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GROWTH RESPONSE OF SOYBEAN (*Glycine max* (L.) MERRILL) TO ADDITION SENTANG LEAVES (*Azadirachta excelsa* (JACK.) JACOBS) AND MINDI LEAVES (*Melia azedarach* Linn.)

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ABSTRACT

Soybeans is one of important food sources in Indonesia mainly as protein resources. The needs of soybeans which increasing and lower number of cultivation land causes soybeans import. Soybeans productivity improvement could be done by agroforestry system. Mindi and sentang are a fast growing species which famously cultivated at this time. One of benefit gained from agroforestry system is providing sources of organic material. Planting combination between mindi and sentang with soybeans could give organic material such as from mindi leaves and sentang leaves. This research aimed to examine the response of soybeans growth to the additional of leaves. The experimental design used was Complete Random Design (CRD) with single factor and seven treatments (control, dry whole, dry chopped, dry powder, wet whole, wet chopped, and wet powder. This research shows that the addition of sentang leaves does not impact to the diameter and height growth. The additional of mindi leaves give not significantly different to the growth of soybeans diameter, total dry mass, and total wet mass. The additional of sentang leaves give effect to the growth of number of leave, total wet mass, total dry mass and total pud mass. The additional of mindi leaves give significant impact to the height, number of leaves, and pot mass. The treatment give best impact to total pud mas was sentang dry leave chopped and mindi dry leave whole.

Key words: Agroforestry, *Azadirachta excelsa*, *Glycine max*, *Melia azedarach*

INTRODUCTION

Soybean is a multipurpose plant because of its use as food, feed and industrial raw materials processed. Soy protein content higher than other types of nuts (Kamsiati 2006). Soybean production in 2014 was estimated at 921.34 thousand tons of dry beans or increased as much as 141.34 thousand tons (18.12%) than in 2013 (BPS 2014).

This production increase is still not sufficient to complete the needs of the community so that the increase in production still needs to be done. One alternative that can be used is the optimization of land by implementing agroforestry systems. Agroforestry system is a dynamic management of natural resources by integrating plant-based ecological forestry with agricultural crops in the landscape (FAO 2006). Benefits of agroforestry system consists of protection and land productivity as well as productivity results obtained from agricultural crops or forest litter, forestry plant roots, shade, etc. (Ridiah 2010).

Sentang and Mindi is a multipurpose tree species that is rapidly growing because all parts of the plant can be utilized. Both have a tree canopy cone with a balanced architecture, so the potential is developed with agroforestry. Planting trees together with crops in one area have a positive impact one of which provides a source of organic matter. The leaves of the plant Mindi and Sentang can be a source of nutrients for crop soybean underneath. Moreover, the addition of organic matter can improve the environment in which to grow. Based on these considerations, the study was conducted in order to determine the growth response of soybean (*Glycine max* (L.) Merrill) to addition of Sentang leaf (*Azadirachta excelsa* (Jack.) Jacobs) and Mindi (*Melia azedarach* Linn.).

METHODS

Location and Time

The study was conducted in the nursery section of Silviculture, Department of Silviculture, Faculty of Forestry, Bogor Agricultural University. Time the study began in January to April 2015.

Tools and Materials

The tools used in this study are hoes, polybag, scissors, blender, buckets, scales, caliper, tallysheet, ruler, measuring tape, old newspapers, ovens, cameras, software Ms. Word, software Ms. Excel, SAS 9.1 software Portable. Materials used in this study are soil, compost, soybean seed, fresh and dried leaves Sentang, fresh and dried leaves Mindi, NPK fertilizer, fungicide and insecticide active ingredient Mankozeb Deltamethrin and Carbofuran.

Research Procedure

Planting and Maintenance

Growth media for soybean planting consisted of soil and compost with a ratio of 3 : 1. Each polybags contains planting medium as much as 1 kg. Sentang leaves and Mindi leaves that will be used in the study consisted of fresh and dried leaves in the form of whole, chopped and powder. Dose leaves are added to the growing media is 50 g per polybag. Soybean seed is varieties Grobogan. The number of seeds are planted two seeds in each polybag. Soybean seed planted in a hole that had been prepared with the drill. Planting holes totaling two with each hole planted the seeds of soybean and plus Carbofuran. Plant maintenance consists of fertilizing, thinning, cleaning weeds (weeds), watering, giving marker and pest and disease control. The data taken is high, diameter, number of leaves, total wet weight, dry weight and the total weight of the pod. The data were recorded in the tally sheet. Soybean harvest time is determined when the plants have started yellowing nearly 90% and the pod has lost its green color. For these types of Grobogan, the harvest is done at the age of 12 weeks after plant. Plants then separated into the roots, shoots and pods. The parameters observed in this study were plant height, diameter, number of leaves, total wet weight, total dry weight, and weight of pods.

Design of Experiments and Data Analysis

The design used in this research is completely randomized design (CRD). This study uses a factor of seven treatments and each treatment was repeated five times. There are:

S : Sentang leaves P: Mindi leaves

1 : Control 2 : Wet whole
3 : Wet chopped 4 : Wet powder
5 : Dry whole 6 : Dry chopped
7 : Dry powder

Data obtained from observations are then analyzed using a linear model as follows (Mattjik and Sumertajaya 2006):

$Y_{ij} = \mu + \tau_i + \varepsilon_{ij}$

Y_{ij} : Observations on granting leaves Sentang and Mindi to-i and repeat all
μ : Mean general
τ_i : Influence of treatment factors Sentang and Mindi granting leaves to-i
ε_{jj} : Error treatment i-th and j-th repetition
I : Treatment
j : Soy into 1, 2, 3, 4 and 5

Further data was processed using SAS software 9.1.3, if:

a. P-value> α (0:05), then the treatment had no significant effect on the parameters of height, diameter, total wet weight, dry weight and the total weight of the pod.
b. P-value <α (0:05), then the real treatment effect against high parameters, diameter, total wet weight, dry weight and the total weight of the pod. When the real treatment effect, the data was then tested further by Duncan's Multiple Range Test.

RESULT AND DISCUSSION

Growth is the addition of volume and mass of plants. The addition of the volume indicated by the growth of both primary and secondary. Primary growth occurs in the form of additional high meristem tissue, while secondary growth occurs in the cambium tissue shown by the increase in diameter (Darmawan and Baharsjah 2010). Wet weight and total dry weight of the plant growth is an indicator of mass accretion. Treatment addition Sentang and Mindi leaves give a different effect on soybean growth parameters.

Growth parameters were not significantly affected giving is height and diameter of Sentang leaf, whereas the real effect parameter is the number of leaves, total fresh weight and dry weight and the total weight of the pod. Giving mindi leaves with various treatments significantly affected plant height, leaf number and weight of pods. Giving mindi leaves with various treatments do not provide a real influence on the diameter, total fresh weight and dry weight of the total soybean crop (Table 1).

Table 1 Recapitulation of the variance effect of addition Sentang leaves and Mindi leaves the growth of soybean

Parameters	Treatment	
	Sentang leaves	Mindi leaves
Diameter	tn	tn
Height	tn	*
Number of leaves	*	*
Total wet weight	*	tn
Total dry weight	*	tn
Total weight of the pod	*	*

Description: The figures in the table is significant value; * = Significant effect on the treatment of 95% confidence interval with a significant value (Pr> F) 0:05 (α); tn = treatment had no significant effect on the confidence interval of 95% with a significant value (Pr> F) 0:05 (α).

Treatment S6 and P5 generates the best response to the number of soybean leaves. Sentang leaves and leaf dry Mindi has a value of C / N is lower than Sentang leaves fresh. This resulted in the decomposition process is faster than the dried leaves of fresh leaves. Rapid decomposition in the dry leaves enables the availability of nutrients faster than soybean ability to absorb nutrients. Sentang leaf nutrient content is also much more than the dried leaves of fresh Sentang such as phosphorus and nitrogen. It provides nutrients for the soybeans in the formation of the leaf. The number of leaves affects the production because of its connection with the process of photosynthesis. The more leaves, the photosynthetic process will be maximized resulting in greater production.

An accumulation of plant biomass and growth within a certain area. Biomass is often used in the study of plant growth because it is relatively easy to measure and the accumulation of all the physiological processes of plants. Wet weight can be used as an indicator of growth when it has a linear relationship with a dry weight (Sitompul and Guritno 1995). Results of analysis of variance showed that the leaf Sentang have a significantly different effect on the total wet weight and total dry weight, while giving leaves mindi no significant effect on the growth of the soybean biomass (Table 1).

Wet weight and total dry weight of most major soybean owned by S6 treatment. This is related to the type and shape of leaves Sentang used as an addition of nutrients. In addition, the amount of wet weight and dry weight with regard to the number of leaves and the process of photosynthesis. The number of leaves was not affected by the diameter and height of the plant because the two are not significant. Dry matter accumulation reflects the ability of plants in the binding energy of sunlight through photosynthesis and interaction with other environmental factors. S6 has a number of leaves at most compared to the other treatments, so the ability of plants to photosynthesize greater and greater biomass yield as well.

Weight pod is one indicator of growth in the generative phase. Weight of the pod important parameter to measure because the main use of soybean on soybean seed. The higher the weight of the pod then productivity higher. Research on soybean usually seek to improve the productivity. Results of variance showed that the giving of Sentang leaf and mindi leaf provide a significantly different effect on the weight of the pod. Treatment S6 has the highest weight of the fruit pods compared to other treatments.

Treatment S6 and P5 have the highest weight of the pod. This is presumably because the S6 and P5 have the most number of leaves. The number of leaves was instrumental in increasing soybean yield relation to the process of photosynthesis. Leaves as the main organ in the process of photosynthesis because it serves receive sunlight and photosynthesis, thus indirectly contribute significantly to the yield of soybean (Darmawan and Baharsjah 2010).

CONCLUSION

Treatment provision Sentang leaves did not significantly affect the growth of diameter and height, but significant effect on the growth of the number of leaves, total wet weight and dry weight and total weight of pods. Giving Mindi leaves no significant effect on the diameter, total fresh weight and dry weight of the total soybean crop, but the granting of leaves mindi give real effect to height, number of leaves, and heavy pod. Treatment provision leaves that give the most excellent effect against weight Sentang pods are dried chopped leaves and dry mindi leaves intact.

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