# Growth and Yield Performance of Pegaga (*Centella asiatica*) to Different Types of Organic Fertilizer and Levels of Planting Media

*Nur Masriyah Hamzah*

ABSTRACT

*The demand for herbal medicines has increased tremendously in recent years. Many Malaysian plants which have been traditionally used to treat certain ailments are now being processed using modern technology for the production of functional foods and tonics including Centella asiatica (pegaga). Recently, the adverse effect of modern agriculture causes several problems in environment and one of the solutions is by turning to organic agriculture. The objective of this study was to determine the best combination of three different types of organic fertilizer (chicken manure (F1), goat manure (F2), and vermicompost (F3)) and four different levels of planting media (clay soil-control (M1), clay soil + rice husk ash (M2), clay soil + sawdust (M3), and clay soil + rice husk ash + sawdust (M4)) to the growth and yield performance of pegaga. This experiment was conducted on clay soil under open rainshelter structure at Makmal Luaran Program Teknologi dan Pengurusan Perladangan, (AS220), Universiti Teknologi MARA Shah Alam. A Randomized Complete Block Design (RCBD) with twelve (12) treatments and three (3) replications has been employed in this study. The first data collection was conducted on the 12th January 2009 and was continued to collect data at weekly basis until 60 days. Then the data was analyzed by using the Microsoft Excel and Minitab software. At the end of this experiment, the result showed that the best combination treatment was obtained when plants grown with chicken manure combine with clay soil and rice husk ash (F1M2)pegaga.*

**Key Words:** *organic fertilizer, planting media, Centella asiatica, clay soil*

## Introduction

Interest in pharmaceutical products and drugs derived from plants has increased tremendously in recent years. In Malaysia local herbal market industry reach RM10 billion in 2008 and is projected to grow of 15% per annum for upcoming 10 years. (FAMA, 2008). This growth is based on to increase acceptance of herbal products as traditional medicine, functional foods, health food supplements, care products themselves natural and organic foods. The plant of interest in this study was *Centella asiatica* or its Malaysian name 'pegaga' from the family of Umbellifarae species generally found in tropical and sub-tropical countries (Lau and Runi, 2008). Its ability to treat hypertension, sore throat, skin disease, rheumatism, nose bleed and diarrhea were important reasons for its extensive use in many countries (Premila, 2006).

Currently, pegaga is considered as one of the commercially potential herb in Malaysia. This is mainly because of its easiness to cultivate and its great researched health benefits. Pegaga easily propagated asexually using stolon. Stolon can be defined as a modified stem which grows horizontal from a crown above the ground, taking root at the tip, and ultimately developing a new plant (Nash and Thomas, 2003). According to Zainal Abidin and Kamaruddin (2005), the suitable planting distance for pegaga is 20 cm between the row and 20 cm between the plants in the row with planting density of 125, 000 plants per hectares and favors sandy loams with high organic matter content and good water infiltration for healthy growth.

However, the conventional intensive agriculture causes several problems as depletion of soil organic matter and plant nutrients besides occurrences of pest and diseases. Therefore, turning to organic farming is one of the methods that avoid the use of chemical pesticide and returning the nutrients into the soil through crop residues, compost, green manure, crop rotation and maintaining different life form in the soil (Yadav, 2005). Thus, this study hopefully could provide important information on the effects of different types of organic fertilizer and different combination of planting media. The objectives of this study; (1) to determine if there was any significant difference in the growth and yield performance of *Centella asiatica* to different types of organic fertilizer, (2) to determine if there was any significant difference in the growth and yield

performance of *Centella asiatica* to different levels of planting media and (3) to determine the optimum combination of three different types of organic fertilizer and four different levels of planting media.

## Materials and Methods

### Experimental Site, Planting Material and Soil Series

This study was conducted under open rainshelter structure at Makmal Luaran Program Teknologi dan Pengurusan Perladangan (AS220), UiTM Shah Alam to minimize the effects of varying rainfall and to provide enough sunlight for the development process of *Centella asiatica*. The varieties of *Centella asiatica* under studied were pegaga gajah and were obtained from Kg. Sg. Adam, Jejawi in Perlis. Clay soils of Ulu Dong series from Raub, Pahang was used in this study and were treated with three different types of organic fertilizer with four different levels of planting media.

### Experimental Design

The experiment was a Randomized Complete Block Design (RCBD) factorial design with 12 combination treatments and three replications. This experiment was conducted to compare three different types of organic fertilizer (chicken manure (FA), goat manure (F2), and vermicompost (F3)) to 4 different levels of planting media (clay soil-control (M1), clay soil + rice husk ash (M2), clay soil + sawdust (M3), and clay soil + rice husk ash + sawdust (M4)). There were twelve (12) treatments, giving all possible combination as follows; FIMI, FIM2, FIM3, FIM4, F2M1, F2M2, F2M3, F2M4, F3M1, F3M2, F3M3, and F3M4.

### Plot Size and Levels of Organic Fertilizer and Planting Media

This experiment involved of 36 plots (trays) and each tray had 4 stolons of pegaga gajah. The chicken manure, goat manure and vermicompost have been applied and mixed with the medium at the constant rate of 68 grams per plant one week before planting and 28 grams per plant after one month of planting to ensure sufficient nutrients for the growth of pegaga. Four combination treatments consist of 100% (M1), 80%+20% (M2), 80%+20% (M3) and 80%+10%+10% (M4). The watering was carried out once a day for the first two weeks after planting then it has been reduced to once in two or three days for the following weeks. The crop was harvested 60 days after planting.

### Data Collection and Statistical Analysis

The number of leaves and plants height was measured at 7, 14, 21, 28, 35, 42 and 56 days after planting. The number of stolons and the fresh weight of leaves and roots were measured at 60 days after planting using electronic balance. The harvested plants were rinsed with water and oven dried at 60°celcius for one week. Then, the dried weighted of pegaga leaves and roots were measured using electronic balance. The resulting data from the organic fertilizer application on the planting media on plant parameters was calculated using Microsoft Excel and was analyzed using Minitab software. A statistical analysis of variance (ANOVA) has been carried out to test significant differences between the mean of the treatments. Tukey's pairwise comparison was used to compare the means of each treatment if F test in the ANOVA is significant.

## Results and Discussion

From Figure 1, there is lower growth of the plants in 21 days after planting. But, the steepest increased in number of leaves was for treatment F2M2 (goat manure + clay soil + rice husk ash) and F1M2 (chicken manure + clay soil + rice husk ash) with the highest numbers of leaves about 20 to 25 as compared to others treatments especially after 42 days after planting. On the other hand, F3M3 (vermicompost + clay soil + sawdust) signify the lowest number of leaves within the period of planting. Noted that pegaga plants fertilized with chicken manure (F1) and goat manure (F2) produced the highest number of leaves as compared with vermicompost (F3). The same trend was observed in plant height of pegaga after 42 days after planting (Figure 2). The mean height of plants were increased considerably especially for treatment F1M1

(chicken manure + clay soil) among other treatments followed by F1M2 (chicken manure + clay soil + rice husk ash) and F1M3 (chicken manure + clay soil + sawdust). However, F3M3 once again showed the lowest performance in plants height of pegaga. Therefore from the Figure 1 and 2 had shown that plants grown with F1 (chicken manure) was significantly had greater number of leaves plants height as compared with plants grown with F2 (goat manure) and F3 (vermicompost).

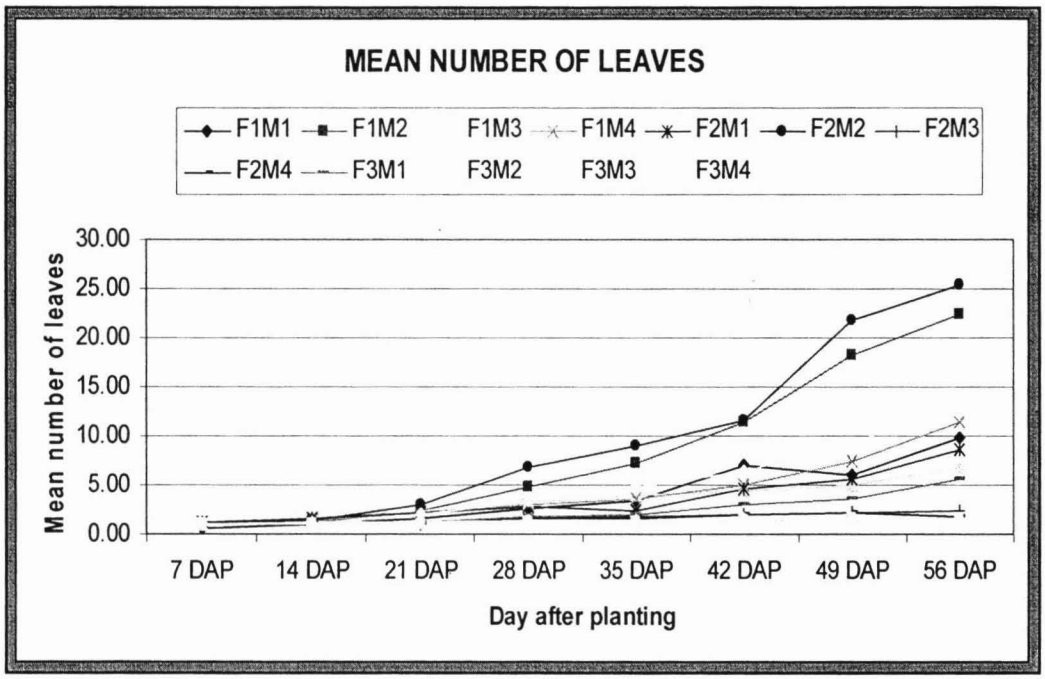


Figure 1: Mean number of leaves

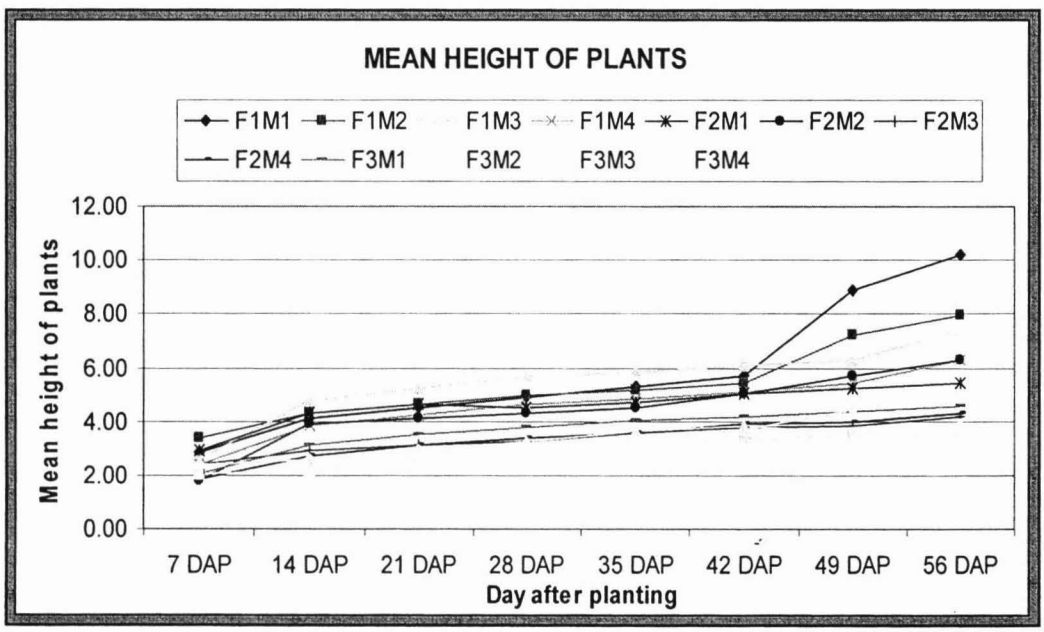


Figure 2: Mean of plants height

**Analysis of Variance (ANOVA) for Plant Growth Parameters**

Table 1: Significance of F-values (probability) from analysis of variance for plant growth parameters

| Treatments | DF | Number of leaves | Plant height (cm) | Fresh weight of leaves (g) | Fresh weight of roots (g) | Dry weight of leaves (g) | Dry weight of roots (g) | Number of stolons |
|---|---|---|---|---|---|---|---|---|
| Fertilizer | 2 | 0.001 | 0.000 | 0.065 | 0.087 | 0.000 | 0.006 | 0.014 |
| Medium | 3 | 0.000 | 0.111 | 0.009 | 0.004 | 0.000 | 0.000 | 0.000 |
| Fertilizer x medium | 6 | 0.008 | 0.764 | 0.327 | 0.413 | 0.026 | 0.153 | 0.096 |

Table 1 show the significance of F-values (probability) from analysis of variance for plant growth parameters of pegaga. Statistically, the fertilizer application and planting media significantly affected the number of leaves of pegaga meanwhile plants height had significantly affected only by different types of fertilizer application (Table 1). On the other hand, the mean fresh weight of leaves and roots at 60 days after planting were significantly affected by four different levels of planting media than application of fertilizer as shown in Table 1.

However, the ANOVA of dry weight of leaves revealed there were significantly effects for the different types of organic fertilizer, the planting media and interaction between organic fertilizer and the planting media used (Table 1). Figure 3 shows that plants grown with chicken manure (F1) combined with Medium 2 (clay soil + rice husk ash) had significantly greater in dry weight of leaves as compared to other combination treatments. Additionally, Medium 2 also showed a good combination treatment when combined with goat manure (F2). However, plants grown with vermicompost (F3) show the lowest dry weight of leaves when combined M1, M2, M3 and M4 respectively. The ANOVA Table 1 also indicates that fertilizer and medium had significant differences on dry weight of roots and number of stolons but interactions between fertilizer and medium were not significant.

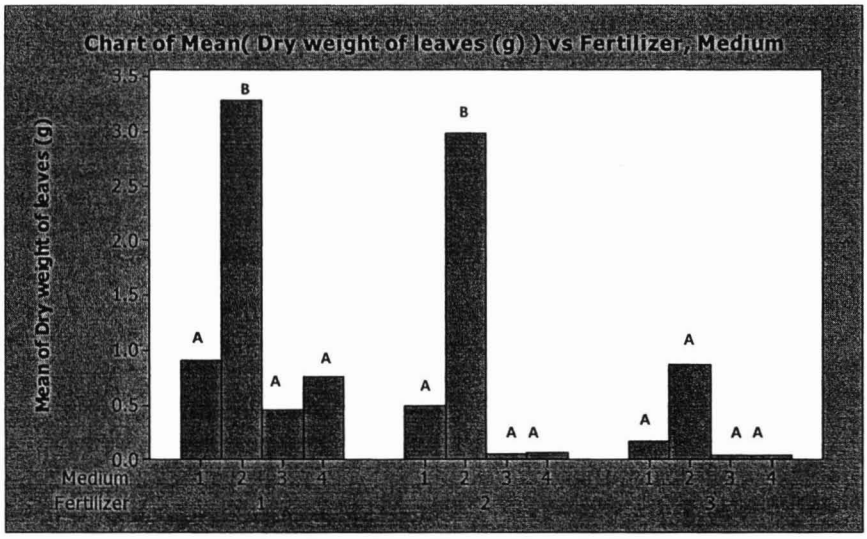


Figure 3: Mean chart dry weight of leaves (g) vs. fertilizer x medium

Generally this study showed the greatest treatment was gained from the plant grown with Fertilizer 1 (chicken manure) whiles the best medium for planting pegaga was obtained from Medium 2 (clay soil + rice husk ash). This current study agreed with Marcia, (1993) who stated that chicken manure contains higher nitrogen (2%), phosphorus (2%), and potassium (25) rate as compared with other types of fertilizer. Moreover, this results also in agreement with the result of Araji et al., (2001) who reported that chicken manure has higher pH, lower organic carbon, and higher inorganic nitrogen content and had lower carbon

nitrogen (C/N) ratio. Normally, potassium (K) is required in root development process for plant growth and the potassium uptake by plants is affected by soil moisture (Rehm and Schmitt, 2002). Therefore, the phosphorus in chicken manure helps to stimulate the growth of young *Centella asiatica* giving them a good and vigorous start when grown with chicken manure (Marcia, 1993).

On the contrary, this present study illustrates the plants that grown with vermicompost have the lowest mean in all parameter measured especially when it combined with Medium 3 (clay soil + sawdust) and Medium 4 (clay soil + rice husk ash + sawdust). This consequences was inconsistent with the result of Arancon et al., (2008) who stated that vermicompost increased the seedling emergence of other ornamental and vegetables with those grown in control commercial plant growth media. However, according to Aracon et al., (2006) in their study on the effects of humic acids from vermicompost on plant growth, the slower growth rates of plants grown with vermicompst might be due to the higher concentration of plant growth hormones such as auxin and humic acids produced by microorganism in vermicompost. When auxin is applied at high concentration, they can reduce the rates of groth and development of plants (Hopkins & Huner, 2004).

Furthermore, *Centella asiatica* that grown with Medium 2 (clay soil + rice husk ash) had given better performance than other types of planting media tested. Current study was strongly agreed with the finding of Alhassan (2008) which stated that rice husk ash contain about 67-70% silica and 67.3% of oxide composition that could help mobilize the calcium hydroxide (CaOH) in the soil for the formation of cementitious compounds. On the other hand, the silicon composition also provide cell wall toughening of the plant growth that leads to the increasing in number of leaves and number of stolons of pegaga. In opposition, plants that grown in the medium with the combination of clay soil and sawdust (Medium 3) gave the lowest mean in all parameters measured. This is because sawdust contains high cellulose and lignin compound which was reduced the development of photosynthesis process thus severely restricting plants growth. According to Sakamoto et al., (2009), lignin is one of the major components of plant cell walls, comprising 20%-30% of the cell wall in woody plants and because of this unique structure of lignin, wood cell walls are resistant to degradation by most microorganisms. Furthermore, the carbon content and C:N ratio increased as a result of incorporation of sawdust (Zhang and He, 2006 and Kwasna et al., 2000).

## Conclusion

One of the central aims of this experiment was to determine the most suitable combination treatment of three different types of fertilizer with four different level of planting media. On the basis of the results obtained from this study, it can be concluded that *Centella asiatica* can be grown in many types of fertilizer with different types of media. The best combination treatment was obtained from plants that grown with FIM2 (chicken manure + clay soil + rice husk ash). The chicken manure and rice husk ash helps to improve the fertility of the clay soil thus enhancing the growth and performance of *Centella asiatica*. However, this study also indicates that the combination treatment of F3M3 (vermicompost + clay soil + sawdust) resulted in plants retardation. The main reason for the poor performance is because they had low nutrients contents that restrict the growth of pegaga. Then again, the combination of chicken manure with clay soil (FIMI) indicated good response in yield and growth of pegaga but not as much as chicken manure with clay soil and RHA (FIM2).

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NUR MASRIYAH HAMZAH.
Universiti Teknologi MARA (Pahang).
nurmasriyah@pahang.uitm.edu.my.