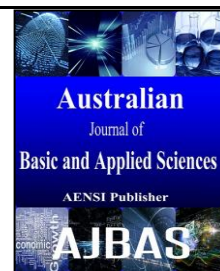




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Effects of Different Types of Foliar Fertilizer on Growth Performance of Spider Plant (*Cleome gynandra*)

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ABSTRACT

A field experiment was conducted at Sharefarm Unit, Faculty of Applied Science, Universiti Teknologi MARA, Negeri Sembilan Branch, Malaysia. The aim of this study is to evaluate the effects of different types of foliar fertilizers on the growth performance of spider plant. Growth parameters were indicated by plant height, leave number, leaf area and yield. This experiment was conducted in randomized complete block design with 5 blocks and 4 treatments. Four treatments investigated were T0 (control), T1 (organic fertilizer), T2 (inorganic fertilizer) and T3 (semi-organic fertilizer). This study indicated significant different between four treatments where semi organic fertilizer gave the best growth performance of spider plant. The level of goodness of utilizing foliar fertilizer can be arranged in the order of semi organic > inorganic > organic > without fertilizer. The use of either organic or inorganic fertilizer does not give different in term of spider plant yield in this study. Thus, this study suggested that the application of semi organic foliar fertilizer to increase the yield of spider plant in Malaysia.

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INTRODUCTION

Cleome gynandra is a family of Cleomaceae known by the common name of spider flower, mountain bee plant (Aparadh *et al.*, 2013), African spider flower, cat whiskers and Bastard's mustard (Mishra *et al.*, 2011; Chweya and Mnzava, 1997). This plant is one of the important edible weed in Zimbabwe (Maroyi, 2013) and most of the tropical country (Chweya and Mnzava, 1997). In Malaysia, this plant is known as maman and langsana merah vegetable (Department of Agriculture Malaysia, 2012; Chweya and Mnzava, 1997) and it is originated from Sri Lanka, India and whole Asia (Aparadh *et al.*, 2012). Negeri Sembilan is the largest producer of spider plant vegetable in Malaysia with planted area of 34.31 hectare followed by Pahang, Pulau Pinang and Kelantan (Department of Agriculture Malaysia, 2012).

Spider plant is known as traditional vegetables and has high medicinal values (Aparadh *et al.*, 2012; Mishra *et al.*, 2011; Bala *et al.*, 2011; Muchuweti, 2007; Maroyi, 2013) as antioxidant, anticancer, treatment for headache, fever, skin disease, and etc.

Department of Agriculture Malaysia (2012) reported that the area planted with spider plant in Malaysia on 2011 was 44.6 hectares with estimated production of 91.2 metric tonne and the average production of 2.2 metric tonne per hectare. The demand of spider plant vegetable can increase during the period of special event like 'Hari Raya' where the market price can achieve between RM 7 and 15 per kilogram. *Cleome gynandra* is highly economically important due to rich in protein and amino acid content (Mishra *et al.*, 2011).

The fertilizer is the supplements that are mainly apply to enhance the productivity of the plant especially their yield. Lack of fertilizer use is one of the factor that contributing to the low leaf yield of spider plant (Masinde and Agong 2011). However, plant nutrition is varying depending on soil fertility, plant type, surrounding environment, plant age and cultivation techniques (Chweya and Mnzava 1997). Organic fertilizer is naturally occurring fertilizer including compost and manure. Ng'etich *et al.*, (2012) indicated that composted farmyard manure as organic fertilizer can increase spider plant yield by influencing it stomata conductance and chlorophyll

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content. Inorganic fertilizer is the type of fertilizer that is manufactured from minerals or synthetic material. High cost of chemical fertilizer makes people find alternative foliar organic fertilizer to provide nutrient to the crop (Katsaruware and Gwembire, 2014).

Majority of the farmer especially in Malaysia do not know exactly the suitable type of fertilizer that suit for their crop. Lack of this information causes low profit and low production of this vegetable among the farmers. Therefore, this study was conducted and aimed to evaluate the responds of different types of foliar fertilizer on the growth performance and nutrient content of spider plant.

MATERIALS AND METHODS

The field experiment was conducted at Sharefarm Unit, Faculty of Applied Science, Universiti Teknologi MARA, Negeri Sembilan Branch, Kuala Pilah Campus, Malaysia. Specifically, this study site located on latitude 2° 44' 6.1038" north and longitude 102° 14' 12.5556" south. This area receives 1623 mm rainfall yearly with maximum and minimum average temperature between 24 and 34°C. Spider plant seeds were obtained from farmer grower at Gemenchek area, Negeri Sembilan, Malaysia where the seed quality has been approved by the Department of Agriculture Malaysia. The planting medium of spider plant was prepared by adding 0.5 kg coco peat mixed with 2.5 kg of loamy soil for each poly bag. Five spider plant seeds without seed treatment were directly sown on each poly bags (23 x 30 cm). The poly bags further placed under 50% permeability toward light of netting to decrease the evaporation rate from the soil medium. Cultivation of spider plant below the netting can reduce plant stress due to extreme weather and

reduce the risk of plant disease. The experiment was laid out in randomized complete block design with four treatments and five replications. The treatments were T0 (control), T1 (organic fertilizer), T2 (inorganic fertilizer) and T3 (semi organic fertilizer).

Spider plant growth performances were observed by measured plant height, leaf number, leaf area and yield. The data on plant high and leaf area were taken by using ruler meter and portable leaf area meter (LI-COR LI 3000C) respectively. The quantity of leaf was calculated without any equipment used. The data on plant high, leaf number and leaf area were taken once every 7 days interval. An electronic balance (aeADAM PGW 253e) was used to estimate it fresh weight and dry weight sample was obtained after drying in an oven. The data from this study was subjected to analysis of variance (ANOVA) and descriptive statistic by using Microsoft Excel. Significant different between means was determined by Duncan Multiple Range Test. Probability statistic with $p < 0.05$ was considered to be significantly different.

Prior to the cultivation, the pH of the soil medium was measured and it was in the range between 6.2 and 6.8. Watering and weeding were conducted as normal practice by the farmers. All types of fertilizers were applied in the liquid form by dissolving in non chlorinated water. Organic fertilizer was applied by foliar spraying once per week. The details on types of fertilizer used, dosage and frequencies of application in this study was shown in Table 1. Organic fertilizer used in this research was prepared base on fish amino acid (Department of Agriculture Malaysia, 2006). Inorganic fertilizer and semi organic fertilizers were obtained from nearby fertilizer shop.

Table 1: Type of fertilizers used, it dosage and frequency applied in this study.

Type of fertilizer	Dosage/measurement	Frequency Applied
Organic fish amino acid (FAA) base	2ml fertilizer + 1000 ml water (non chlorine)	Once a week
Semi organic (12+7+25)	20ml fertilizer + 1000 ml water (non chlorine)	Once a week
Inorganic (18+33+18+TE)	2.5 gram + 1000 ml water (non chlorine)	Once a week

RESULT AND DISCUSSION

Generally, all fertilizers treatments showed continuous increase in plant height (Figure 1a). Sarkar *et al.* (2007) admitted that foliar application had better economic benefit compared to soil application like broadcasting, banding and etc. However, there were no significant different between all treatments subjected to the different type of foliar fertilizer (Figure 2a). Semi organic foliar fertilizer application showed the highest growth of plant height followed by those applied with organic and inorganic foliar fertilizer. The height of spider plant can grow up to 60 cm (Muchuweti, 2007; Mishra *et al.*, 2011). The lowest mean of plant height is the

plant with the control treatment. This is because other treatment might give extra nutrient to the plant compared to the control treatment that gets the required nutrient from soil medium only. Spider plant can be cultivated easily with optimum depth of 1 to 5 mm (Seeiso and Materchera, 2011) and the seed need 4 to 5 days to germinate (Chweya and Mnzava, 1997).

The plant showed a steady continuous increase in the number of leaf for the 5 weeks period. Among five treatments, it was indicated that spider plant treated with semi organic fertilizer showed the rapid increase in the number of leaf starting from second week until the fifth week. Control treatment showed the lowest number of leaf to the plant. The higher

mean leaf number of semi organic treated plant was due to the higher presence of humic acid that accelerates plant cell division and promotes growth. There were significant different between fertilizers types to the number of leaf except semi organic fertilizer treatment and inorganic fertilizer treatment (Figure 2b).

Figure 1(c) indicates that spider plant treated with semi organic fertilizer showed most rapid increments of the leaf area started from weeks 1. The lowest leaf area was the control treatment for all the reading in the 5 weeks interval. Spider plant treated with semi organic fertilizer showed the highest mean among the treatment applied to the plant. Spider plant without treatment showed the lowest mean of leaf area. There were no significant differences in leaf area values between control treatment, organic and inorganic foliar fertilizer application. However, leaf area showed significant different to the semi organic foliar fertilizer. The high leaves number and mean leaf area indicated that spider plant treated with foliar semi organic fertilizer might uptake better nitrogen nutrient compared to other. Thus chlorophyll content and photosynthesis in spider plant treated with semi organic fertilizer can growth better. Organic fertilizer from chicken manure and cow manure can increase the yield of Chinese cabbage and amaranthus under specific field condition due to high nitrogen level in manure (Baitilwake *et al.*, 2011). Maayo *et al.* (2008) found

that increase in nitrogen fertilizer on spider plant can increase it yield beside prolonged the harvesting period.

The application of semi organic foliar fertilizer can give significant yield of spider plant. The use of organic or inorganic foliar fertilizer does not affect the yield of spider plant. Mortvedt (2000) emphasized that fertilizer application by foliar can reduce the usage of fertilizer, fast respond by the crop and uniform distribution of fertilizer over crop canopy. The tested of organic and inorganic fertilizer on Brassica sp can be increased the yield and crop production. (Wambani *et al.* 2008). Semi organic fertilizer is formulated by combining the organic material and synthetic mineral together. The used of semi organic fertilizer is better compared than other type of fertilizer because semi organic is a balance fertilizer which purpose to give nutrient to the plant and make the soil remain fertile. One of the organic materials that are used in the semi organic fertilizer is humic acid. The humic acid cans benefits toward the soil health and better yield. The semi organic fertilizer has been applied for rice farming system in Indonesia (Sukristiyonubowo *et al.*, 2011) which results in better soil fertility and better yield for the crop. The semi organic fertilizer is being used for one alternative in order to maximize the nutrient absorption by applying the actual fertilizer needed by plant. In term of cost, the semi organic fertilizer is much lower compare to inorganic fertilizer.

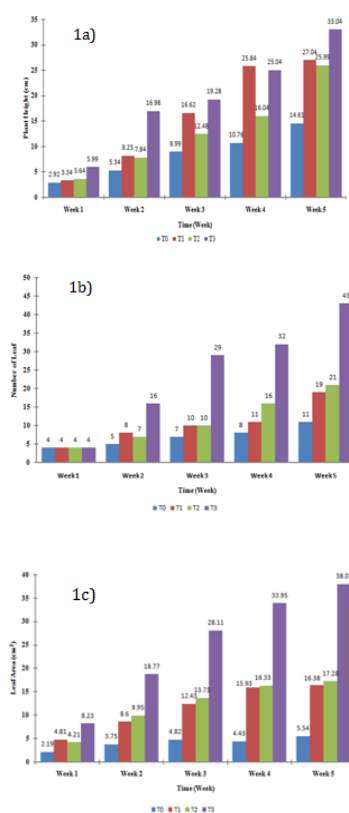


Fig. 1: The performance of the a) plant height b) leaf number and c) leaf area of spider plant with different treatment of fertilizer within 5 weeks. T0 is control treatment, T1 is organic fertilizer, T2 is inorganic fertilizer and T3 is semi organic fertilizer.

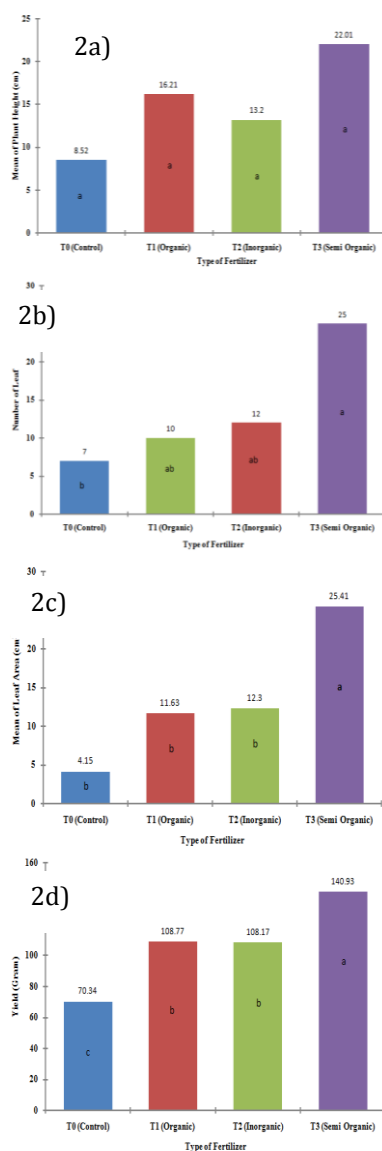


Fig. 2: Effect of treatments on a) plant height b) number of leaf c) leaf area and d) yield of spider plant. Data are mean and different letter at the bar chart show significant different at $p < 0.05$.

Conclusion:

Selection of suitable fertilizer is very important for vegetables production in order to maximize the profit and yield. Different type of fertilizer will give different response to the plant growth performance. The application of semi organic fertilizer by foliar spraying can give good performance on growth and yield. Modification or combination of different types of fertilizer has potential to be explored toward sustainable and environmental friendly agriculture.

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