Physical comparison of parijoto fruit from hydroponic farming with parijoto fruit from natural plantations

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Abstract. One of the advantages of hydroponic systems is that plants can be cultivated under controlled environmental conditions. The parijoto fruit plant has also been successfully cultivated with a bucket hydroponic system. This fruit has been shown to have a high antioxidant capacity. In this study wanted to compare the physical characteristics of parijoto fruit grown with hydroponic farming, with parijoto fruit obtained from the garden naturally. The method used in this study is to buy the seeds of the parijoto plant. It later developed it in the hydroponic farming, Dutch Bucket System, DFT (Deep Flow Technique). After the plant is fruite and ripe, parijoto fruit is picked and subjected to physical testing. Similar tests were imposed on samples of parijoto fruit obtained from natural plantations. The results of the test are further compared. Based on physical testing data obtained the conclusion that the diameter of parijoto fruit produced by hydroponic agriculture has a smaller diameter than the diameter of parijoto fruit produced by natural plantations. Lighter fruit weight, almost the same purple color, have the same moisture content, the same sugar content, higher pH value, as well as lower mineral levels.

1. Introduction

Indonesia is an agrarian country with 200 million land and 25% used for agricultural activities. This agricultural activity takes an important role in the national economy with its contribution to Gross Domestic Product (GDP) of 15.4% [1-2]. The challenges currently faced in farming activities are the limitations of natural resources, capital, and knowledge of technology. In addition, the increasingly declining land factor due to the transfer of functions into settlements is also a challenge to be overcome [3]. Precision farming is the solution. This agricultural interception is run with a system approach to agriculture with low-input, high efficiency, and sustainable agriculture. In other words, precision agriculture is an agricultural system that optimizes the use of resources to get maximum results and also reduce the impact on the environment. Concepts that are considered include the system approach that pays attention to Input, Process, Output [1,4]. Hydroponic technology is a way of cultivating plants without the use of soil, but rather using a medium given a nutrient solution with the content of all the essential elements necessary for the normal growth and development of plants [5].

One of the advantages of hydroponic systems is that plants can be cultivated under controlled environmental conditions. In hydroponic systems, environmental factors such as water availability, temperature, and relative humidity can be regulated, in addition to fewer plant disrupting organisms.
Agriculture is hydroponic, able to provide a harvest period tends to be faster and most importantly, save land [5,6]. The Dutch Bucket System is the most popular hydroponics technique in the world. Modern agriculture on a large scale in the Netherlands on average uses this technique. Dutch Bucket System is widely adopted in various countries of the world in agricultural cultivation. This is well-founded, as the Dutch Bucket System has been shown to be able to increase crop yields with a simple technique [7-9].

In this study, Dutch Bucket System hydroponic technology is applied to grow parijoto plants. Parijoto plant is a wild plant that is widely found in the mountains of Muria Kudus, Central Java with the Latin name "Medinella Speciosa L". Myths believed by the inhabitants of the holy city, consuming fruit from the parijoto plant will make pregnant women and their children will look beautiful. It has been used the fruit of the Parjoto plant (Medinella speciosa L) for the improvement of the taste of the typical holy food, namely dodol. It is known that the addition of Parijoto fruit extract is able to extend the shelf life of dodol food. Dodol food is a food made from glutinous flour dough, java sugar and coconut milk [10]. Previous studies found that the antioxidant capacity of parijoto plant fruit extract is very high [11,12], when extracted with water solvent is 53%. Whereas when extracted using ethanol solvent 96% is 75% [11]. In this study the physical characteristics of the fruit of the parijoto plant as an indicator of success in hydroponic development was investigated. It was then compared to the physical characteristics of parjoto fruit derived from natural agriculture.

2. Method
Purchased from an online store, hydroponic Dutch Bucket System which consists of set Installation of 5 pcs 8-liter bucket, 5 pcs net pot for 1 hole / 10 pcs Net pot 10cm white / black for 2 holes, 5 pcs flannel (for 1 hole) / 10 pcs flannel (for 2 holes). Purchased from the local store 5 seeds of parijoto plants, purchased from Colo Kudus Central Java Indonesia, parijoto fruit picked from natural plantations, also purchased tools: pH meter, moisture meter, refractometer sugar, refractometer salinity and caliper. The seeds of the parijoto fruit plant were developed in the Dutch Bucket System. Plants are fertilized using AB mix fertilizer on a regular basis. After the plant is fruitful and ripe, parijoto fruit is picked and subject to physical testing in the form of measurements: fruit diameter, fruit weight, purplish level of fruit color, fruit water content, fruit sugar content, fruit mineral content and acidity (pH) level of fruit. Color analysis is done with the color grab application obtained from the Google store.

3. Results and Discussions
Measurement of the physical characteristics of parijoto fruit cultivated with hydroponics bucket system and natural plantation, aimed at two aspects of the fruit part. Aspects of the outside of the fruit (Table 1) and aspects of the inside of the fruit (Table 2).

Based on measurement data on the outside of parijoto fruit (Table 1), it is known that parijoto fruit produced by hydroponic agriculture has a younger color than natural plantation-produced parijoto fruit. The color tends to be violet red while the natural plantation-produced parijoto fruit tends to be dark red. Referring to the color system L*a*b (Figure 1.), it is known that hydroponic agricultural parijoto fruit has a brighter color (L=+34.9), has almost the same reddish rate (a = + 45), but has more purplish (b = -3.5), than natural plantation-produced parijoto fruit. This is thought to occur because the content of tannins or saponins of parijoto fruit produced by hydroponics is more. This is corroborated by data from Table 2, that the pH of parijoto fruit pulp produced by hydroponics has a higher value (9.49).
Table 1. The physical characteristics of the parijoto fruit is carved from the external aspect of the fruit

|                        | Parijoto in hydroponics | Parijoto in plantation |
|------------------------|-------------------------|------------------------|
| Conversion              | CONVERT & MATCH         | CONVERT & MATCH        |
| Interpretation          | Violet:Pink             | Dark Pink:Red          |
| Hex                     | #BF2059                 | #74042C                |
| RGB                     | R = 143                 | R = 116                |
|                         | G = 45                  | G = 4                  |
|                         | B = 89                  | B = 44                 |
| HSV / HSB               | H = 333°                | H = 339°               |
|                         | S = 69%                 | S = 97%                |
|                         | V = 56%                 | V = 45%                |
| HSL                    | H = 333°                | H = 339°               |
|                         | S = 52%                 | S = 93%                |
|                         | L = 37%                 | L = 24%                |
| Lab                    | L = 34.9                | L = 23.6               |
|                         | a = 45.2                | a = 45.6               |
|                         | b = -3.5                | b = 9.7                |
| CMYK                   | C = 0%                  | C = 0%                 |
|                         | M = 69%                 | M = 97%                |
|                         | Y = 38%                 | Y = 62%                |
|                         | K = 44%                 | K = 55%                |
| Greyscale              | 31%                     | 16%                    |
| Lightness              | 35%                     | 24%                    |
| Darkness               | 65%                     | 76%                    |
| Web-safe               | #993366                 | #660033                |
| Hunter Lab             | L = 20%                 |                        |
| OK                     |                         |                        |

Average diameter 0.7 cm  
Average weight 0.20 g per piece
The size of the diameter and weight of hydroponic agricultural fruit has smaller dimensions, compared to parijoto fruit produced by natural agriculture or plantations (Table 1). This happens likely because media nutrients and hydroponic agricultural fertilizers are not as complete as nutrients that can be taken from the soil directly, as in natural agriculture. It is also suspected to cause the color of parijoto fruit produced by hydroponics more dilute. The sugar content and water content of parijoto fruit produced by hydroponics and natural agricultural products are the same (Table 2). It shows that the nutrients in the media and fertilizers added are sufficient.

Table 2. Physical characteristics of parijoto fruit are seen from the interior aspect of the fruit.

| Parameter               | Parijoto in Hydroponics | Parijoto in Plantation |
|-------------------------|-------------------------|------------------------|
| Sugar content           | 4%                      | 4%                     |
| Mineral level           | 17%                     | 24%                    |
| Moisture content        | 18%                     | 18%                    |
| pH fruit porridge       | 9.49                    | 8.27                   |
| pH fruit extract        | 2.79                    | 2.36                   |

Mineral levels in parijoto fruit produced by hydroponics are also lower than natural agricultural fruits. Nutritional problems in planting media and fertilizers remain the main conjecture.

4. Conclusion
The characteristics of parijoto fruit turned out to be determined from the way of planting, planting media and fertilizer nutrients applied. The use of modern agricultural systems such as the dutch bucket system
Hydroponics is very effective for the domestication of parijoto plants. Domestication process of parijoto plants in this study, produced almost the same characteristics of the fruit as the original fruit, especially in color, sugar content, and water content. But for mineral levels, the pH and physical size of the fruit need to be increased again.

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