# Growth and Yield Performances of (*Abelmoschus esculentus*) Inoculated with Different Concentration of IMO

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ABSTRACT

*The existence of awareness on negative effect of using inorganic fertilizer to human health and environment resulted the farmers shift to the use of organic fertilizer and focused on organic farming. Organic farming involves the use of natural resources derived from agricultural waste as a source of fertilizer and pesticide. An experiment was conducted to study the effect of different concentrations of indigenous microorganism on growth and yield of okra (Abelmoschus esculentus). The results of the study indicated that inoculation with 5% concentrations of indigenous microorganism significantly enhanced the yield (10%), plant height (12.4%), leaves number (15.8%), fresh weight (150%) and dry weight (69.2%) of okra. These properties showed the benefits of indigenous microorganism in promoting soil fertility and then can increased growth and yield of crop production.*

**Keywords**: *indigenous microorganism, natural farming, okra, inorganic fertilizer, organic fertilizer*

## Introduction

Fertilizer is considered as organic and inorganic materials which supply essential nutrients for plant growth. However, the application of inorganic fertilizer gives some positive and negative effects towards crop growth, human health and environmental quality (Maguire and Alley, 2009; Funda et al., 2011). The existence of awareness on negative effect of using inorganic fertilizer to human health and environment was resulted the farmers shift to the use of organic fertilizer and focused on natural farming. Natural farming involves the use of natural resources derived from agricultural waste as a source of fertilizer and pesticide to supply nutrients required by plants. In modern agriculture, natural farming with application of indigenous microorganism (IMO) was introduced with the purposes to improve structure of soil, plant health and reduce environmental problem which posed from inorganic pesticides and chemical fertilizer (Jackie, 2010). The application of IMO in natural agriculture was introduced by Korean natural farming more than 30 years ago (Park, 2008). Previous study reported that the replacement of inorganic fertilizer with organic fertilizer increased vegetables production in Vietnam. Besides that, it is also one of the good management practices in order to improve soil fertility and plant quality (Inckel et al., 2009).

IMO is a group of beneficial microorganism found from local area such as forest surface, under bamboo tree, lemon grass and near the river (Charunee, 2009). Beneficial microorganisms such as rhizobacteria, diazotrophs bacteria and biological fungi can play an important role in stabling the ecosystem of the soil (Hermosa et al., 2011). IMO can also act as biocontrol agents and growth promoters (Russo et al., 2012) in crop development. Furthermore, several modes of action by IMO have a positive indirect impacts on plants growth but affecting adversely the density of pathogen, dynamics and metabolic activities of soil-borne pathogens, mainly through antibiosis, lysis,competition and hyperparasitism (Russo et al., 2012).

Okra is one of the important fruit crops in Malaysia and it can be eaten as raw and cooked vegetables. The nutrient content of such as protein, fat, vitamins, carbohydrate and minerals drive the farmers to scale up the okra production (Sorapong, 2012). Today, many people demand on organic vegetables which have

nutritional value and being safe for consumption (Nenita et al., 2010). Thus, the application of IMO in natural farming can be an alternative of inorganic fertilizer which can increase the production of organic vegetables such as okra as well as can reduce environmental problem. Therefore, the study was conducted to

determine the effect of IMO concentrations on growth and yield production of okra and to determine the best concentrations of IMO that can produce maximum growth and yield of okra.

## Materials and Methods

***Site preparation***

An experiment was conducted in nursery at the Universiti Teknologi MARA Pahang. Planting medium composed of soil mixture at ratio 3:1:1 was prepared and filled in polybag with the size of 15 inches x18 inches. All polybags were arranged with row spaces between each polybag about 90cm.

***Preparation of indigenous microorganism (IMO) mixtures***

IMO mixture was prepared based on standard methods of natural farming with some modifications. About one kilogram of cooled cooked rice was placed in plastic container with size 7cm height, 8 cm width and 15 cm length. The plastic container was then covered with a plain or white paper and tied with rubber band before placed under lemon grass plant for three days. After three days, white mold appeared on top surface of rice. Then, the mixtures were mixed with one kilogram of brown sugar and kept for one week in dark places for fermentation process. After one week, the fermented mixtures were put into plastic bottles and kept for further uses.

***Treatment and experimental design***

Four treatments of IMO concentrations consists of 5%, 4%, 3% and a control (no application of IMO) were prepared using distilled water. The experiment was arranged in randomized complete block design (RCBD) with ten replications.

***Plant sampling and growth measurement***

Two-week-old okra seedlings varieties MKBe1 were transplanted into polybag. The seedlings were irrigated using sprinkler irrigation, twice a day for 15 minutes per irrigation except on rainy day. Plant height was measured twice a week. Fruits of okra was collected twice a week and weighed. Ten plants per treatment were harvested at maturity of 55 days after transplanting (DAT). Fresh weights of okra at above ground mass were recorded and were then oven dried at $65^0$C for dry weight measurement.

***Statistical analysis***

All the data were analyzed and interpreted using SPSS system. The effect of treatments on plant growth parameters were evaluated by ANOVA. Variances and separation of means were analyzed using Duncan New Multiple Range Test (DNMRT) for post hoc comparisons at alpha = 0.05. Values were reported as mean and standard deviation (SD).

## Results and Discussion

The results of the study found that the growth of okra was affected when treated with different IMO concentrations. Plant height (Figure 1A) of okra was increased about 11% (118cm) as compared to the control. There was a significantly different in plant height of okra when treated with 5% concentration of IMO. Total leaves number (Figure 1B) of okra was increased about 22.4% (110 pieces) as compared to the control in 5% IMO concentration. Besides that, the result of the study revealed that fresh weight (FW) and

dry weight (DW) of okra plant were significantly different in 5% concentration of IMO. FW (Figure 1C) and DW (Figure 1D) of okra increased from 2106g and 66g in control to5140g and 108g respectively in 5% IMO concentration. However, there is no significant difference in number of fruit (Figure 1E) and fruit weight (Figure 1F) of okra in all IMO concentration.

The increase in plant height, total leaves number, fresh weight and dry weight of okra shows that the plant received adequate nutrition and this in line with the statement of Muthaura et al. (2010) which found that the growth of plant was increased when supplemented with organic fertilizer. Increase in plant growth was due to the increasing in photosynthetic activity of the plant. Besides that, the use of beneficial

microorganism in plant growth can also increase soil biological activity, soil texture and soil structure. The use of IMO in agriculture can stimulate the decomposition process, enhancing nutrient uptake and provide nutrient for plant growth and thus can enhanced growth and yield of plant (Hermosa et al, 2011; Funda et al, 2011).

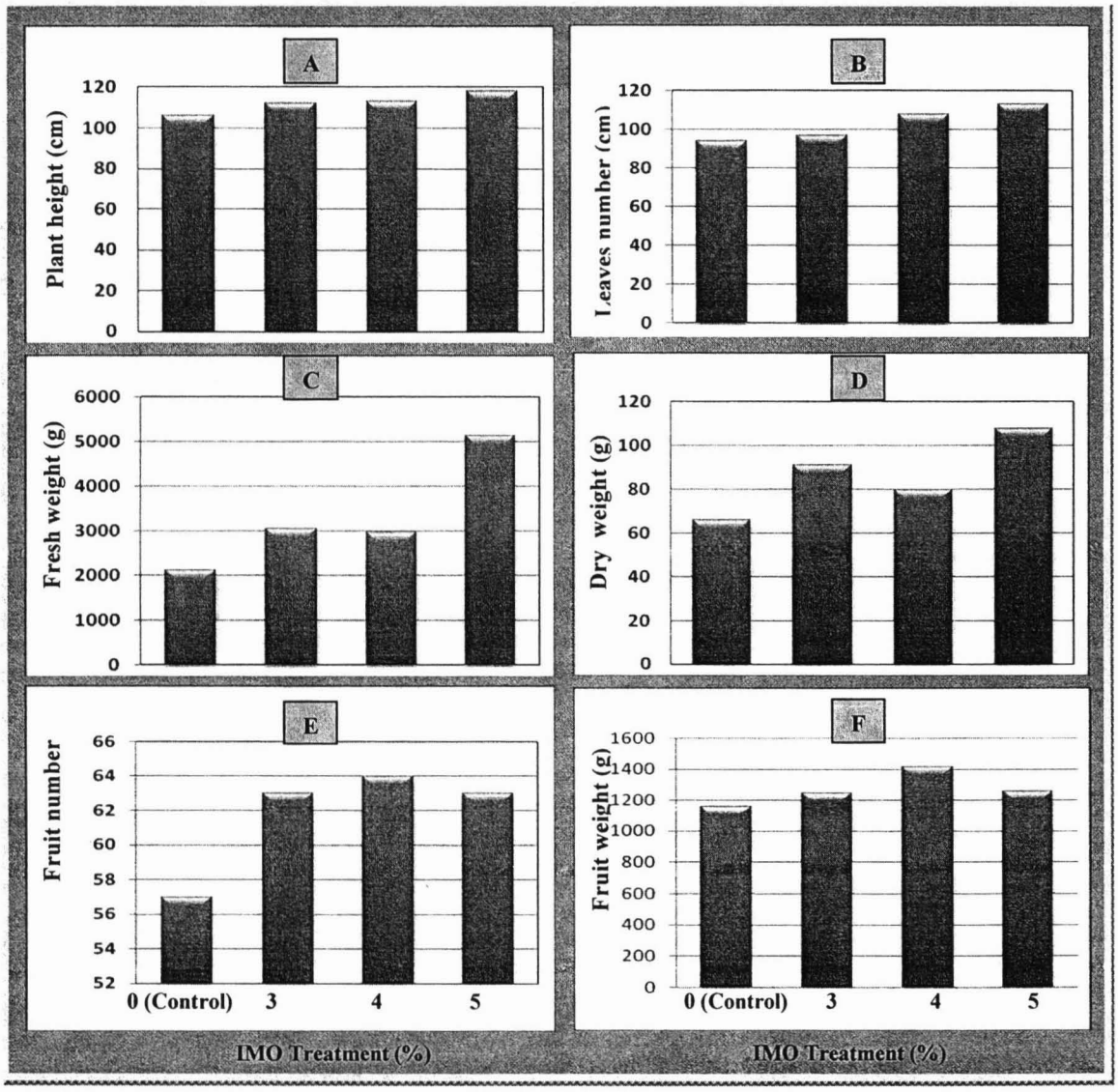


Figure 1: (A) Plant height; (B) Leaves number; (C) Fresh weight; (D) Dry weight; (E) Fruit number and (F) Total fruit weight of okra.

## Conclusion

Beneficial microorganism was reported to fasten the decaying process in compost preparation and finally improve soil fertility. The results of the study indicated that IMO can increased growth and yield of okra. However, further study needs to be conducted to learn the interaction of microorganisms with the environments. The collaboration contribution of multi scientific disciplines is of primary importance to promote sustainable practices in plant production system, as well as in conservation and ecosystem stabilization.

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