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Yield Performance of *Ficus carica* as Affected by Different Rate of Chicken Manure

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ABSTRACT

The objectives of this study are to study the development of the fruit of *Ficus carica* as affected by the different rates of chicken manure. The experiment was conducted at Glasshouse and Nursery Complex (GNC), IIUM Kuantan Campus. The experiment was arranged in a randomized, completely block design (RCBD). Four rates of chicken manure used were 0 g (T1), 150 g (T2), 300 g (T3) and 450 g (T4) respectively. Based on this study, it showed that there was a significant difference between treatments on all parameters collected. From all parameters, thirteen parameters showed the highest value from treatment consist of 450 g of chicken manure (T4). Meanwhile, no fruit produces from treatment with no fertilizers applied (T1). This indicates that higher performance was produced from the greater amount of chicken manure used. So, it was recommended to increase chicken manure rate on fig to increase yields productivity.

Key words: Chicken manure, *Ficus carica* L., Fruit development, Yield performance.

INTRODUCTION

F. carica L. is an important member of the genus *Ficus* family Moraceae with more than 1400 species and 40 genera. It is ordinarily deciduous and commonly referred to as “fig”. The common fig is originally from southwest Asia and the eastern Mediterranean region and is one of the first plants grown by people (Mawa *et al*., 2013). The fig leaves are large (up to 1 foot long), thick, bright dark green in color, single and alternate. These leaves are deeply lobed, usually three to five sinuses. The leaves contain trichomes (pubescences), which are particularly rough on the adaxial (upper) leaf surface. Fig trees can produce multiple crops each year and are gynodioecious, consisting of either hermaphroditic or female parts on separate trees (Flaishman *et al*., 2008). During the spring season, the fruits are borne at the axils of the leaves and the receptacle and drupelet tissue are clearly distinct during fruit ripening (Flaishman *et al*., 2008). The drupelets are developed in syconium which encloses numerous unisexual flowers (Flaishman *et al*., 2008). The formation of syconium is complete when an ostiole is formed by the development of the apical portion of cup-shape structure at the center of the receptacle (Crane and Brown 1950; Crane and Baker 1953; Crane 1986 as cited in Flaishman *et al*., 2008)

The native land of fig is from Anatolia (Asia Minor) and has been distributed to the Mediterranean, Crimea, Iran, Iraq, Saudi Arabia, South Caucasia and Syria (Condit, 1947). The fig is thought to be indigenous to West Asia and distributed by humans throughout the Mediterranean region (Mawa *et al*., 2013). It has been cultivated for thousands of years; remnants of figs having been found in excavations of Neolithic sites traced back to at least 5,000 B.C. As time went on, the fig growing area extended from Afghanistan to southern Germany and the Canary Islands. *F. carica* is cultivated in warm and temperate parts of Europe, the Mediterranean countries and the United States of America (Starr *et al*., 2003).

Today, fig fruit has gained acceptance on the fresh fruit market where marketers and grow-shippers anticipate a high demand for fresh fig. Additive-free, low-sugar and natural products are the main drivers of fried fruit consumption in the European country (CBI, 2018). In addition, fig fruit consists of a combination of minerals and fiber such as calcium, iron and potassium (Khapre *et al*., 2015). Fresh fig naturally has a short post-harvest life which about 7 to 10 days but it can be stored up in the combination of cooler conditions and a CO_2 enriched atmosphere from 2 to 4 weeks (Sozzi *et al*. (2005); Tanwar *et al*., 2014). Furthermore, fig pulp can be processed into fig jam and fig nectar (Tanwar *et al*., 2014) while its powder can be utilized as a novel food ingredient for the enrichment of toffee (Khapre *et al*., 2011).

F. carica crop is increasingly widespread and famous in Malaysia due to its diverse value and benefit. It can be used to treat cancer, soften tissue irritations, aid digestion, chest disease remedy and improve overall health. The demand for fig seedlings is currently on the rise amongst Malaysians and many people have started planting figs. The

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fig tree, however, can also produce fruit in Malaysia and seen as potentially commercialized in this country (Mohamad, 2019). In addition, the potential market for fig is very high due to the consumers' interest in the nutritional content of the fruit (Kamaruddin *et al*., 2019) and the price could reach RM 80/kg (Mohd, 2018). Furthermore, local fig growers have reported that fig can be harvested three times per year as a result of Malaysian climate change (Mohd, 2018). However, due to problems like fruit set and un ripened fruit, there is still no information on fig fruit production in Malaysia. Besides, there is no recorded information for an adequate amount of fertilizer that is needed to promote plant growth. Therefore, the knowledge on the production of fig fruit is needed to help improve understanding of fig among Malaysians

Fig can continuously grow and produce fruit when planted under the glasshouse or open field. Lawal *et al*. (2015) also indicated that the use of fertilizers could enhance fruit growth and development, as well as the quality and quantity of fruit production. According to Kotschi *et al*., (1989); (Naim *et al*., 2015), the use of chicken manure helps improve the availability of soil minerals and the uptake of nutrients. Brady and Weils, (1999); Naim *et al*., (2015) reported that chicken manure rapidly releases its nutrients for plant uptake and utilization as it mineralizes more quickly than other animal manure. Besides, organic manure contains both micro and macronutrients, which help ensure high crop yields (Koireng *et al*., 2018). The proper use of chicken manure can, therefore, help to increase the number and quality of the yield and, at the same time, reduce the time of harvesting of the fruit. Thus, the contribution and potential application of data generated from the study could improve the current local production of fig in Malaysia.

MATERIALS AND METHODS

This study was conducted in the open area of the Glasshouse and Nursery Complex (GNC), IIUM Kuantan Campus between May 2018 to March 2019. Twenty-four of one-year-old *F. carica* c.v. Brown Turkey Modified-6 (BTM6) were used in the experiment. The experiment was arranged in a randomized, completely block design (RCBD) of six blocks. There was 1 experimental unit per treatment per block in this experiment. Six plants were replicated per treatment in six blocks. The plant distance between the block was 1 m, while the plant distance between the treatments was 2 m. All selected trees were pruned and left with only seven apical meristems. Four rates of chicken manure used were 0 g chicken manure (T1), 150 g chicken manure, 300 g chicken manure and 450 g chicken manure. Chicken manure was applied every two weeks.

Every fruit that appears to be 0.5 cm length on the fig branch was tagged and observed in the study. Data were recorded every ten days. There were 11 parameters were recorded such as fruit weight (FW), fruit length (FL), fruit diameter (FD) and receptacle length (RL). The fruit yield was collected two months after the fruit start to develop. Analysis of variance (ANOVA) was used to test the statistical significance between treatments. Multiple mean comparisons were performed using the Duncan New Multiple Range Test (DNMRT) for mean comparison. All statistical tests were performed using the open-source Statistical Analysis Software (SAS) version 9.4.

RESULTS AND DISCUSSION

The result showed that there was a significant effect of chicken manure rate on all reproductive parameters (Table 1). As in fruit weight, T4 (450 g chicken manure) produces a significantly higher result with 29.54 g while T2 (150 g chicken manure) produces the lowest fruit weight with 20.90 g. From this result, T4 can be considered as the best rate for fruit production. Besides, the higher amount of chicken manure applied leads to an increase in fruit yield. According to Osman and Abd El Rhman (2010), fruit yield was significantly affected by organic fertilizers. Result also showed that there was no fruit produced from T1 (0 g chicken manure applied). Based on the result, *F. carica* that was applied with 450 g chicken manure (T4) produces a significantly higher performance of fruit length (5.37 cm) while T1 (150 g chicken manure) produces the lowest fruit length (4.28 cm) (Table 1). Fertilizer plays an important role in fruit production. Osman and Abd El-Rhman (2010) reported that the application of bio-fertilizer showed significant effect on fruit length. Besides, the use of compost was highly efficient in improving physical and chemical properties of soil (Al kahtani and Ahmed, 2012).

In terms of fruit diameter, the application of 450 g chicken (T4) manure produced a significantly higher with 3.88 cm while 150 g of chicken manure (T1) produces the lowest performance with 3.38 cm (Table 1). Study from Osman and Abd El-Rhman (2010) showed that different fertilization treatment were significantly effected fruit diameter. T1 produced the lowest fruit diameter due to inadequate nutrient content compared to other treatments. In reference to receptacle length, T4 (450 g chicken manure) produced significantly higher receptacle length (0.42 cm) while the lowest receptacle length (0.35 cm) were from T2 (150 g of chicken manure) (Table 1). This could be explained by the nutrient availability in the plants. Khattari and Shatat (1993); Osman and Abd El-Rhman, 2010) stated that the organic manure help increase physical properties of fruit by improving the uptake of nutrient that lead to carbohydrates formation and also cell enlargement.

Based on the result, *F. carica* that was applied with 450 g chicken manure (T4) produces significantly higher stalk length and width performance with 0.94 cm and 0.70 cm, respectively. Meanwhile, T2 (150 g chicken manure) produces the lowest stalk length (4.28 cm) and T3 (300 g chicken manure) produces the lowest stalk diameter (0.47 cm). Chicken manure application improves the soil productivity by providing the nutrient and organic carbon content within the soil environment as they help stimulate

Table 1: Mean value of fruit parameters affected by different rate of chicken manure.

Rate of chicken manure	Fruit weight (FW)	Fruit length (FL) (cm)	Fruit diameter (FD) (cm)	Receptacle length (RL) (cm)	Stalk length (SL) (cm)	Stalk width (SW) (cm)
0 g chicken manure (T1)	0^{b}	0^{c}	0^{b}	0^{b}	0^{b}	0^{b}
150 g chicken manure (T2)	20.90^{a}	4.28^{b}	3.38^{a}	0.35^{a}	0.70^{a}	0.55^{a}
300 g chicken manure (T3)	23.55^{a}	4.62^{b}	3.58^{a}	0.38^{a}	0.85^{a}	0.47^{a}
450 g chicken manure (T4)	29.54^{a}	5.37^{a}	3.88^{a}	0.42^{a}	0.94^{a}	0.48^{a}
$CD_{0.05}$	19.51	0.6392	0.9033	0.0899	0.4132	0.1017

Table 1 continue...

Rate of chicken manure	Neck length (NL) (cm)	Neck width (NW) (cm)	Pedicel length (PL) (cm)	Ostiole length (OL) (cm)	Ostiole width (OW) (cm)
0 g chicken manure (T1)	0^{b}	0^{b}	0^{b}	0b	0b
150 g chicken manure (T2)	0.56^{a}	0.57^{a}	0.83^{a}	0.44^{a}	0.43^{a}
300 g chicken manure (T3)	0.50^{a}	0.53^{a}	0.78^{a}	0.48^{a}	0.48^{a}
450 g chicken manure (T4)	0.56^{a}	0.60^{a}	0.87^{a}	0.50^{a}	0.55^{a}
$CD_{0.05}$	0.2959	0.0897	0.3499	0.0933	0.1083

the microbial activity (Sheoran, *et al*., 2010). Al-kahtani and Ahmed (2012) reported that the fruit set, yield and physical properties were highly produced from a combination of 10% sheep manure and agricultural waste. In term of neck length, the performance was significantly better in treatment with 150 g chicken manure (T2) and 450 g chicken manure (T4) which recorded the same mean of yield with 0.56 cm while T3 (300 g chicken manure) produces the lowest result (0.5 cm) (Table 1). No fruit production from T1 (no chicken manure applied) might be a result of low organic content in the soil. Joseph *et al.* (2017) stated that higher fruit yield was recorded in the mixture of organic and inorganic fertilizer.

Application of 450g chicken manure produces a significantly higher neck width (0.60 cm) while the lowest neck width (0.53 cm) were from T3 (300 g of chicken manure) (Table 1). Geraldson (1985); Omar *et al*., 2017) mentioned that the nutrient content in term of potassium (K) highly influences the fruit yield and size. In accordance with pedicel length, T4 (450 g chicken manure) produced a significantly better performance of receptacle length (0.87 cm) while the lowest pedicel length (0.78 cm) were from T2 (150 g of chicken manure) (Table 1). The length of the pedicel also could be related to the amount of nutrients based on fertilizer application. Lawal *et al*. (2015) reported that fruit growth in terms of length, girth, number and weight were all significantly influenced by the rate of fertilizer. Besides, the performance of organic fertilizers is due to stabilized organic content (Bevacqua and Mellano (1995); Al kahtani and Ahmed (2012).

Based on the result, *F. carica* that was applied with 450 g chicken manure (T4) produced significantly higher ostiole length and width with 0.50 cm and 0.55 cm, respectively (Table 1). Meanwhile, T2 (150 g chicken manure) produces the lowest ostiole length and width with 0.44 cm and 0.43 cm, respectively. From this experiment, the fruit growth performance increases proportionally to the rate of fertilizer. T4 which contain the highest rate of fertilizer produces the highest result in term of ostiole length. This might be due to the amount of nutrients supplied. Bevacqua and Mellano (1993); Al-kahtani and Ahmed (2012) reported that the performance of organic fertilizers is due to the amount of organic matter and nutrient element components.

CONCLUSION

Based on this study, it observed that there was a significant difference between treatments on all parameters collected. From all parameters, thirteen parameters showed the highest value for the treatment consist of 450 g of chicken manure (T4). Meanwhile, no fruit produces from treatment with no fertilizers applied (T1). This indicated that higher performance was produced from the greater amount of chicken manure used. So, it was recommended to increase chicken manure rate on fig to increase the productivity. On the other hand, the fruits are fully ripened and can be harvested after 60 days as the fruit has fully developed in the form of a syconium structure. In addition, it was recommended to use organic fertilizer as they help improve soil and led to a healthy environment.

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