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# Improving the Quality of Guava cv. Kristal with Various Fruit Wrapping Color

**Tidar Aru Fatahillah[1], Dhani[2], Wijaya[3], Umi Trisnaningsih[4]***
[1]Universitas Swadaya Gunung Jati, Cirebon, Indonesia, Tidar21121989@gmail.com
[2]Universitas Swadaya Gunung Jati Cirebon, Indonesia, inidhani25@gmail.com
[3]Universitas Swadaya Gunung Jati Cirebon, Indonesia, Wijaya6104@gmail.com
[4]Universitas Swadaya Gunung Jati Cirebon, Indonesia, umi.trisnaningsih@ugj.ac.id
Corresponding author: Umi Trisnaningsih (umi.trisnaningsih@ugj.ac.id)

**Abstract.** Fruit appearance is one of the factors that determines fruit quality. Environmental influences can cause the appearance of guava fruit to become unattractive. Fruit wrapping is one effort to improve the quality of guava fruit. This research aims to determine the effect of different wrapping colors on the quality of guava cv. Kristal. The research was conducted in Gegesik Village, Ciawigebang District, Kuningan Regency, from May to August 2023. The research method used was an experimental method with a completely randomized design. The treatment consisted of five wrapping colors (transparent, black, red, blue, and yellow) repeated five times. The variables observed were fruit skin color, fruit weight, fruit diameter, weight loss, fruit hardness, vitamin C content, and total soluble solids. The results showed that the color of the wrapper affected all observed fruit quality variables. Black plastic provides higher fruit size, fruit hardness and total soluble solids than other colors.

**Keywords**: guava, Kristal, quality, wrapping color

## INTRODUCTION

Guava is a type of tropical fruit traded on the global market. In Indonesia, guava production is not as high as that of bananas or oranges, but it has tended to increase in the last five years. In 2023, production will reach 404,654 tons with a total of 4,501,811 productive trees.(Kementerian Pertanian RI, 2024). Guava is often called a “tropical apple” because it contains vitamin C, pectin, and minerals such as phosphorus and calcium. (Kumar Mondal et al., 2015)One of the guava cultivars widely traded in Indonesia is Kristal. Crystal guava is a Pak guava mutation that originates from Thailand. (Parameswara & Susanto, 2019). Crystal guava has white flesh, an irregular round shape, and few seeds. (Romalasari et al., 2017).

The appearance of the fruit is the first factor that consumers consider when buying fruit (Parameswara & Susanto, 2019). During growth and development, the fruit undergoes various physical and chemical changes and is susceptible to pest attacks, which can reduce its commercial value (Romalasari et al., 2017). Abiotic environmental stress before harvest will influence post-harvest fruit quality and fruit resistance to pest and disease attacks (Kumar et al., 2021). Therefore, efforts need to be made so that the fruit is protected from environmental factors and attacks by plant pest organisms during its development.

The fruit wrapping material commonly used by guava farmers is plastic bags in various colors. Using different colors of plastic has different colored rays so the wavelengths produced are also different. The use of various types of plastic colors can affect the absorption of light transmission transmitted to the fruit (Cahyani et al., 2024). In peaches, the use of white non-woven polypropylene bags causes a redder skin color due to the higher anthocyanin content, compared to yellow (Liu et al., 2015). In tomato plants, different shade colors have different effects on growth variables and fruit quality (Ilić et al., 2015).

Not much information is available about the effect of fruit wrapping color on the quality of guava fruit. This research aims to determine the effect of various colors of fruit wrapping plastic on the quality of the guava fruit cv. Kristal.

## LITERATURE

Wrapping the fruit is one technique for protecting guava fruit during its growth. It is safer for consumers than using pesticides or chemicals. Wrapping the fruit will minimize agrochemical residues on the surface of the fruit, provide physical protection to the fruit, and modify the microenvironment around the fruit to support fruit development. (Kumar et al., 2021). In mangoes, wrapping the fruit can improve the morphological and chemical quality of the fruit (Islam et al., 2019).

Wrapping fruit will modify the microclimate inside the wrapper so that it is suitable for fruit development (Kumar et al., 2021). The temperature and humidity around the fruit will increase in wrapped fruit compared to unwrapped fruit (Parameswara & Susanto, 2019). Wrapped guava fruit has significantly better physicochemical quality compared to unwrapped ones (Ram Meena et al., 2016).

Wrapping the fruit will also inhibit transpiration and protect it from exposure to ultraviolet light. Physical protection of fruit from ultraviolet light will increase cell division and the availability of sufficient photosynthate for developing fruit, thereby causing an

increase in fruit weight. (Bishnoi et al., 2023). Fruit wrapping significantly improves fruit size, improves organoleptic ranking, and reduces fruit fly attacks (Brar et al., 2019).

## METHOD

Fruit sampling was carried out in the farmer's guava plantation in Gegesik Village, Ciawigebang District, Kuningan Regency. The orchard is located 400 m above sea level. The experimental design used was completely randomized, with the treatment being the color of the fruit wrapper. The treatments consist of transparent, black, red, blue, and yellow plastic. All treatments were repeated five times. Each experimental unit consists of one tree.

The fruit is wrapped one by one 28 days after the flowers bloom. The packaging used is polyethylene terephthalate plastic, which is colored according to the treatment. Plant care is carried out according to what farmers usually do. Fruit is harvested 110 days after the flowers bloom. The fruit is immediately taken to the Postharvest Laboratory, Faculty of Agriculture, Universitas Swadaya Gunung Jati, Cirebon.

Observations were made on peel color, fruit diameter, fruit hardness, weight loss, vitamin C content, and total soluble solids. The color of the fruit is observed by comparing the colors on the color chart. Fruit hardness was observed using a penetrometer. Vitamin C content was observed using the titration method. Total soluble solids were observed using a refractometer.

## DISCUSSION

### *Peel Color*

The color of the wrapping affects the color of the peel. Blue plastic provides a relatively brighter fruit color compared to other packaging colors (Figure 1. d). This shows that the intensity of sunlight influences fruit color. In grapes, the intensity of sunlight affects the biosynthesis of anthocyanins in the peel, thereby affecting the color of the fruit (Sun et al., 2017). The same thing happens to peaches (Liu et al., 2015).

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(a) (b) (c) (d) (e)

Figure 1. Guava peel color wrapped in various colored wrappers, (a) transparent, color index 4.26; (b) black, color index 4.76 ; (c) red, color index 4.65; (d) blue, color index 4.96; and (e) yellow, color index 4.80.

Research Kalaitzoglou et al. (2019) shows that light intensity will affect the pigment in plants. Light quality plays a role in suppressing the conversion of biologically active phytochromes, thereby reducing the expression of genes involved in ripening-related changes, including color and the biosynthesis of β-carotene and lycopene (Ilić & Fallik, 2017). Wrapping fruit can increase the fruit's sensitivity to light and stimulate the pigments responsible for peel color, such as chlorophyll, carotenoids, and anthocyanin synthesis, after the fruit is exposed to light again after being wrapped for a certain period of time, resulting in better color (Buthelezi et al., 2021).

*Fruit Weight*

Statistical analysis shows that the fruit wrapper's color significantly affected the fruit's weight. Fruit wrapped in black plastic was significantly larger than those wrapped in other colors. Black wrappers produced fruit that was significantly larger than the other treatments. The smallest fruit is produced by a yellow wrapper (Table 1).

Wrapping fruit before harvest will change the relative humidity and temperature around the fruit, affecting the respiration rate. Faster respiration will break down the fruit's carbohydrate reserves so that the fruit becomes smaller (Srivastava et al., 2023). However, the results of this research are different from the results of Hossain et al. (2017), which showed that the highest fruit weight was obtained in the black wrapper treatment compared to the white wrapper. Wrapping the fruit before harvest can improve the quality of guava fruit thereby increasing its selling value (Saputra et al., 2022; Sharma et al., 2020).

**Table 1. Weight and diameter of guava fruit wrapped in different colored wrappers.**

| Treatment | Fruit Weight (g) | Fruit Diameter (mm) |
|---|---|---|
| Transparent | 315.4 b | 87.59 b |
| Black | 456.2 d | 99.43 e |
| Red | 318.5 b | 80.00 a |

| | | |
|---|---|---|
| Blue | 428.0 c | 97.32 d |
| Yellow | 305.6 a | 90.47 c |

Note: Numbers followed by the same letter in the same column are not significantly different according to Duncan's Multiple Range Test at a 5% error rate.

*Fruit Diameter*

Statistical analysis shows that the color of the fruit wrapper significantly affected the fruit diameter. Black plastic caused the fruit diameter to be larger compared to other treatments (Table 1). The results of this research are the same as the results of Cahyani et al. (2024), but different from what Rahman et al. (2017) showed that fruit wrapped in blue polyethylene produced fruit diameters that were significantly larger than those without wrapping and white polyethylene.

Different wrapper colors will cause temperature differences in the wrapper. This is because different colors will absorb sunlight differently. The wrapping temperatures of sponnets and red plastic and sponnets and blue plastic were higher than other wrapping treatments, indicating greater sink strength, which allows the addition of larger fruit sizes at harvest. (Romalasari et al., 2017).

*Loss Weight*

Statistical analysis showed that different fruit wrapping colors had significantly different effects on weight loss. Black and blue plastic caused weight loss significantly more than other colors (Table 2). Weight loss is caused by high water content at harvest. It can also be caused by carbohydrates being converted into sugar in the respiration process.

In this study, a black wrapper was thought to raise the temperature inside the wrapper more than other colors. This is because black absorbs all of the sun's energy without reflecting it back. High temperatures cause higher transpiration, so when the fruit is harvested, the water content is lower.

**Table 2. Loss weight dan Fruit Hardness of guava fruit in different colored wrappers**

| Treatment | Loss Weight (%) | Fruit Hardness (kg/cm$^2$) |
|---|---|---|
| Transparent | 35.58 b | 4.98 b |
| Black | 36.45 c | 6.48 d |
| Red | 26.67 a | 4.86 b |
| Blue | 36.76 c | 5.26 c |
| Yellow | 26.76 a | 3.71 a |

Note: Numbers followed by the same letter in the same column are not significantly different according to Duncan's Multiple Range Test at a 5% error rate.

*Fruit Hardness*

The color of the fruit wrapper has a significant effect on fruit hardness. The black wrapper produced the hardest fruit, while the yellow wrapper produced the softest fruit (Table 2). The results of this study differ from previous research, which stated that the color of the wrapper had no significant effect on fruit hardness (Cahyani et al., 2024). Other research shows that wrapping with sponnets and plastic causes fruit to become softer than plastic alone. A higher temperature in the wrapper causes the fruit to ripen more quickly (Parameswara & Susanto, 2019).

*Vitamin C*

The vitamin C content in fruit is significantly affected by the color of the fruit wrapping. Transparent and blue wrapping produced fruit with significantly higher vitamin C content than other treatments (Table 3). The results of this study are different from previous research, which showed fruit wrapping did not affect the vitamin C content of fruit (Parameswara & Susanto, 2019). Other research shows that guava fruit wrapped in polyethylene plastic is more porous than without wrapping. (Srivastava et al., 2023).

**Table 3. Vitamin C content and total soluble solid of guava fruit in different colored wrappers**

| Treatment | Vitamin C (mg/g flesh) | Total soluble solid (°Brix) |
|---|---|---|
| Transparent | 9.24 c | 18.07 d |
| Black | 9.19 b | 19.22 e |
| Red | 9.10 a | 15.96 a |
| Blue | 9.24 c | 16.84 c |
| Yellow | 9.09 a | 16.67 b |

Note: Numbers followed by the same letter in the same column are not significantly different according to Duncan's Multiple Range Test at a 5% error rate.

*Total Soluble Solid*

The color of the fruit wrapper significantly influenced total soluble solids. Black wrapping produced the highest total soluble solids compared to other treatments. Red wrapping produced the lowest total soluble solids (Table 3). Wrapped fruit contains higher total soluble solids and lower total titratable acids compared to unwrapped fruit (Parameswara & Susanto, 2019)This shows that wrapping the fruit will make the guava taste sweeter than unwrapping it. Increasing the temperature in the wrapper causes the fruit to ripen more quickly, making the fruit taste sweeter. (Srivastava et al., 2023).

## CONCLUSION

Fruit wrapping can improve the quality of guava fruit. Different wrapping colors influence guava fruit quality variables. Black plastic produces larger, firmer fruit sizes and higher total dissolved solids than other packaging colors. Therefore, black wrapping is recommended.

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