

THE INCREMENT OF GENETIC POTENTIAL OF MANGOSTEEN THROUGH FERTILIZATION

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Submit: 23 September 2022, Revised: 27 September 2023, Accepted: Desember 2023

DOI : <https://doi.org/10.22487/agroland.v0i0.1442>

ABSTRACT

Indonesia's mangosteen exports to several Asian countries, Europe, and the Middle East have increased yearly, especially during the Covid19 pandemic. However, efforts to improve domestic mangosteen cultivation technology are inadequate. The research materials used include 45 mangosteen trees accessed by Donggala and Sigi already producing (age + 20 years) and Urea, TSP, and KCL fertilizer. The tools used are meters, plastic labels, calipers, digital scales, Smartphones, and GPS Garmin 64 Sc. Using a Randomized Block Design (RBD), one factor, namely fertilization, consists of three levels of treatment in each District. The observation results were analyzed using ANOVA, and if there was a significant influence, it was continued with the BNJ analysis. The results showed that fertilization treatment using BALITBU TROPIKA Solok and analysis results from the Soil Science Laboratory Unit of the Agriculture Faculty University of Tadulako increased plant height and triangular area stamina by 100 to 300 percent compared to without fertilization. There was an increase in plant height and triangular stamina area by 100 to 300 percent compared to without fertilization. There was an increase in plant height and triangular area stamina by 100 to 300 percent compared to without fertilization. There was an increase in production of fruit height from 155 to 394 percent, fruit/seed locul number from 101 to 106 percent, fruit production per tree from 175 to 178 percent, and fruit diameter from 119 to 137 percent.

Keywords: Accession, Locul, Growth, Fertilization, Production

INTRODUCTION

The Covid19 pandemic that has hit the world has devastated millions of people's lives globally, including in Indonesia. However, on the other hand,

this situation has provided a breath of fresh air for the trade in agricultural commodities, especially Indonesian horticultural, especially mangosteen fruit. Mangosteen exports from Indonesia to several countries, namely China, Australia,

Malaysia, united arab emirates, Saudi Arabia, France, and the Netherlands, have increased significantly from year to year. BPS noted that the export volume of mangosteen in 2018 was 38,830 tons, an increase of 324 percent compared to 2017, which was only 9,167 tons. The export value in 2018 reached Rp 474 billion, an increase of 778 percent compared to 2017 of Rp 54 billion. In 2020, it was 47,330 tons, a double increase compared to 2019.

This momentum is the basis of how important it is to improve the technology of mangosteen cultivation. Farmers should be able to use it as an opportunity in their farming business to increase the growth and production of mangosteen, especially farmers who live in production centers in Central Sulawesi. They mainly cultivate mangosteen only to the extent of filling yards or gardens without adequate cultivation application.

The problem of mangosteen cultivation in Indonesia lies in the low quality of mangosteen fruit produced from the production centers that have been built. Optimal efforts are needed to improve mangosteen cultivation techniques by applying cultivation technology to increase growth and production to meet domestic and global market standards (16) (5).

Previous research has found four mangosteen accessions with different genetic characters originating from Donggala, Sigi, Poso, and Banggai Laut Regencies of Central Sulawesi (2) (3) (4) (12), which have the opportunity to increase their potential through the application of technology in the form of fertilization packages. BALITBU Solok has recommended a mangosteen fertilization package. However, so far, it is unknown how much growth and yield it causes, as well as fertilization based on the results of soil analysis and the cultivation method of mangosteen farmers. This study aims to examine the improvement of the genetic potential of local mangosteen in Central Sulawesi through fertilization applications based on different recommendations.

RESEARCH METHODS

Study Area

This research was carried out in mangosteen planting land in Donggala Regency, namely in Tamarenja Village at 00° 25' 06.77" LS and 119° 48' 31.24" BT at an altitude of 69 meters above sea level, Labean Village with 00° 07' 35.64" LS and 119° 49' 56.68" B T at an altitude of 24 meters above sea level, and in Sigi Regency, namely in Berdikari Village 01° 07' 38.91" LS and 120° 02' 16.49" BT at an altitude of 624 masl and Happy Village 01° 08' 25.76" LS and 120° 05' 41.39" BT at an altitude of 587 MSL.

Materials and tools

The materials used include 45 mangosteen trees accession palolo, berdikari, labean, and tamarenja already produced (age ± 20 years), Urea, TSP, and KCL fertilizer.

The tools used in this study were hoes, shovels, meters, poles, rulers, plastic labels, ropes, calipers, digital scales, smartphones, GPS Garmin 64 Sc, cutters, and calculators.

Research design

This study used a one-factor Randomized Group Design (RAK), namely fertilization consisting of three levels of treatment in each village with the following details: P0=Control (No Fertilization),

- P1 = Fertilization dose based on the recommendations of the Soil Science laboratory of Faperta UNTAD, namely, Urea = 0 Kg / plant; SP-36 = 3.7 Kg/ Plant; KCl = 2.5 Kg/ Plant
- P2 = Fertilization dose based on the recommendations of BALITBU 2014, namely, Urea = 2.2 Kg / Plant; SP-36 = 1.3 Kg / Plant; KCl = 1.6 Kg/ Plant.

Each treatment was repeated 15 times so that there were 45 experimental units.

Implementation of research

Location survey

This research began with a direct survey of selected mangosteen plant

locations (PTUPT 2017). This activity is to complete data on plant growth conditions, productivity, cultivation techniques, and climate, namely Tamarenja Village, Labean Village, Berdikari Village, and Bahagia Village.

Observations of variable growth and production before fertilization treatment

Preliminary observations were made by calculating the amount of fruit production per tree, plant height, trunk diameter, and plant canopy.

Accompaniment p making

The manufacture of disks is made by making circles to the boundary of the outer canopy of the plant. The disks are as many as three with a hole width of 10 to 15 cm. The distance of the circle from the stem is 30 cm for the first circle, 60 cm for the second circle, and 90 cm for the third circle.

Fertilization

Fertilization is carried out using the recommended doses of the laboratory analysis and the recommended doses of BALITBU. Fertilization recommended by laboratory analysis uses two types of fertilizers: P fertilizer and K fertilizer. There are three conditions for apply fertilizer. First, after the initial harvest is required for plant growth in the vegetative and generative phases. Second, when ahead of flowering, and the third is when the fruit diameter \pm 2 cm. Meanwhile, BALITBU recommends using N, P, and K fertilizers with two applications: after harvest and before flowering.

Analysis data

The results of the observation of accession mangosteen at each location were analyzed using ANOVA, and if there was a significant influence, it was continued with the BNJ analysis.

RESULT AND DISCUSSION

The increment of plant height. Analysis of the variables showed that the treatment of fertilization recommendations on all mangosteen accessions showed a noticeable effect on plant height gain.

Table 1. Average Improvement plant height manggis

Access	Treatment		
	P1	P2	P3
Donggala	4.20a	8.87b	13.07c
Sigi	4.53a	9.67b	12.93c

Description: The numbers followed by the same letter in the line (a,b,c) did not differ markedly at the BNJ test level of 5%.

The 5% BNJ test showed that plant height gain based on fertilization recommended by laboratory analysis (P3) was more effective than the BALITBU (P2) recommendation. Donggala accession mangosteen and Sigi accession experienced a significant increase in plant height after fertilization compared to no fertilization (P1). The data above also shows that fertilization that applies the recommendations of the laboratory analysis results is more effective than the BALITBU recommendation.

The increment of mangosteen stem diameter. The Donggala accession and Sigi accession plants did not experience a significant increase in stem diameter after fertilization compared to no fertilization. However, both the Donggala accession and the Sigi accession showed a tendency to increase the diameter of the stem after fertilization treatment.

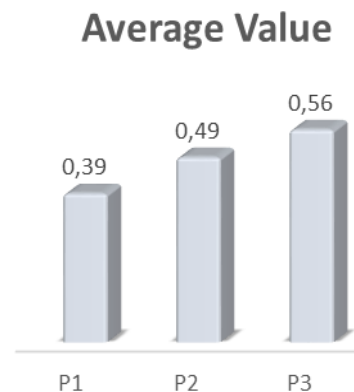


Figure1. The increment in the diameter of Sigi accession mangosteen stem

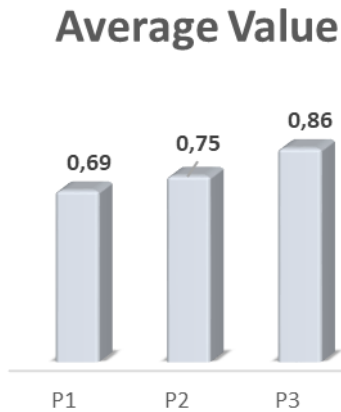


Figure2. The increment in the diameter of Donggala accession mangosteen stem

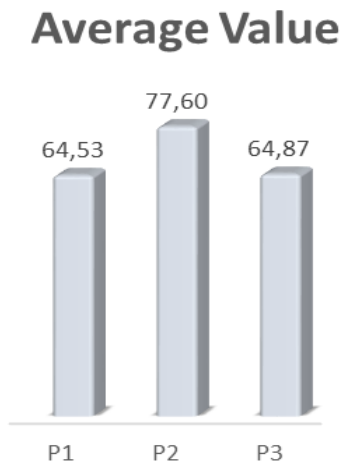


Figure 3. The widespread increase of Sigi accession in mangosteen canopy.

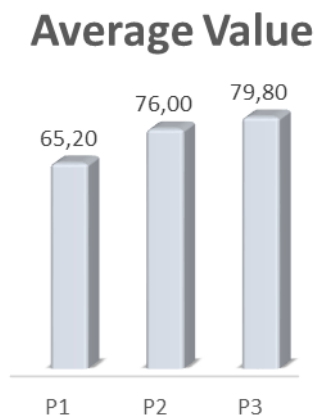


Figure 4. The widespread increase of Donggala accession in mangosteen canopy

The widespread increase in mangosteen canopy

The plants of the Donggala accession and the Sigi accession did not experience a significant increase in the canopy area after being fertilized compared to those without fertilization. However, both the Donggala accession and the Sigi accession showed a tendency to increase the extent of the heading after being given fertilization treatment.

Increase in the area of the triangle stamina of mangosteen

The analysis of the variables showed that the treatment of fertilization recommendations on the accession of Donggala and Sigi mangosteen showed a noticeable influence on the increase in the area of the mangosteen stamina triangle.

Table 2. Increase in the area of the triangle stamina of mangosteen

Access	Treatment		
	P1	P2	P3
Donggala	148.7a	385.1b	331.13b
Sigi	141.83a	417.6b	452.23b

The plant of *mangosteen* accession Donggala and accession Sigi experienced a significant increase in the triangle area after being fertilized compared to without fertilization. The data above also show that fertilization with BALITBU recommendations and recommendations from laboratory analysis results has an equally good stamina triangle overall increase effect on each observed mangosteen accession.

The increment of fruit height

Analysis of the variables showed that the treatment of fertilization recommendations on the accession of Donggala and Sigi mangosteen showed a noticeable influence on the height of the mangosteen fruit.

The Donggala accession mangosteen plant and the Sigi accession experienced a significant increase in fruit location after fertilization compared to no fertilization. The data above also show that fertilization

with BALITBU recommendations and recommendations from laboratory analysis results has an equally good fruit location and high-growth effect on each observed mangosteen accession.

Table 3. The increment of fruit height

Access	Treatment		
	P1	P2	P3
Donggala	1.81a	2.82b	2.88b
Sigi	2.38a	9.37b	8.90b

The increase in the number of locul mangosteens

The analysis of the variables showed that the treatment of fertilization recommendations on the accession of Donggala and Sigi mangosteen showed a noticeable influence on the increase in the number of mangosteen loculs.

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Table 4. The increase in the number of locul mangosteens

Access	Treatment		
	P1	P2	P3
Donggala	2.57a	2.47a	2.72a
Sigi	2.63a	2.68b	2.72b

The Donggala accession mangosteen plant and the Sigi accession experienced differences in fruit production growth per tree after fertilization compared to no fertilization. The data above shows no significant difference in the increase in the number of mangosteen loculs accessed by Donggala. However, fertilization treatment significantly impacts the increase in fruit production per tree on Sigi accession after fertilization treatment compared to no fertilization. The data above also show that fertilization with BALITBU recommendations and recommendations from laboratory analysis results has an

equally good effect on the observed Sigi accession mangosteen.

Increased fruit production per tree

The analysis of the variables showed that the treatment of fertilization recommendations on the accession of Donggala and Sigi mangosteen showed a noticeable influence on the increase in fruit production per tree.

Table 5. Increased fruit production per tree

Access	Treatment		
	P1	P2	P3
Donggala	1.39a	2.09b	2.27c
Sigi	1.27a	2.27b	2.23b

The Donggala accession mangosteen plant and the Sigi accession experienced a significant increase in fruit production per tree after being fertilized compared to no fertilization. The data above also show that fertilization with BALITBU recommendations and recommendations from laboratory analysis has an equally good effect on increasing fruit production per tree on every observed mangosteen accession.

The increment of fruit diameter

The analysis of the variables showed that the treatment of fertilization recommendations on the accession of Donggala and Sigi mangosteen showed a noticeable influence on the diameter of the fruit.

Table 6. The increment of fruit diameter

Access	Treatment		
	P1	P2	P3
Donggala	19.76a	23.61b	23.66b
Sigi	19.70a	27.02b	27.88c

The Donggala accession and Sigi accession plants experienced a significant increase in fruit diameter after fertilization compared to no fertilization. The data above also show that fertilization with BALITBU recommendations and recommendations from laboratory analysis results has an equally good fruit diameter

gain effect on each observed mangosteen accession.

Discussion

Increased growth of mangosteen

Departing from the data obtained, it appears that the effect of fertilization has increased plant height and the area of the stamina triangle on the accession of Donggala and Sigi mangosteen compared to without fertilization (farmer's way). The accession of Donggala and Sigi mangosteen showed the highest plant height increase by providing fertilization recommendations from laboratory analysis, namely 13.07 cm and 12.93 cm, in contrast to BALITBU recommendations. Fertilization becomes more effective because the fertilizer applied meets the needs of plants and follows the conditions of the plantation mangosteen both in Donggala and Sigi.

The requirements for growing mangosteen plants require that the height of a suitable place for planting mangosteen plants is not more than 800 masl. However, mangosteen plants will be more optimal in growth when planted at an altitude of about 500 meters above sea level; if mangosteen plants are planted in a place that is too high, the growth of mangosteen plants will be hampered (agrotek.id). Plant height gain is closely related to the area of the stamina triangle, namely the ability of plants to utilize energy from their environment, nutrients, and sunlight to support growth and production. Kramer and Kozlowski (1979) report that tropical plants have irregular flowering and fruiting periods that are influenced by climatic and environmental conditions and seasonal conditions.

Sigi mangosteen accession shows the highest increase in plant triangles through fertilization of laboratory analysis recommendations of 452.23 cm² and is no different from the recommendations of BALITBU. The increase in the area of the triangle stamina is an indication of the increase in its vigor plant.

Increased mangosteen production

Biologically, the potential for fruits to form is not only determined by the

degree of maturity of the tree (maturation), but also determined by the availability of energy available in cells throughout the plant tissue and physically in addition to being determined by the height and diameter of the trunk, also the canopy and the condition of the leaves as energy-forming organs growing through the process of photosynthesis (Loveless, 1991).

Fitter and Hay (1992) report that the potential of fruits produced by various types of tropical plants, in addition to being determined by physiological factors, will also be primarily determined by factors of land conditions as well as environmental conditions in which they grow. Meanwhile, fruit productivity as a regeneration material will be determined mainly by the availability of land nutrients, as well as the canopy area factor (header), which is closely related to the ability of leaves to produce energy to support fruit production. Mangosteen fertilization, both based on BALITBU recommendations and the results of laboratory analysis, has affected the increase in fruit location height, the number of mangosteen loculs, production per tree, and fruit diameter. This increase shows that the creation of optimal growing environmental conditions can bring out the best potential that Donggala and Sigi mangosteen accessions genetically have. Sigi's accession showed the highest production per tree after being fed fertilizer based on laboratory analysis, which was 2.27 kg/tree, different from BALITBU recommendations. It is suspected that there is a dominant genetic trait in the absorption of solar intensity and nutrients. In accordance with the opinion of Sopalena (2018), plants during their growth period are not only determined by environmental factors, but the genetic properties of plants play a role in growth and production.

The number of lobes and the number of seeds are related to the genetic traits of plants. The more the number of seeds produced, the ability of plants to absorb nutrients from the environment also increases. Soegito and Arifin, (2004) in Jusniati (2013).

The highest increase in fruit diameter was obtained at the accession of fertilized Sigi based on the laboratory analysis results. The variable of fruit diameter is closely related to the weight of the fruit because the weight of the fruit is related to the magnitude of the photosynthetic translocated to the fruit part (Sriyanto et al., 2015). The greater the photosynthetic produced, the greater the weight of the fruit. Wardani (2009) states that fruit height is related to fruit productivity. This means that the larger the fruit, the greater the productivity. Fertilization using fertilization with BALITBU recommendations and recommendations from laboratory analysis results has an equally good effect on increasing fruit production per tree on Sigi accession mangosteen. Rick and Holle (1990) in Soedomo (2012) stated that the height of pure fruit is derived from genetic traits even though the environment also influences the growth and development of fruits, including light intensity, temperature, and the availability of nutrients, primarily N and P elements which play an essential role in producing photosynthesis for fruit enlargement.

CONCLUSIONS AND SUGGESTIONS

Conclusion

Increasing the genetic potential of Donggala and Sigi mangosteen accession through fertilizer application both based on BALITBU recommendations and the results of laboratory analysis has been proven to increase mangosteen growth, namely, the increase in plant height and the area of the stamina triangle increased by 100 to 300 percent compared to without being fertilized. It can increase production, namely fruit height by 155 to 394 percent, the number of fruit loculs/seeds by 101 to 106 percent, fruit production per tree by 175 to 178 percent, and fruit diameter by 119 to 137 percent.

Using fertilizers based on the recommendations of the laboratory analysis results tends to be better at

increasing the genetic potential of mangosteen and significantly increasing The increment of plant height and fruit diameter.

Suggestion

It is necessary to conduct further research that leads to the improvement of the quality of mangosteen fruits.

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