

# Organic Fertilizers Increase Yield of Dragon Fruit in Western Lombok, Indonesia

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## ABSTRACT

One of the efforts to support a healthy and sustainable agriculture program in Indonesia is to reduce the use of chemical fertilizers by using organic fertilizers. Cow manure, goat manure, chicken manure, rice husk and other waste have not been utilized optimally in agricultural cultivation even though it can be used as organic fertilizers. Although dragon fruit plants (*Hylocereus undatus* (Haw.) Britton & Rose) has increasing planting areas in Lombok Island, research on the use of organic fertilizers has not been done much. This study aimed to determine the effectiveness of the use of various types of organic fertilizers on growth and yield of dragon fruit plants. The experimental design used was a randomized completely block design with 6 organic fertilizer treatments, namely: 1) cow manure, 2) goat manure, 3) chicken manure, 4) rice husk compost, 5) sand, and 6) control (no fertilizer). Each plant was given 5 kg of organic fertilizer with 3 replications. The parameters observed included the number of shoots, number of fruits and fruit weight. The results show that the application of cow manure produced the highest number of shoots, while the application of chicken manure was attributable to the highest fruit weight.

**Keywords:** dragon fruit; growth; Lombok Island; organic fertilizer

## 1. INTRODUCTION

Fruit plants are favourite complement to the needs of human life. Consumption of fruits is increasing from time to time along with the need for vitamins for the body and lifestyle and provides many benefits for human health including high levels of beta-carotene and antioxidants to prevent the appearance of cancer on the skin and ward off free radicals. In the last period, the production of fruits has increased; the increasing need must be balanced with the increased level of availability and productivity [1].

Dragon fruit (*Hylocereus undatus* L.) is originated from Mexico and Central and South America. It is a cactus, belonging to the family of Cactaceae. It is considered to be promising and remunerative fruit crop. It has very attractive colour and mellow mouth melting pulp with black colour edible seed embedded in the pulp along with tremendous nutritive properties [2, 3, 4]. It is a nutritious fruit with a variety of uses. It can be eaten fresh and can be

made into various valuable processes products [5]. The fruit possesses medicinal properties, known to prevent colon cancer and diabetes, neutralizes toxic substances such as heavy metals, reduce cholesterol and high blood pressure. The fruit also reported to control high sugar levels. It is considered a health fruit. It is considered as fruit crop for future, hence widely favoured [6].

Dragon fruit is a fruit commodity that contributes to the total national fruit production. Lombok Island in West Nusa Tenggara (WNT) Province of Indonesia is one of the dragon fruit producing regions. This fruit is a superior fruit after mangosteen and oranges because it has high economic value, promising benefits, and has a wide open market [7]. Chakma *et al.* [8] stated that the biggest advantage of growing dragon fruit is that once planted it can grow for up to 20 years. Plants can produce in the second year after planting and reach full production within five years. Asari [9] states that the need for dragon fruits in Indonesia reaches 200-400 tons, when the Chinese New Year increases 30-40% per year so that opportunities and efforts to increase dragon fruit production and help optimal growth for dragon fruit are getting bigger [10].

One of the problems faced in the growth and development of dragon fruit plants is low productivity and low fertility of the land for its low growth, so the steps taken are to make efforts to improve land fertility. Various efforts have been made to increase the production of fruits, especially dragon fruit, one of which is by improving the fertility of the land or soil where dragon fruit grows and develops. Among them by providing organic fertilizers by providing organic materials that help the process of nutrient absorption by plants.

Soil structure and aeration can be improved by adding organic matter in the form of organic fertilizers. The use of organic matter is intended to reduce the level of erosion in the soil and have an influence on the water holding capacity so that it can be optimally utilized by plants, the organic matter contained in the soil is not much only around 3-5% but the effect of providing organic material will affect the properties of the soil and has an influence on plant growth [11].

Among the fertilizers that provide the largest contribution to the growth of fruit trees is manure. According to Yustisia *et al.* [12], manure has a higher water holding ability, while sand has good aeration and drainage. The addition of organic matter through the application of manure will increase yield productivity and provide optimal growth for fruit plants. Asari and Napitupulu's research [9] states that the application of cow manure has a significant effect on the growth of shoots, shoot lengths and the best growth of stem cuttings on dragon fruit.

Bio-fertilizers and organic supplements can play very significant role and are being used for improving crop growth and quality of products producing phytohormons, enhancing the uptake of plant nutrients thus help in sustainable crop production through maintenance of soil fertility and productivity [5]. The use of organic, inorganic resources and bio-fertilizers could drastically enhance plant height, number of branches per plant, number of thorns and stem diameter of dragon fruit plants [5].

Very little information is available until now with regards use of organic fertilizers in dragon fruit plants in Lombok Island of Indonesia for which the present study was initiated to find out the alternative source of chemical fertilization. This study aims to determine the effectiveness of using various types of organic fertilizers on the growth performances and yield of dragon fruit plants in lowlands of Western Lombok, West Nusa Tenggara Province of Indonesia.

## 2. MATERIALS AND METHODS

### 2.1. Materials

The plant materials used were in the form of dragon fruit plants that are approximately 3 years old with red (purple) flesh, cow manure (CoM), goat manure (GM), chicken manure (ChM), sand (S), and rice husk compost (RH).

### 2.2. Methods

This research was conducted from September 2013 to March 2014 at the research station of the Institute for Assessment of Agricultural Technology (IAAT) West Nusa Tenggara (WNT) Province in Peresak Village (altitude 132.8 m above sea level), Narmada Sub-district, West Lombok Regency, WNT Province on an area of 150 m<sup>2</sup>. The experiment used a randomized block design with 6 organic fertilizer treatments, namely: 1) cow manure (CoM), 2) goat manure (GM), 3) chicken manure (ChM), 4) sand (S), 5) rice husk compost (RH), and 6) control/no fertilizer (C).

Each plant was given 5 kg of organic fertilizer with 3 replications. The parameters observed in this study were included the number of shoots, number of fruits and fruit weight. The data collected was analyzed by means of Analysis of Variance followed by Duncan's multiple range test with the SAS Software program.

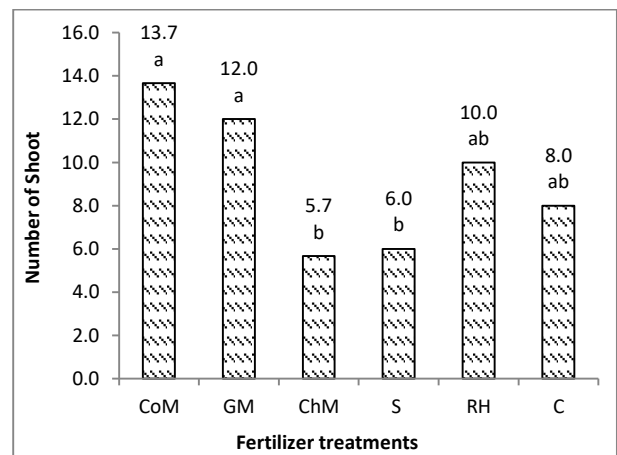
## 3. RESULTS AND DISCUSSION

### 3.1. Number of Shoots

The results of the analysis of variance showed that the treatment of organic fertilizers had a significant effect on the number of shoots. The highest number of shoots was produced by the treatment of cow manure (13.7), but it was not significantly different from the treatment of goat manure (12.0), husk (10.0), and control (8.0). While the lowest number of shoots was produced by the treatment of chicken manure (5.7) but it was not significantly different from sand (6.0).

According to Asri and Napitupulu [9], giving cow manure can accelerate the growth of plant roots and shoots. The results showed that dragon fruit stem cuttings treated with cow manure produced shoots faster than those without cow manure.

The results of the study are in line with [13] which showed a significant effect of manure treatment on the number of shoots. However, chicken manure treatment was significantly different from goat manure treatment and control. Then [5] showed that the application of a combination of organic, inorganic and biological fertilizers was able to increase the value of plant height, number of branches per plant, number of thorns and stem diameter of dragon fruit plants. The increase in vegetative growth was due to increased nitrogen fixation, better use of organic nitrogen, and development of better root systems. Number of dragon fruit shoots in each treatment of organic fertilizer is shown in Figure 1.



**Figure 1** Number of dragon fruit shoots treated with various organic fertilizers

### 3.2. Number of Fruits

The results of the analysis of variance showed that the treatment of organic fertilizers had a significant effect on the parameters of the number of dragon fruit produced. The highest value was produced by the treatment of goat and chicken manure (2.0), but it was only different from the control which resulted in the lowest number of dragon fruit (0.0).

The number of dragon fruits produced is lower when compared to [14] research which produces around 3 - 7 fruits/plant. Organic fertilizer dosage treatment had a significant effect on the number of fruit and dragon fruit production. So that the difference in yield here is thought to be due to differences in the dosage of fertilizer applied.

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Fertilization application can have an effect on dragon fruit yield, be it fruit size, number of fruit and fruit weight. Then [15] shows that dragon fruit plants that are given compost at a dose of 12 kg / pillar / year can produce dragon fruit with a total of 67.7 fruit in a period of 2 years with a production of 21.5 kg / pillar / year. Meanwhile [16] showed that giving potassium fertilizer was able to increase the number of dragon fruits by about 20-24% of control in the first year of production and 64-70% in the second year. It stated that biological fertilizers and organic fertilizers have an important role to play in increasing plant growth and the quality of products that produce phytohormones, and increasing the absorption of plant nutrients so as to help sustain plant production through maintaining fertility and soil productivity [5].

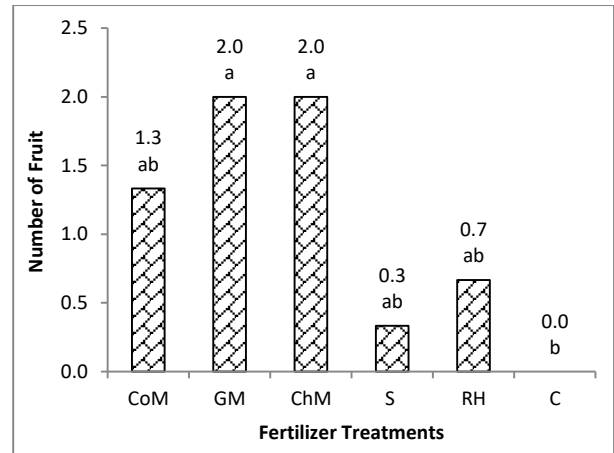


Figure 2 Number of dragon fruit produced from the treatment of various organic fertilizers

### 3.3. Fruit Weight

The treatment of organic fertilizers had a significant effect on the weight of the dragon fruit produced. Based on the results of Duncan's continued test, the highest fruit weight was produced by the treatment of chicken manure (0.7), but this value was not significantly different from other treatments except control (0.0).

The resulting fruit weight is relatively the same as [18] which produces dragon fruits with a weight of about 0.31 - 0.35 kg with the treatment of goat manure and rice straw. Meanwhile, research by [8] showed that the average individual weight of dragon fruits with NPK fertilizer dosage treatment ranged from 0.27 - 0.29 kg. Apart from manure and NPK, foliar fertilizers can also increase the weight of dragon fruits to 22.2% of control plants [16].

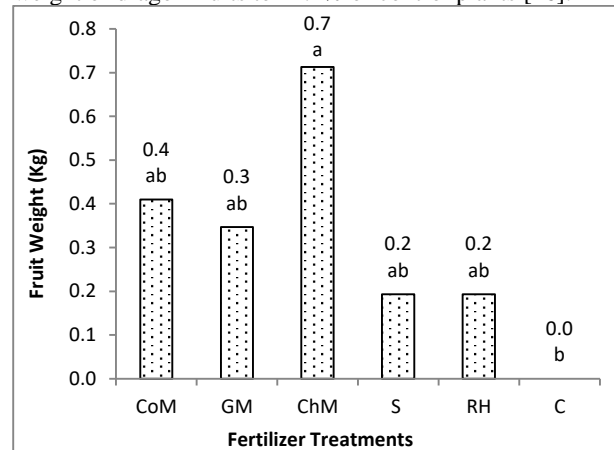


Figure 3 Fruit weight from the treatment of various organic fertilizers

Azri's research [14] shows that application of 300 g of NPK fertilizer accompanied by 10 kg of chicken manure produces the best number of fruit and dragon fruit production. It was explained that in order to obtain better dragon fruit yields, wise fertilization application is needed. The fertilization recommendations are quite varied. The resulting fruit increases at a certain level and then decreases again [8].

#### 4. CONCLUSION

This research concluded that the application of various kinds of organic fertilizers had a significant effect on the number of shoots, the number of fruit and fruit weight of dragon fruit plants in the lowlands of Lombok Island. Cow and goat manures had the highest effect on shoot formation, while the highest number of fruit was obtained from the use of goat and chicken manure. However, the highest fruit weight was only obtained in the application of chicken manure.

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