The Influence of Mycorrhiza and Organic Ferlitizer to The Growth of Seedling Matoa (*Pometia pinnata*)

Sugiyarto[1],**Putri Kusuma Wardani**[1&2], **Prabang Setyono**[1], **Edwi Mahajoeno**[1], **Sunarto**[1]
[1)]Postgraduate Program Sebelas Maret Unversity Surakarta
[2)]SMP Negeri 8 Surakarta (0271) 632947

Abstract. This research was conducted on Central Laboratory Sebelas Maret University Surakarta from December 2010 to May 2011. The purpose of this research was to find out the influence of mycorrhiza, organic fertilizer and their combination to the growth of seedlings matoa. The reseach was arranged on Completely Randomized design with two treatments factor ; i e : giving mycorrhiza (0 g, 5g, 10g /polybag) and giving organic fertilizer (0ml, 1ml, 2ml /polybag) respectively each in 6 replications. The observed treatments were plant height, leaf number and plant biomass. The observation datas were analyzed by multivariate analysis level of 5 %, continued with LSD test. The result showed that there was no significant influence on given mycorrhiza for matoa seedling growth for all of the growth parameters. There was no influence of organic fertilizer for plant height parameter, but significantly influence for the number of leaf and biomass. The best increase of the number of leaf and biomass was on organic fertilizer treatment at 2ml dosage. There were no influence in the growth of matoa by the combination treatments betwen mycorrhyza and organik fertilizer.

Key word : Mycorrhiza, organic fertilizer, the growth, matoa (*Pometia pinnata*)

INTRODUCTION

Matoa (*Pometia pinnata*) was a plant that produced fruit and had the potential to be developed as an Indonesian fruit seed. Matoa was one of the endemic species of plants in Papua. This plant could growth only in Papua first (Suharno and Tanjung, 2011). However this plant had spread rapidly throughout the region in Indonesia, namely Sumatra, Java, Sulawesi, Sumbawa Island, Maluku and Papua. In the exploitation of forests in Papua, matoa was the most widely harvested trees. Cutting down all the trees caused the population decrease. On the oher side, replanting effort had not been done yet (Suharno and Tanjung, 2011). Matoa was an adaptive and suitable plant for replanting accelerated program, so it took a lot of seeds. Then matoa seedlings needed to be done.

The requirements growth of matoa based on several surveys in Papua indicated that matoa could be grown in areas with low to high nutrient content (Suharno and Sufaati, 2008). According to Suharno and Tanjung (2011) to stimulate the early growth of matoa seeds, that was needed enough nutrient.

Supplied of good seed could be done for example by the application of biotechnology crops and land improvements that was environmentally friendly. Application of soil microbial with Vesicles Mycorrhizal Arbuscul (VMA) became one of the efforts to optimize the prospective biotechnology. According Miransari (2010), an alternative method that could provide nutrients for plant growth and yield of production was the used of soil microbes which proved beneficial. The used of mycorrhizal fungi as biological equipment in agriculture could improve growth, productivity and quality of crops without reducing the quality of soil ecosystem. Mycorrhizal fungi had been known that it was beneficial effect of plant growth because it could enhance nutrient uptake, especially P element that was much needed young plants in forming meristematic tissue.

The utilization of mycorrhizal fungi in some commercial plants had shown good results (Anwarudin et al, 2008). VAM

inoculation on apples could improve the content of P on their leaves. For the VAM, the element of P was an important part that can affect the colonization with the host plant roots (Linderman and Davis, 2004). The use of mycorrhizal primarily aimed at nutrient-deficient land. However if the land lack in C element, it should be used organic fertilizer. The use of both could also be done to provide for C and nutrient as well.

In Indonesia, an organic fertilizer had long been recognized by farmer, but most of them were highly dependent of artificial fertilizer and other external inputs on a large scale, caused pollution of water sources, which mean reduction in enviromental quality (Pujianto,2001). Another problem of artificial fertilizer that was used for this, caused damage to soil structure, resulting from the use of artificial fertilizer continuous, so the development of roots became imperfect. In this research wanted to be known the growth of matoa seedlings caused by mycorrhizal, organic fertilizer and their combination treatment.

MATERIAL AND METHOD

The research was conducted from December 2010 to May 2011. Analysis and testing of parameters were done every month fo plant height and number of leaves parameters, while for biomass and mycorrhizal infectivity test were done in April to May 2011. The place of this research was at the Central Laboratory Sebelas Maret University Surakarta.

The research was arranged in Completely Randomized Design factorial pattern, consist of two factors with six replications. The first factor was the concentration of mycorrhizal (A) comprized 3 standard :

A_0 : without mycorrhizal
A_1 : 5g mycorrhizal/polybag
A_2 : 10g mycorrhizal/polybag

The second factor was the concentration of organic fertilizer (B), comprized 3 standard :

B_0 : without organic fertilizer
B_1 : 1ml organic fertilizer/polybag
B_2 : 2ml organic fertilizer/polybag

Therefore there were 9 treatments combinations as follows :

A_0B_0 A_1B_0 A_2B_0
A_0B_1 A_1B_1 A_2B_1
A_2B_2 A_1B_2 A_0B_2

Seedling growth matoa variable was observed at the first, second and third month after treatment included plant height, number of leaves and plant biomass. The data od mycorrhizal infectivity was displayed descriptively with the histological preparation image root. Matoa seedlings growth data were statistically analysis to test variance (ANOVA), and if there was a real difference, followed by LSD test.

RESULTS AND DISCUSSION

A. Mycorrhizal Infectivity

Root of seedlings matoa being infected with mycorrhizal if there was found vesicles, arbuscul, hyphae and spores or four things. In this research there was found only one sign of a vesicle at the observed root sample, namely the provision of sample with mycorrhizal 5g/polybag combined with no organic fertilizer treatment (figure 1)

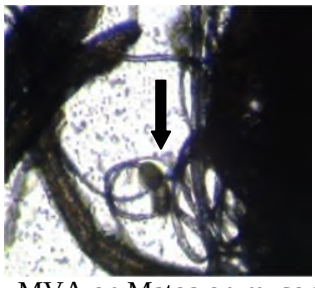

Figure 1. MVA on Matoa on mycorrhizal 5g/polybag combined with no organic fertilizer treatment

In this research there was shown lack of mycorrhizal infection in matoa roots. This could happen because it was influenced by several factors including the species of fungi and environmental factors. The species of fungi was suspected related to the relationship between suitability of plants with VMA and their environmental condition. If the VMA mach to the host plant, in general VMA had also been adapted to the growth environment. As the opinion of Anwarudin (2008) which stated that the ability of the VMA could associate with several commercial plants quite wide, however compliance in symbiosis with plants was strongly influenced by variety of soil condition, type of mycorrhizal and plant species.

Environmental conditions that was suspected influence the development of VMA was soil media used factor. Type of soil that be used for VMA colonizations in this research were not tested before. Other conditions thought to affect the result of this research was because of the water given in the soil media in polybag was too much. Watering was done every two days, whereas according to Delvian (2005) production of spores of several VAM would increase in dry conditions.

Another factor that infuence the development of VAM was the age of the plant. Observations of VAM infection in this research were done after 3 months-old-seedlings. VAM colonization with matoa seedlings root in this research had not develop optimally yet because of the relatively short observation time was 3 months after planting, so at that time the mycorrhizal growth response had not been seen clearly. According to Abbot (1982)

B. The Growth

1. The Growth due to Mycorrhizal

a. Plant Height

The observation on plant height (figure 2) based on that plant height was a measure og growth that was easily seen (Sitompul and Guritno,1995).

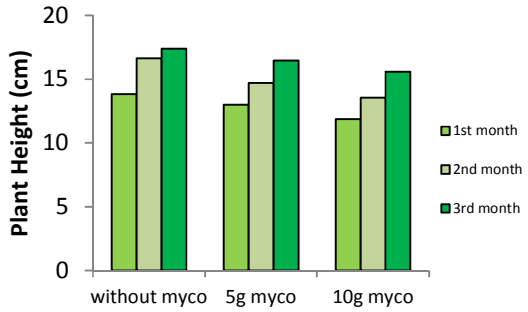

Figure 2. Histogram Plant Height of Matoa Seedlings at Mycorrhizal Treatment

Based on the calculations for mycorrhizal treatment data description, obtained an average of increased plant height for 3 months, with no mycorrhizal was 1,83, for giving 5g mycorrhizal was 1,84 and for giving 10g mycorrhizal was 1,79. Based on that result showed that the best average increased of plant height was the provision of 5g mycorrhizal/polybag.

b. Number of Leaves

The observation variable of number of leaves was very necessary as one indicator of plant growth (figure 3)

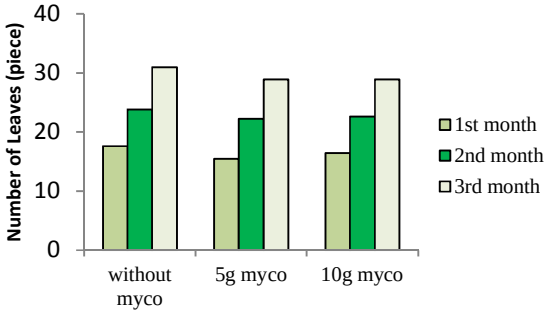

Figure 3. Histogram Number of Leaves of Matoa Seedlings at Mycorrhizal Treatment

Based on the calculation for mycorrhizal treatment data description, obtained an average increase number of leaves for 3 months, with no mycorrhizal was 5,78, for giving 5g mycorrhizal was 5,78 and for giving 10g mycorrhizal was 5,35. Based on that result showed that the best average increased of number of leaves was the provision of 5g mycorrhizal/polybag.

c. Plant Biomass

Biomass was a reflection of the energy capture by plants in photosynthesis process. That was greatly influenced by the optimal process of photosyntesis where the biomass formed reflected the amount of photosyntat as photosynthesis result.

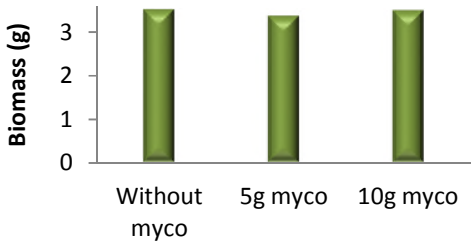

Figure 4. Histogram Biomass of Matoa Seedlings at Mycorrhizal Treatment in The Third Month

Based on the calculations for mycorrhizal treatment data description, obtained an average of increased plant biomass after 3 months, with no mycorrhizal was 3,53, for giving 5g mycorrhizal was 3,38 and for giving 10g mycorrhizal was 3,51. Based on that result showed that the best average increase of plant biomass was the treatment with no mycorrhizal.

The results of multivariate analysis showed that the variation of mycorrhizal treatment had no real effect on plant height, number og leaves and plant biomass. It might occur because the plants at the age of 3 months after planting, it had not find any signs of mycorrhizal infection. With or without giving a differences dosage of mycorrhizal, the growth result obtained was not significantly different.

2. The Growth due to Organic Fertilizer

a. Plant Height

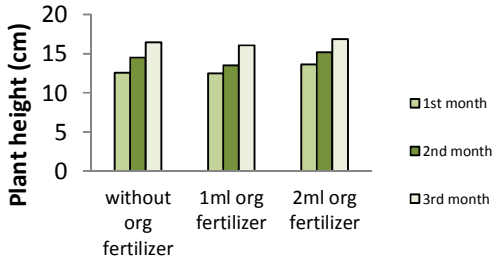

Figure 5. Histogram Plant Height of Matoa Seedlings at Organic Fertilizer Treatment

Based on the calculations for data description of organic fertilizer treatment, obtained an average of increased plant height for 3 months, with no organic fertilizer was 1,89, for giving 1ml organic fertilizer was 1,72 and for giving 2ml organic fertilizer was 1,88. Based on that result, showed that the best average increased of plant height was 1,89 or with no organic fertilizer.

Based on the multivariate analysis, showed that the variation of organic fertilizer treatment had no real affect on plant height. According to Gardner (1991) stated that the growth and plant production were influenced by their environment. The increase of plant height was one of the characteristics of plant growth, caused by cell division activity at meristem apical. The increased of plant height, according to Herdiana (2008) was begun with an increasing by elongated shoots and continued their growth became leaf and stem.

In this research, the result on the parameters of plant height were significantly different, because of the different intensity of sunlight received by plant, although the plant were treated with different doses or

without organic fertilizer. In the shaded plants, the auxin hormon was dominant. Sunlight could increase the working of auxin to stimulate cell renewall, but if the sun was too much the auxin was inhibited, so the plants had such a problem in their growth (Hapsari,2008).

High sunlight intensity could increase the amount of carbohydrates in the plant and according to Kastono (2005) carbohydrates needed in a large quantities to influence the processes of cell division and elongation which were factors that influenced plant growth. The process of plant growth and development manifested by the accumulation of asimilat which would translocate to the various plant organs, such as plant height, number of leaves and plant biomass. If the plant was not able to form enough asimilat, the competition between organs coud have been occured.

b. Number of Leaves

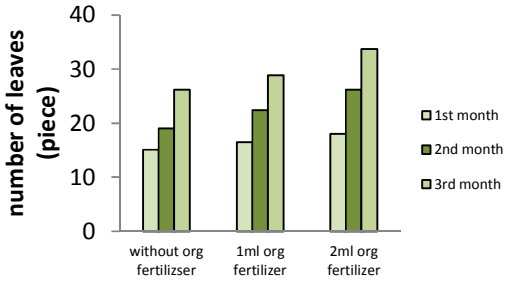

Figure 6. Histogram Number of Leaves of Matoa Seedlings at Organic Fertilizer Treatment in The Third Month

Based on the calculations for data description of organic fertilizer treatment, obtained an average of increased number of leaves for 3 month, with no organic fertilizer was 4,83, for giving 1ml organic fertilizer was 5,74 and for giving 2ml organic fertilizer was 6,35. Based on that result, showed that the best average of number of leaves was the organic fertilizer treatment at 2ml/polybag.

Based on multivariate analysis, showed that the organic fertilizer treatment could influence the increase of number of leaves. There were a significantly effect, so the datas were continuous analyzes with LSD test. The highest average of the number of leaves was in the provision of organic fertilizer for 2ml/polybag.

c. Plant Biomass

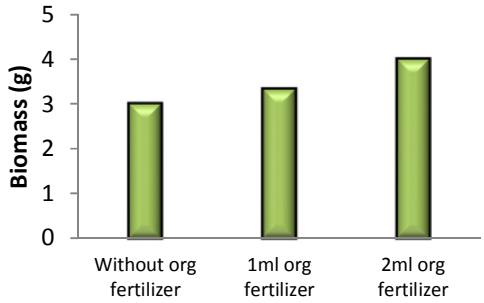

Figure 7. Histogram Biomass of Matoa Seedlings at Organic Fertilizer Treatment in The Third Month

Based on the calculations for data description of organic fertilizer, obtained an average increase of plant biomass after 3 months, with no organic fertilizer was 3,02, for giving 1ml of organic fertilizer was 3,35 and for giving 2ml of organic fertilizer was 4,02. Based on multivariate analysis, the obtained of p value was 0,004 which means that the giving of organic fertilizer influenced on plant biomass. The highest average of plant biomass was on the provision of 2ml organic fertilizer/polybag.

Organic fertilizer in this research significantly influence to the number of leaves and plant biomass. This could happen because of organic fertilizer had an important role in soil fertility, such as a source of plant nutrients and could form a

stable soil structure. One of the factor that determine and affect early growth of plant in this research was a fertilization. The early growth of a plant started from the growth and development of seeds. According to mechanisms and the processes of growth, the physiological growth of seed had a close relationship with the aspects of nutrient availability.

Fertilization would increase the availability of nutrient needed by plant, to increase crop production and quality. In this case, the use of organic fertilizer were to increase nutrient avalibility, improving soil structure, increase cation exchange capacity and enhance the ability of soil to hold water. This was the same as the opinion of Simanjuntak (2004) which suggest that the obtained of organic materials to the soil would give nutrient resources especially N, P, K and S element as a binding micro element and cations in the soil.

Organic fertilizer in this research was Sampi Biogrow Complete that have many function such as to stimulate the growth, increase plant immunity against pests and deseases, increase leaf and fruit, prevent loss of flowers, enrich the soil and stabilize the soil nutrients.

From the description of the data was known that the best increase in number of leaves and plant biomass was at 2ml organic fertilizer treatment or according to the recommended dosage. This suggested that the use of the fertilizer dosis in fertilization could not be done freely because of several factors that limit, among others the harmful effect of fertilizers on soil properties and disruption of the balance of nutrients in the soil which bad effect on the absorption of specific nutrients by plants (Istomo et. al, 2009).

The influence of biomass was proposed by Abbas (1991) that the provision of organic fertilizer had a positive effect in increasing the formation of dry matter of plant. Nutrient availability which relatively greater would ensure the existence of plant nutrient to form asimilat as result of photosynthesis. Asimilat in a large number allowing the formation of a larger plant biomass (Hakim, 2009).

3. The Growth due to The Interaction Between Mycorrhizal and Organic Fertilizer

a. Plant Height

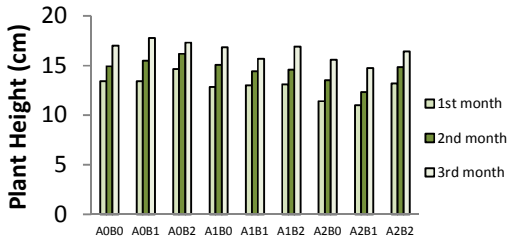

Figure 8. Histogram Plant Height of Matoa Seedlings at The Interaction Between Mycorrhizal and Organic Fertilizer

Description :

A_0 : Without mycorrhiza
A_1 : 5g mycorrhizal/polybag
A_2 : 10g mycorrhizal/polybag
B_0 : Without organic fertilizer
B_1 : 1ml organic fertilizer/polybag
B_2 : 2ml organic fertilizer/polybag

Based on multivariate analysis (p value = 0,141), this means that the provision of mycorrhizal and organic fertilizer simultaneously had no effect on plant height growth. Although the sample with no mycorrhizal treatment combined with 1ml of organic fertilizer/polybag had the best average of the growth, however that difference was not significant.

b. Number of Leaves

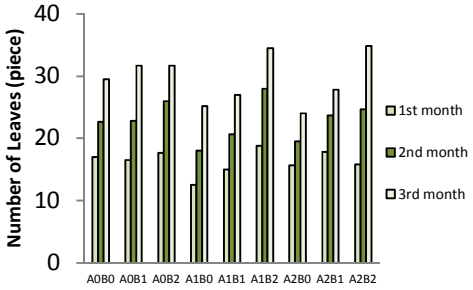

Figure 9. Histogram Number of Leaves of Matoa Seedlings at The Interaction Between Mycorrhizal and Organic Fertilizer

Description :
A_0 : Without mycorrhiza
A_1 : 5g mycorrhizal/polybag
A_2 : 10g mycorrhizal/polybag
B_0 : Without organic fertilizer
B_1 : 1ml organic fertilizer/polybag
B_2 : 2ml organic fertilizer/polybag

Based on multivariate analysis, p value was 0,223 which means that the treatment of mycorrhizal and organic fertilizer simultaneously had no effect on the increased of number of leaves, although the sample with 10g mycorrhizal combined with 2ml organic fertilizer had the best average increase of number of leaves however the result was significantly different.

c. Plant Biomass

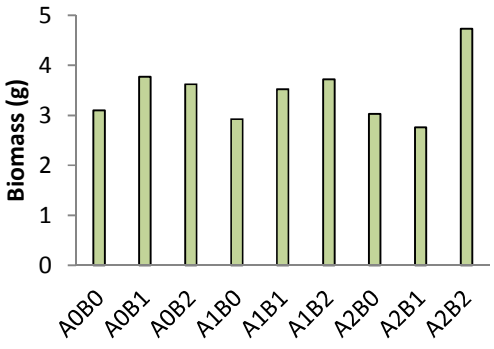

Figure 10. Histogram Plant Biomass of Matoa Seedlings at The Interaction Between Mycorrhizal and Organic Fertilizer on The Third Month

Description :
A_0 : Without mycorrhiza
A_1 : 5g mycorrhizal/polybag
A_2 : 10g mycorrhizal/polybag
B_0 : Without organic fertilizer
B_1 : 1ml organic fertilizer/polybag
B_2 : 2ml organic fertilizer/polybag

Based on multivariate analysis, p value was 0,052, this means that the mycorrhizal and organic fertilizer treatment simultaneously had no effect to plant biomass. Although the sample with 10g mycorrhizal combined with 2ml organic fertilizer had the best average increase of plant biomass, howevwer the result was not significantly different.

From all three measurement parameters of plant growth, obtained the result that the treatment of mycorrhizal and organic fertilizer simultaneously had no significantly effect on plant height, number of leaves and plant biomass. It could happen because of if there was an organic fertilizer, the plants would have got nutrient for their growth, while the mycorrhizal expected to help the absorption of nutrients either from organic fertilizer or from soil media. Several species of VAM formed sporocarp only at the certain time and it was influenced by seasonal changes, fertilization, cultivation of land, ect. However some elements in organic fertilizer would be possible inhibit the growth of mycorrhizal as proposed by Atmaja and Dana (2001) which was about a profound study of the N and P fertilization on VAM on the ground in temperate regions. It was said that the N fertilization (188kg/ha) adversely affect to the population of VAM. The plots that was not cutivated, contain a number of spores 2 or 4 times more, and the degree of infection 2 or 4

times higher than the plots that received fertilizer. This caused the treatment of organic fertilizer that contain N elements combined with mycorrhizal became ineffective to support the growth of matoa plant.

The addition of organic fertilizer that contains element of P that exceed crop needs, could prevent the development of mycorrhizal, so the mycorrhizal symbiosis became ineffective. Similary the opinion of Neumann and George (2009) which stated that under the condition of low soil water and the presence of P element, the presence of mycorrhizal arbuscul fungi in the soil, appeared to be successful from Cowped cultivars. The downside of mycorrhizal was not able to work in fertile land condition, because the root of plant without mycorrhizal could directly absorb nutrients from the soil (Sudomo et. al, 2007). This occured because the media seedlings in polybag in this research already contain enough nutrients because it had been fertilized, so it could be said that the mechanism of mycorrhizal relationship with the organic fertilizer in this research was neutral.

CONCLUSION

The results showed that there was no significantly influence on the mycorrhizal treatment to the growth of matoa seedlings in all of growth parameters. There was no influence of organic fertilizer on the plant height, but there was a significantly influence on number of leaves and biomass. The best increase of number of leaves and biomass was at 2ml organic fertilizer/polybag. There was no significantly influence at the interaction between mycorrhizal and organic fertilizer to the growth of matoa seedlings.

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