and typic hapludults. These soil types are located in tectonic landform and develop from clay and sandstone as the main material. This location is located in a choppy shape with a slope grade of 3-8%.

Soil types associated with typic palaeduts and typic hapludults are dryland with an effective depth and texture that relatively suitable for plant growth requirements. However, there are several obstacles, particularly the existence of low cation exchange capacity (KTK) and alkaline saturation (KB). This has an impact on the availability of nutrient elements in the soil which are needed by plant growth. In addition, the soil pH is acidic with a pH of 4.5 – 5.5.

The climatic conditions in this region fall into the category of tropical wet (humid) climate with type B (according to Schmidt and Ferguson). The humidity level is quite high with relative values ranging from 82-89% and monthly average temperatures ranging from 27-36°C. Rainfall conditions have a rather rare frequency with an average of around 1.934 mm/year. Another climate information that needs to be considered is the agro-climate zone, this area is included in zone B1. This explains that this area has the number of wet months of 7-9 consecutive months and number of dry months is around 2 months. Based on the results of the current area, the potential for water resources that can be used as a source of irrigation is the presence of branches or tributaries of the Mentaya river, which is about 6.82 km from the location.

3.2 The Growth and Production Component of Soybean
The manure application of P2 had significant effect on plant height since the age of plant 45 to 75 DAP compared to P1 and P3. Likewise for number of branches, P2 have significant effect at 35-75 DAP. For production, the better result of pod number and number of seed was P2 treatment (Figure 2).
Figure 2. Average of soybean plant height.

Figure 3. Average of soybean number of branches.

Figure 4. Average of soybean number of pods.
From the results, it may suggest that manure improve grow and production of soybean. If manure compare with NPK, it improves the effectiveness and efficiency NPK fertilizer [3]. In this treatment, available manure is reservoir of nutrients and these nutrients are released during humification, thus supplying the necessary elements for plant growth. The nutrient content of the poultry matter was fair, and the quantity applied must have supplied the important nutrients such as N and P which are critical for soybean growth [9] [10]. Expected nutrient supply available to the crop (for N in farmyard manure, about 20-30% of the amount applied is available to the crop during the first year; it can be relatively high under tropical climates) and the need to minimize nutrient losses or other detrimental effects [11].

4. Conclusion
Base fertilizer using manure at dose of 750 kg.ha\(^{-1}\) improved soybean growth and increased productivity. The results showed that basic fertilizer doses had significant effect on soybean growth and production, while P2 treatment at 75 DAP (days after plant) gave better results on soybean plant height and branch number (89,388 cm and 19,600). For production of soybean, the better result for pod number in P2 treatment (20,029). Therefore, it can be concluded that manure can increase soybean growth and production.

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