



STUDY ON THE USE OF ORGANIC FERTILIZER TO IMPROVE PLANT PRODUCTIVITIES IN THE AGROFORESTRY SYSTEM

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Introduction

Agroforestry system is an example of land use that has been developed in areas with poor soil fertility in the area of Education Forest of IPB, in Gunung Walat, Sukabumi, Indonesia. This system was able to serve the environment, and also improve the farmer's welfare through intensive management, such as fertilizer application, maintenance of plant diversity, the use of superior planting stock and application of proper silvicultural techniques.

One challenge faced by agroforestry system, as in all other land use systems in tropical area, is the low efficiency of nutrient utilization (Van Noordwijk *et.al.* 1996). Effort to improve nutrient utilization efficiency in agroforestry of Gunung Walat Education Forest is by planting various kinds of crops such as among other things sengon (*Parasertiantehes falcataria*) and dammar (*Agathis loranthifolia*). For improving the growth of such crops, either of those developed under shaded or open site, there had been efforts to improve nutrient status by fertilizer application or input of organic material, so that nutrient availability in the site is increasing and high productivity could be sustainably achieved (Lal, 1995).

The objective of this study is to learn the effect of fertilization on the diameter and height growth of dammar in agroforestry system in Education Forest of Gunung Walat.

Materials and Methods

Three treatments of fertilizer application, namely 15 g NPK, 500 g Bokashi, and Bokashi 1000 g were applied on sengon and dammar plants. Comparison was made to Control treatment. Two agroforestry systems were selected in this research, namely under the shade (with tree density



around 100 trees per hectare), and open site. Observation of height and diameter of each plant species was conducted for 6 weeks.

Experimental design used in studying the effect of fertilizer is Factorial Experiment 2 X 3 which was Completely Randomized. Shade factor consisted of two levels, namely shaded and open site. Factor of fertilizer application consisted of 4 levels, namely Control, 15 g NPK, 500 g Bokashi, and 1000 g Bokashi. Each treatment had 15 replications.

Results And Discussions

According to analysis of variance, fertilizer application for dammar and sengon in agroforestry system produces significant effect, either in terms of height or diameter growth. However, in the interaction between shade and fertilizer application, only diameter growth of dammar that gave significant respond.

Table 1 Height growth of dammar and sengon plants at various dosages of fertilizer application

Fertilizer dosages	Height (cm)	
	Dammar	Sengon
B0	2.87 ^{b*)}	6.11 ^c
B1	4.27 ^a	8.63 ^d
B2	4.97 ^a	13.83 ^a
B3	4.57 ^a	8.22 ^b

Notes :*) numbers followed by similar letter, in the same column, are not significantly different at 0.05 significant levels.

Bo = Control

B1= 15 g NPK

B2 = 500 g Bokashi

B3 = 1000 g Bokashi.

Table 1 showed that there was significant difference in terms of height growth of dammar and sengon, between fertilizer treatment, either for NPK or Bokashi as compared to Control. Fertilizer application of 500 g Bokashi was able to increase height growth by 42 %, whereas the corresponding figure for 1000 g Bokashi was 37 %, and for 15 g NPK was 32 % as compared to Control. The highest average of sengon height was exhibited by treatment of 500 g Bokashi with increase by 55 %, followed by treatment of 15 g NPK with increase by 29 % and 1000 g Bokashi with increase by 25 % as compared to Control. In other words, the organic fertilizer application (500 g Bokashi) produced better height growth and differed significantly with those of 15 g NPK fertilizer and 1000 g Bokashi for

sengon, whereas for dammar plant there was no significant difference between Bokashi and NPK fertilizer.

Table 2 Diameter growth of dammar and sengon at various dosages of fertilizer

Fertilizer dosages	Diameter (cm)	
	Dammar	Sengon
B0	0.08 ^{c*)}	0.09 ^b
B1	1.13 ^b	1.17 ^a
B2	1.12 ^b	1.18 ^a
B3	1.16 ^a	1.19 ^a

Notes :*) numbers followed by similar letter, in the same column, are not significantly different at 0.05 significant levels.

Bo = Control
 B1= 15 g NPK
 B2 = 500 g Bokashi
 B3 = 1000 g Bokashi.

Table 2 showed that there was significant difference in terms of diameter growth of sengon and dammar between fertilizer treatments, either for NPK or Bokashi, as compared with those of unfertilized plants or Control. There was significant increase in diameter growth of dammar with application of 1000 g Bokashi fertilizer, namely by 93 % as compared to Control, whereas the corresponding figure for 15 g NPK and 500 g Bokashi was 92 %. In sengon plant, there was significant increase in diameter growth, with application of 1000 g Bokashi, 500 g Bokashi and 15 g NPK, namely by 92 % as compared to control, or in other words, the three treatments were relatively similar or did not differ significantly.

Table 3 Height growth of dammar and sengon according to land cover condition

Land cover condition	Height (cm)	
	Dammar	Sengon
With Shade	4.56 ^{a)}	7.64 ^a
There Without Shade	3.78 ^b	10.82 ^b

Notes :*) numbers followed by similar letter, in the same column, are not significantly different at 0.05 significant levels.

Table 3 showed that there was significant increase in height growth of dammar under shade compared to open site (without shade), but height growth of sengon was significant increase in open site compared to under shade.

Table 4 Diameter growth of dammar and sengon according to land cover condition

Land cover condition	Diameter (cm)	
	Dammar	Sengon
With Shade	0.11 ^{a)}	0.15 ^a
Without Shade	0.14 ^a	0.17 ^a

Notes :*) numbers followed by similar letter, in the same column, are not significantly different at 0.05 significant levels.

Table.4 showed that there was no significant difference in terms of diameter growth of dammar and sengon between those under shade and open site (without shade). In other words, difference in land cover condition did not give significant effect on diameter growth of dammar and sengon.

Table 5 showed that interaction between shade treatment and 1000 g Bokashi treatment produced the best diameter of dammar and significantly difference as compared to other treatment interaction.

Table 5 Interaction between treatments and dammar diameter

Interaction	Diameter (cm)
A2B3	0.18 ^a
A2B1	0.16 ^{ab}
A1B3	0.14 ^b
A2B2	0.14 ^{bc}
A1B2	0.01 ^{cd}
A1B1	0.09 ^d
A2B0	0.08 ^d
A1B0	0.07 ^d

Notes :*) numbers followed by similar letter, in the same column, are not significantly different at 0.05 significant levels.

- A1 : With Shade
- A2 : Without Shade
- B0 : Control
- B1 : 15 g NPK
- B2 : 500 g Bokashi
- B3 : 1000 g Bokashi

The two phenomena as described above, which are related with height and diameter growth, are in line with characteristics of dammar plant that need shade during juvenile stage. Data from the study supported this suggestion, where the height growth of dammar in shaded sites is higher as compared to open area. On the other hand, for sengon plant, height growth in open site showed a tendency to be higher as compared to that of shaded sites at each fertilizer treatment.

Data of height and diameter growth indicates that organic fertilizer Bokashi that was applied directly will influence the nutrient status in the soil, namely the occurrence of total N increase which had implication on the size of height and diameter of dammar and sengon trees. Beside that, organic fertilizer application could reduce the input for artificial fertilizer so that in the future, there will be tendency toward organic farming soil management. Therefore, efforts to produce organic fertilizer from organic materials available locally (in situ), is an appropriate choice for simultaneous improvement of soil characteristics in Gunung Walat area.

Conclusion

1. Sengon growth in open site was better than that under shaded site. On the other hand, for dammar, in general, growth is better under the shade.
2. The best fertilizer for improving the height growth of dammar and sengon was 500 g Bokashi, whereas that for diameter growth was 1000 g Bokashi. In general, organic fertilizer was better in improving plant growth if compared with artificial fertilizer (15 g NPK). Interaction combination between without shade treatment and 1000 g Bokashi treatment produced the best diameter growth for dammar.

References

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