

THE IMPACT OF MEDIA TYPE AND DOSE OF NITROGEN FERTILIZER TO THE SEEDLING GROWTH OF *Accacia mangium* Willd

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Abstract

*AccaciaMagnium*Willd. is one of plant species which is used for industrial raw materials pulp and paper. Since 1984, government has allocated 1,4 million hectares of this plant but the annual average ability of Sumatera is just about (70.000 – 120.000). the growth and the development of acacia depend on seeds sources and the condition of soil nutrient in the media used. The massive use of topsoil as the seedling media will make bad effect to the land, so that other alternatives which can be used such as : sawdust, rice huskash, municipal solid waste compost, organic material or fallen leaves of plants compost and dung compost is needed. N element in right amount has important role in the growth of seed, still we need 0,46 gram/polybag (1 gram TSP/ polybag) of P element. Supplementary fertilizer is given twice to 15-day-old and 30-day-old after weaning seedlings, the dose is 0,1 gram/polybag (0,2 gram of Urea/polybag and 0,2 gram KCL/ polybag) for each of N and K element. The aims of the research are: to know the kind of suitable alternative media; the dose of nitrogen fertilizer and the interaction of them both to the growth of *Accacia mangium* Willd seed. The research is done in the Kranjingan village, Summersari sub-district, Jember at altitude \pm 89 m above sea level in April to July 2009. The research uses randomized block design which is factorialy (4x3) repeated 3 times. The first factor is the kind of growing media (M) which consists of 4 experimental stages those are: M1= top layer of the soil (topsoil); M2=municipal solid waste, sawdust , rice huskash (1:2:1); M3=municipal solid waste, sawdust , rice huskash (2:2:0); M4:municipal solid waste, sawdust , rice huskash (0:2:2). The second factor is the dose of nitrogen fertilizer (P) which consists of three experimental stages those are: P0=0 gram N/ polybag (0,0 gram urea/polybag); P1 =0,09 gram N/polybag (0,2 gram urea/polybag); P2 = 0,18 gram N/polybag (0,4 gram urea/polybag). Observational parameters include: height, the amount of leaf, stem diameter which is observed on 14, 28, 42, 56, 70, and 84 HST; The length and number of main root at 84 HST and the arise of crescent leaf (HST). The result of the research: a. alternative media M1 (topsoil which contains organic material that is pine leaf litter) is the best media for all of the growth observation of seedling parameters; b. application of fertilizer dose P1 (0,09 gram N/polybag or 0,2 gram urea/polybag) is the best dose for all of growth observation of seedling parameters and more efficient use; c. Interaction occurs and MIPI treatment (topsoil alternative media which contains pine leaf litter with 0,09 gram/polybag of nitrogen) is the best result especially for diameter observation parameters and the time when crescent leaf of the plant appears.

Keywords: *growing media (topsoil, municipal solid waste, sawdust , rice huskash), nitrogen fertilizer, Accacia Mangium willd.*

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Introduction

Acacia mangium Willd. is a fast growing plant species that have been developed extensively in Indonesia in the development program of industrial forests plantation to supply raw pulp materials and paper industries in the forestry industry. to ensure the availability of raw materials, since 1984 the government has been allocated 1.4 million ha of forest area in Sumatra in order to produce wood for paper and develop plantation *Acacia* species (*Acacia mangium* Willd.), But the ability of plant species each year only about (70,000 - 120,000) hectares per year in Sumatra on average (Maturana, 2005).

The effort to ensure the growth and development of *Acacia mangium* species Willd. In an optimal way is to consider the source of seed and nutrient conditions contained in the growth media. Nutrient conditions that are running low on logged soils cause land use topsoil primarily as a medium for seedlings in forestry has not done much anymore, so need to switch to other alternative media.

As the more advancing knowledge of science and technology, lot of plant media are developed they are not derived from the topsoil land, but from other materials which its availability in Indonesia is still abundant, such as peat, organic matter or compost plant leaf litter, compost cage, sawdust, coconut coir and rice hulls that it can be combined with the composition of materials specified above. Other materials that have the potential to be a seedling media is the large amount of municipal solid waste as compost.

Generally, N is the most prominent element of its role in the growth of seedlings. Subsequent seedlings fertilized with N only grow better than the gain P and K. P and K when working individually was no effect on plant growth. On *Acacia mangium* Willd seedlings, Basic elements of P fertilizer as much as 0.46 g / polybag or equal to 1 g of TSP / polybag. Supplementary fertilizer performed twice at the age of 15 days after weaning and 30 days after weaning, with the dose of each element of N and K was 0.1 g / polybag or the equivalent of 0.22 gram of urea / poly bag, and 0.16 g KCl / poly (Riantoko and Arisman, 1996 in Sukmana & Darwo, 2008).

Based on the description above there are some problems in the study:

- a. What kind of media which are most suitable as an alternative medium for the growth of *Acacia mangium* Willd seedlings.
- b. How much is Nitrogen fertilizer dose affect on seedling growth of *Acacia mangium* Willd.

- c. Are there any kinds of media and the interaction between nitrogen fertilizers on the growth of *Acacia mangium* Willd seedlings.

This study aims to determine:

- a. The appropriate range of media as the alternative medium that can enhance the growth of *Acacia mangium* Willd seedlings.
- b. Nitrogen fertilizer dose corresponding to the growth of *Acacia mangium* Willd seedlings.
- c. The interaction between medium and nitrogen fertilizer effect on seedling growth of *Acacia mangium* Willd.

The results of this study should be able to:

- a. Enrich the repertoire of science and new technology development in agriculture, especially *Acacia mangium* Willd plant nurseries.
- b. Obtain information alternative media materials as a replacement for the media topsoil and increasing the fertility decline.

Methodology

The study was conducted in the Kelurahan Kranjingan, Kecamatan Summersari Jember with a height of ± 89 m above sea level. The experiment was conducted in mid-April to mid July 2009, for 3 months.

The experiment was conducted in factorial with the basic pattern of Rancangan Acak Kelompok (RAK) / Group Randomized Design (GRD) with three replications. The treatment of each factor is as follows:

- a. Factor range of growing media (M) consisting of : M1= Topsoil (Containing pine leaf litter of organic material); M 2 = City garbage, Sawdust, rice husks ash (1: 2: 1); M 3 = City trash, Sawdust, rice husks ash (2: 2: 0); M 4 = Town garbage, sawdust, ash rice husks (0: 2: 2)
- b. Nitrogen fertilizer dose factor (P) consists of: P0 = 0 g N / polybag (0.0 g urea / poly); P1 = 0, g 09 g N / polybag (0.2 g urea / poly); P2 = 0.18 g N / polybag (0.4 g urea / poly)

Implementation Research

1. Preparation of Growing Media

In this study used several kinds of media such as topsoil (organic material containing pine leaf litter), municipal waste, sawdust, rice husk ash. Comparison of mixing media of municipal solid waste, sawdust, rice husk ash (1:2:1), municipal waste, sawdust, rice husk ash (2:2:0), municipal waste, sawdust, rice husk ash (0:2 : 2). Growing media that has been mixed inserted into polybag size of 7.5 x 15 cm.

2. Germination

After the seeds germinate and seedlings sown in beds with soil media then it is covered with rice husk ash \pm 2 cm thick. Watering is done using the powder plot sprayer. Weaning seedlings to polybag, performed at 14 days old seedlings, and after the emerging of bipitinus leaves 3-5 strands (Ansori, S. 2007).

3. Fertilization

Fertilizers on crop weaning the HST 15, HST 30 and HST 45 according to treatment with a dose of fertilizer N as 0 grams, 0, 09 and 0 grams, 18 grams per polybag (equivalent to \pm 0; 0.2; 0.4 grams of urea / polybag). While the P fertilizer requirements as much as 0.46 g P / poly (\pm 1.5 gram equivalent SP-36/polybag) given before planting, and as many 0.1 gram K K / polybag (\pm 0.2 gram equivalent of KCL / polybag) given in conjunction with treatment (Ansori, S. 2007).

4. Maintenance

Maintenance of *Acacia mangium Willd* seedlings include : Sprinkling; Knitting; Weed control; Shade.

5. Parameter Observations

The observed parameters were : Plant height (cm); Diameter (mm); The number of leaves (pieces); Root length (cm); Number of main roots (fruits); When the crescent leaf emergence (HST).

Results and Discussion

Results of analysis of variance of the data presented are the results of observations:

1. Plant Height

Height growth of plants periodically appear that alternative media M1 (upper layer of soil containing organic matter litter of pine needles) better than other alternative media, and fostering of P1 (0.09 g N / polybag) is the best. Further Duncan test results 5%

explained that the M1 between different media is very real alternative to other alternative media, while very real to the different fertilization without fertilization while the P1 and P2 are not real, especially observations of different ages 42-84 HST.

It is suspected that the treatment composition to M1 alternative media (topsoil containing organic material pine leaf litter) is a good medium for the growth of plant height. Besides that, the media contains nutrients N, P, S and micro; crumb structure and good soil porosity due to the role of organic matter; increase the water binding ability of the soil, cation exchange capacity, activity and energy source of microorganisms causing a condition suitable especially for high growth of seedlings.

Height of seed on alternative media M1 (topsoil containing organic matter litter of pine needles) look better than the other alternative media. It is suspected that alternative media M1-containing waste material other than agriculture are few and sketchy in donating the necessary nutrients are available during the growth phase of seedlings. In addition, alternative media M1 contains material other than sawdust ($\pm 50\%$ in the media) who have a slow decomposition process, and during the decomposition process will lead to increased temperature, CO₂ levels, pH and acid - an organic acid loss (Wikipedia, 2008).

Similarly, the provision of the element nitrogen in the media tend to spur the growth of plant height is better than the treatment without nitrogen. It seems clear, especially on the observation of mature plants and 28 to 84 HST.

The above fit in the opinion of Sri Setyati (2002), that the rate of cell division and cell extension and formation of the network is running fast, then the growth of stems, leaves and roots will run faster. Processes related to plant cell requires a supply of sufficient carbohydrates derived from photosynthesis, water supply and nutrients (inorganic compounds). On the research results of Taufan (2003) *in* Maya (2007) also described the role of humus in the soil will be able to maintain and enhance the physical properties of the soil, improving soil's ability to absorb and retain water and fertilizer absorption can take place efficiently.

2. Number of Leaf Plants

The Growth of leaves of plants periodically appear that alternative media M1 (upper layer of soil containing organic matter litter of pine needles) better than other alternative media, and fostering of P1 (0.09 g N / polybag) is the best. further Results of Duncan trials 5 % explained that the M1 between different media is very real alternative to other

alternative media, while very real to the different fertilization without fertilization while the P1 and P2 are not real, especially observations of different ages 28-84 HST.

Therefore it appears that a reasonable alternative media M1 is better and perfect on the observation of the number of leaves compared to other alternative media. In this study, some of the alleged reasons that led to the alternative media other than M1 (topsoil containing organic matter litter of pine needles) showed less good as nursery media are the composition of the media containing sawdust ($\pm 50\%$ in the media) who have a slow decomposition process, and during the decomposition process will cause the temperature, CO₂ levels, pH and acid - an organic acid increased (Wikipedia, 2008) and ultimately detrimental to plant growth activity. While the role of municipal solid waste compost and rice husk ash less than the maximum because of the amount of nutrients that contribute very little to support the activity of plant growth. Further nutrient N is given / available either from municipal solid waste compost or manure is insufficient to support the needs of the activity of plant growth, due in part to N use microorganisms to break down C / protein (Wikipedia, 2008) on fresh organic material such as sawdust and the C / N ± 15 (Anonymous, 2008).

Similarly, the provision of the element nitrogen in the media tends to spur growth in the number of leaves of plants is better than giving treatment without nitrogen. It seems clear, especially on the observation of mature plants and 28 to 84 HST.

According to Wijaya (2008), that administration of N in the plant will encourage the growth of the organ - an organ that is related to leaf photosynthesis of plants. Likewise, according to Humphries and Wheeler (1963) in Gardner *et al.* (1991), that mainly Nitrogen significantly affect leaf width and leaf area. Similarly, according to Sarwono (2002) is a function of nitrogen for plants and improve vegetative plant growth greener and assist in protein formation. Nitrogen deficiency symptoms are: dwarf plants, root growth are limited, the leaves fall easily and its color is yellow. Symptoms mostly Nitrogen is very lush vegetative growth, stem - the stem is weak easy to collapse, reducing the resistance of plants to disease.

3. Plant stem diameter

The same thing on the parameters of the plant stem diameter that periodically demonstrate that an interaction of treatment and the best on M1P1 alternative media for the observation of the age of 70 HST and 84 HST with the plant stem diameter greater than the

treatment of other alternative media. Duncan test results further indicate that 5% of the alternative media's treatment of topsoil containing organic material with a pine leaf litter nitrogen dose of 0.09 g / polybag (M1P1) gives good results and was significantly different compared to other treatments for age 70 and 84 observations of HST.

Suspected of *Acacia mangium Willd seedlings* on alternative media topsoil containing organic matter litter of pine needles with nitrogen fertilization at 0.09 g / polybag M1P1 cause plant stem diameter was a good value compared to other alternative media's treatment at the same dose of nitrogen fertilizer.

In accordance with the opinion of Sri Setyati (2002), those primarily occurs in the vegetative phase of development of roots, leaves and new stems, are associated with three important processes including cell division, cell extension and the first stage of cell differentiation. If the rate of cell division, cell extension and formation of the network is running fast, then the growth of stems, leaves and roots will run faster. All these processes require a supply of sufficient carbohydrates derived from photosynthesis, water supply and nutrients (inorganic compounds). In line with this, according to Gardner *et al.* (1991), that the elements nitrogen and water as a factor affecting vegetative growth. Both are needed in large quantities to support rapid vegetative growth such as stem diameter growth of plants.

4. Root length of plants

In the long roots observation of plant , it seems that the alternative media's treatment of topsoil containing organic matter or litter of pine needles M1 nitrogen fertilization of 0.09 g / polybag P1 is the best. Based on the results of further test Duncan 5% indicates that the alternative media's treatment of topsoil containing organic matter or litter of pine needles M1 nitrogen fertilization of 0.09 g / polybag P1 ter results both very real and different treatment than other alternative media at the end of the age of 84 HST observations.

According to Purwanto (1992), the root elongation is caused by the cell division and enlargement subsequently to form a new tissue. Cell division in the root occurs in meristematic regions. On cell division is an increase in cell wall plasticity and stretching, so that water absorption by root cells and the cell will be getting a lot bigger and bigger and lengthwise, then lengthwise and divide into new cells. Furthermore these new cells will form a network that accompanied cleavage, so as to lengthen the root. In addition there are also likely contributed to the role of elemental phosphorus in the topsoil media,

among others, strengthening the trunk does not easily collapse, increasing root growth and improve the quality of crops such as vegetables or forage crops.

5. Number of Plant Main Roots

Based on the results of further test Duncan 5% indicates that the alternative media's treatment of topsoil containing organic matter or litter of pine needles M1 nitrogen fertilization of 0.09 g / polybag P1 gives the best results of both very real and different treatment than other alternative media at the end of the age of 84 HST observations. It is presumed, that one of grappling root function is as a soil so that plants are not easy to collapse, a growing number of primary roots that grow the plants will stand firm. In this study indicates treatment of composition of alternative media such as M1 is the physical and chemical conditions are especially favorable and unfavorable to the growth of the number of primary roots of plants *Acacia mangium* Willd. This is due to the nutrients contained in the media as an alternative medium of top soil containing organic material M1 pine leaf litter can be absorbed by plants as well, the amount of nutrients received enough so that the growth of plant roots, especially the relatively increased. And vice versa, alternative media M1 allegedly providing poor condition and fit / less fertile due to the development of plant roots among others containing agricultural waste material fresh and only slightly less complete in donating the necessary nutrients are available during the growth phase of seedlings.

6. The emergence of Crescent Leaf Plants

At the observation parameters while supporting the emergence of the crescent leaves of plants, suggesting an interaction of treatment and the best on M1P1 the alternative media to give an indication of the fastest time compared to other alternative media treatment. Duncan test results further indicate that 5% of the alternative media's treatment of topsoil containing organic material with a pine leaf litter nitrogen dose of 0.09 g / polybag (M1P1) provides the fastest time is very real and different than other alternative media treatment until the end of the age of 84 HST research. It is suspected and in accordance with actual conditions in the field, that the alternative media's treatment of topsoil containing organic matter litter of pine needles with nitrogen fertilization at 0.09 g / polybag M1P1 shows the condition of the plant was growing well and fertile compared to other treatments.

Conclusions

Based on the results of research on plant *Acacia mangium* Willd It can be concluded as follows:

- a. Alternative media M1 (topsoil containing organic matter litter of pine needles) is the best medium for all observations of the growth parameters of seedlings.
- b. The treatment dose of fertilizer P1 (0.09 g N / polybag or 0.2 g urea / poly) dose of fertilizer is best for all observations of the growth parameters of seedlings and more efficient use.
- c. Treatment interaction and M1P1 (alternative media topsoil containing organic material with a pine leaf litter nitrogen dose of 0.09 g / polybag) the result was good, especially for the observation parameters as the emergence of stem diameter and plant leaf crescent.

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