Journal of Tropical Horticulture
Vol 1, No 1, October 2018, pp. 7-9
ISSN 2622-8432 (online)
Available online at http://jthort.org

RESEARCH ARTICLE
http://dx.doi.org/10.33089/jthort.v1i1.5

The Determination of Phosphor Status in Leaf Tissues to Make a Fertilizer Recommendation and Predict Mangosteen Yield

Odit F. Kurniadinata[1*], Roedhy Poerwanto[2], and Anas D. Susila[2]

[1]Department of Agroecotechnology, Faculty of Agriculture, Mulawarman University, Samarinda, Indonesia.
[2]Department of Agronomy and Horticulture, Faculty of Agriculture, Bogor Agricultural University, Bogor 16680, Indonesia
**Corresponding author: odit.ferry@gmail.com*

ARTICLE HISTORY

Received: 11 July 2018
Revised: 27 July 2018
Accepted: 10 September 2018

KEYWORDS

Xylem
Leaf
Tissue analysis, Production
Flowers

ABSTRACT

Mangosteen *(Garciniamangostana*L.*)* knows as one of the most delicious fruit in the word, it's call as *"Queen of fruits".* The problems in mangosteen culture are low productivity and low fruit quality due to less developed technical culture, especially on fertilizer. There is a little information available on mangosteen fertilizer recommendation standards based on scientific experiment.Phosphor fertilizer increased growth especially in the generative stage of mangosteen. Phosphor increases the number of flowers and fruits set. It also decreases the number of flowers and fruits drop, with a linear response. It indicates mangosteen trees absorb phosphor to increase the vegetative growth and support production. Fertilizers increase phosphor concentrations in leaf tissues. Leaf tissues analyses showed the status of phosphor status, This status has a correlation to the yield. The higher the nutrients concentration in the leaf tissues, the higher the mangosteens yield in the next harvest.

1. INTRODUCTION

Mangosteen (*Garciniamangostana* L.) is called as the Queen of Tropical Fruits. Mangosteen has a high economic value to be developed on a large scale (Poepenoe 1974; Cox 1988; Indriyani et al. 2002). Currently, mangosteen fruit is a major commodity in the export of Indonesian horticultural products to foreign countries. But the average mangosteen productivity in Indonesia is still low (Abdillah, 2008; Poerwanto, 2003; Liferdi, 2007). The important problem in the cultivation of mangosteen in Indonesia is the low production and quality of mangosteen. The high level of consumer demand for mangosteen fruit has not been followed by an increase in the maximum production of mangosteen. Of the total mangosteen production in Indonesia, only 7.8% included export quality (Poerwanto, 2000). While the low quality is related to the size of the fruit which is not uniform.

The low production and quality of mangosteen fruit are closely related to the availability of macro and micronutrients for mangosteen (Marschner, 1995). Fertilization techniques and doses of fertilizer are one of the main factors causing the low production of mangosteen in Indonesia (Safrizal, 2007). Most ofmangosteen plants in Indonesia are not currently fertilized, but only rely on nutrient supply from the soil. In addition, the technique of fertilizing mangosteen plants used is still not developed. There is a limitation on the latest information regarding proper fertilization techniques and doses of fertilizer because fertilization is done without scientific study or the results have not been proven scientifically.

Plant tissue analysis was carried out to determine the status of nutrients in the mangosteen plant tissues (Ryugo, 1988; Masrchner, 1995). Nutrient status in plant tissues also reflects the nutrient status in the soil. This technique can be the basis for determining the right dosage and fertilizer time. So there is a need for research to get more practical examples of mangosteen leaves but have a high level of correlation with mangosteen production. In this study determination of leaf samples based on trubus age and terminal leaf position on trubus is expected to be a more practical and appropriate method in determining the adequacy of mangosteen plant nutrients and predicting mangosteen production.

2. MATERIALS AND METHODS

The study was conducted in Cengal Village, Karacak, Kecamatan Leuwiliang, Kabupaten Bogor, Indonesia. The research location is located at an altitude of 390-398 m Above Sea Level (ASL). The study lasted for 13 months from preparation to data collection. The experiment was carried out using a Randomized Block Design (RBD),

consisting of five levels of treatment with six replications. Each treatment level consists of one plant so that 30 productive mangosteen trees are needed (approximately 20 years of age and have fruited) that are relatively uni form in each experiment, phosphor Fertilization (P).

The dosage of P fertilizer consists of five levels, namely: without fertilizer P (P0); 300 g P_2O_5/plant/year (P1); 600 g P_2O_5/plant/year (P2); 900 g P_2O_5/plant/year (P3) and 1200 g P_2O_5/plant/year. Fertilization is given in three stages, the first stage is at the dormant stage (not flowering), as much as 20% of the dose specified; the second stage is given when it is approaching flowering stage (the beginning of the rainy season), as much as 60% of the dose specified; while the third stage was given when the mangosteen fruit diameter was about 2 cm, as much as 20% of the dose specified. The provision of basic fertilizer is carried out in conjunction with the first stage of fertilizer application which is 600 g N/plant and 800 g K_2O/plant/year.Leafsamplesbasedon fertilizer application time and harvest time.

Leaf samples taken from the four corners of plant growth (North, South, East, and West) with leaf criteria have reached maximum development. The number of samples was taken as much as 2 sheets for each corner. Leaf samples were taken in four stages, each stage of leaf sampling was as follows: before the first stage of fertilizer application; before the second stage fertilizer application; before the third stage fertilizer application; and after harvest.

3. RESULTSAND DISCUSSIONS

3.1 Effect of Phosphorus Fertilization

3.1.1 Phosphorus content in leaves

Phosphorus content in leaf tissue was observed four times as showed in Table 1.

Table 1. *Phosphorus content in the terminal leaf tissue of mangosteen at four times observation.*

Phosphor (g)	Dormant stage	Approaching flowering	Fruit diameterwas about 2 cm	Post-harvest
		%		
0	0,05	0,07	0,09	0,07
300	0,06	0,09	0,10	0,08
600	0,06	0,12	0,12	0,08
900	0,07	0,12	0,12	0,08
1200	0,09	0,10	0,13	0,06

Source: *Laboratory of the Department of Soil Science and Land Resources, IPB.*
Note:*The phosphorus content of terminal leaves at post-harvest shows a relatively higher value when compared to the phosphorus content at the dormant stage*

3.1.2 Phosphorus Fertilization of Crop Productivity

The application of phosphorus fertilization has an effect on several variables of plant productivity components observed, namely the number of flowers, the number of fruit harvested and fruit production/tree, but does not give effect to the variable amount of flowers and fruit fall.

Table 2. *Effect of Phosphorus on the number of flowers, the number of flowers and fruit fall, the number of fruits harvested and fruit production/tree.*

Phosphor Doses (g/tree)	The number of flowers/tree (Flowers)	The number of flowers and fruit fall/tree (Flowers and Fruits)	The number of fruits harvested/tree (fruits)	Fruit production/tree(kg/tree)
0	90,33	26,33	64,00	5,64
300	94,83	19,17	75,67	7,49
600	105,33	20,33	85,00	8,94
900	135,83	19,33	116,50	12,89
1200	130,00	16,00	114,00	12,55
F-Test	**	tn	**	**
Response patterns	L**	L*	L**	L**

Note: *F test to see the mangosteen response to phosphorus fertilization; Response patterns are tested with orthogonal polynomials, L = linear; * = real at 5% test level; ** = real at 1% test level; tn = not real.*

The availability of phosphorus for mangosteen plants affects the number of flowers and fruit produced, although it does not affect the number of flowers and fruit fall based on analysis of variance, there is a tendency that giving phosphorus decreases the number of flowers and fruit fall with linear response properties. A positive value for mangosteen fruit production. Percentage of flowers and fruit fall on the treatment without giving phosphorus fertilizer is 29.15%, decreased to 12.31% in the treatment of giving phosphorus 1200 g/plant/year.

3.1.3 Optimum dose of P fertilizer for mangosteen

The results of the mangosteen plant showed a linear response to phosphor fertilizer application (Figure 1). These results indicate that the mangosteen plant has a positive response to phosphorus fertilizer with increasing crop yields.

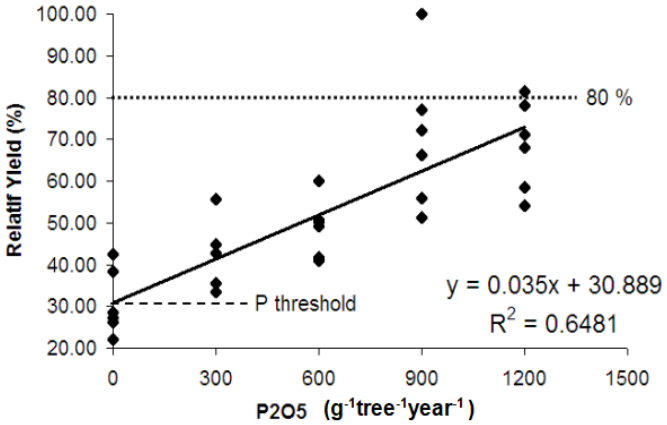

Figure 1. *Relative yield of mangosteen fruit at Phosphor Fertilization*

The response of the mangosteen plant is linear, so to determine the optimum fertilizer requirements for maximum production, the relative yield value of 80% is taken. Without phosphor fertilization application, the relative yield of mangosteen was 30,889% respectively.

3.1.4 Recommendations for Phosphor fertilization on mangosteen plants

This research showed that phosphorus fertilization application has an influence on the growth and production of mangosteen. However, to make a recommendation, a review of the economic aspects is needed, especially related to the price of fertilizer and the results that will be obtained by the mangosteen farmers. There are several alternative recommendations that can be made based on the relative yield data of mangosteen production.

Based on several alternative recommendations for phosphor fertilization on mangosteen that can be given, the best phosphor fertilization recommendation to get optimum results (80%), need more than 1200 g P_2O_5/ mangosteen tree/year (around 1400 g P_2O_5/mangosteen tree/year).

4. CONCLUSION

Phosphorus fertilization application has an effect on the components of mangosteen productivity. The results of the mangosteen plant showed a linear response to fertilizing treatment. This shows that the mangosteen plant has a positive response to phosphorus fertilizer with increasing crop yields. The best phosphor fertilization recommendations are on the optimum yield (80%), is around 1400 g P_2O_5/mangosteen tree/year. The threshold value showed that without phosphor fertilization application, the relative yield of mangosteen plants was 30,889% respectively.

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