Vol. 8 No. 2 March 2025

ISSN : 2597 - 8713 (ONLINE)
ISSN : 2598 - 5167 (PRINT)
Agricultural Science

Journal Of Agricultural Science And Agriculture Engineering
Faculty of Agriculture, Merdeka University Surabaya,Indonesia
Available on :
https://agriculturalscience.unmerbaya.ac.id/index.php/agriscience/index

Maturity Level on the Quality of Pineapple (*Ananas comosus L Merr.)* Smooth Cayenne Variety During Storage Period

Fawwaz Fauzan[1], Dodi Budirokhman[1]*

[1]Faculty of Agriculture, Gunung Jati Swadaya University, Cirebon, Indonesia

*Correspondence E-mail: dodi.budirokhman@ugj.ac.id

ABSTRACT

One factor in maintaining product quality is the level of maturity at harvest. The right level of maturity at harvest can produce good quality fruit. The characteristics of fruit commodities at various levels of maturity at harvest time greatly determine the quality because different levels of fruit maturity will affect the quality of the fruit, and inappropriate levels of maturity will cause low fruit quality. This research was carried out by the UGJ Cirebon Faculty of Agriculture Laboratory from July to August 2024. This research used an experimental method with a Completely Randomized Design (CRD). Variables measured included weight loss, total dissolved solids content and vitamin C. Tests were carried out using analysis of variance and Duncan's test. The results showed that differences in pineapple ripeness levels made a difference to fresh weight, weight loss and total soluble solids levels. High fresh fruit weight and weight loss were obtained at a maturity level of 20%, while high total soluble solids were obtained at a maturity level of 30%. Vitamin C levels showed no differences at various stages of maturity.

Keywords: Quality, Pineapple, Smooth Cayenne, Ripeness, Vitamin C

1. INTRODUCTION

Pineapple (Ananas comosus L. Merr.) is one of the leading fruit commodities that is widely cultivated in Indonesia. Indonesia is the third largest pineapple producing country in Southeast Asia after the Philippines and Thailand with a market contribution of 23%. Almost all of Indonesia is a pineapple producing area because it is supported by a suitable tropical climate. (Indonesian Ministry of Agriculture, 2022).

The area of pineapple plantations in Indonesia in 2020 was around 14,694 ha with a production of 1,729,600 tons (Ministry of Agriculture, 2022). According to the Center for Agricultural Data and Information Systems, Ministry of Agriculture of the Republic of Indonesia (2022 in Syah et al., 2022), pineapple production is in third place after bananas and mangoes. This plant has many benefits, especially its fruit. The pineapple processing industry in Indonesia is a priority plant that continues to be developed. Apart from being consumed as fresh fruit, it can also be processed into various kinds of food and drinks, such as jam, syrup and canned fruit.

Abundant pineapple production can be developed into various industrial products, both food and non-food. Pineapples used for industrial purposes have certain criteria. This ensures

DOI: https://doi.org/10.55173/agriscience.v8i2.155

Vol. 8 No. 2 March 2025
ISSN : 2597 - 8713 (ONLINE)
ISSN : 2598 - 5167 (PRINT)
Agricultural Science
Journal Of Agricultural Science And Agriculture Engineering
Faculty of Agriculture, Merdeka University Surabaya,Indonesia
Available on :
https://agriculturalscience.unmerbaya.ac.id/index.php/agriscience/index

that the pineapple products produced are of good quality. One of the criteria for pineapple used as an industrial ingredient is based on the level of ripeness (Faradila & Chandra, 2019).

Pineapple farmers in Indonesia generally harvest before harvest time. In fact, the harvest age of a commodity greatly influences the taste of the fruit produced. The level of maturity at harvest is an important thing that is irreversible because it will affect the internal and external quality of the commodity. Hence knowledge of harvest methods, harvest time, and the influence of these factors on the internal and physiological processes of the commodity is necessary (Prasad, 2016).

One factor in maintaining product quality is the level of maturity at harvest (Haryono & Priyatno, 2018). The right level of maturity at harvest can produce good quality fruit. The characteristics of fruit commodities at various levels of maturity at harvest time greatly determine the quality because different levels of fruit maturity will affect the quality of the fruit, and inappropriate levels of maturity cause low fruit quality (Setyabudi et al., 2015).

If fruit commodities are harvested when they are not yet ripe, they will produce low quality fruit. On the other hand, harvesting over time will cause the fruit to lose its best quality. Research on pineapple fruit shows that the higher the level of ripeness of the pineapple fruit, the water content, total dissolved solids, vitamin C, preference for the aroma and texture of the fruit will increase, but the total acidity and hardness values will decrease (Nofriati & Asni, 2015). Because in general, fruit quality is determined by several quality requirements, namely size, color, shape, condition, texture, taste and nutritional value. Good fruit quality is obtained if the harvest is carried out at the right level of ripeness (Santosa & Hulopi, 2008).

The level of maturity at harvest has a big influence on the quality of pineapple fruit. Pineapples that are harvested before they are mature enough will have characteristics such as not yet sweet tasting, physical changes including color, texture, weight loss, thickness of the wax layer and low nutritional content in the fruit, while pineapples that are too ripe (maturity level > 80%) have a short shelf life (Purwantiningsih, 2012). Therefore, timely harvesting is the best effort to get quality fruit.

The results of research by Novita Condro and Selmi Y Stefanie in 2022, showed that pineapple with a maturity level of 30% which was stored at a temperature of 5oC, on the 10th day contained a sugar content of 12%, while pineapple fruit with a maturity level of 20% contained a sugar content of 10%.

Thus, the level of fruit ripeness influences the total sugar content. Therefore, it is critical to understand what pre-harvest factors influence many important harvest quality attributes that

DOI: https://doi.org/10.55173/agriscience.v8i2.155

ISSN : 2597 - 8713 (ONLINE)
ISSN : 2598 - 5167 (PRINT)
Agricultural Science
Journal Of Agricultural Science And Agriculture Engineering
Faculty of Agriculture, Merdeka University Surabaya,Indonesia
Available on :
https://agriculturalscience.unmerbaya.ac.id/index.php/agriscience/index

influence post-harvest setback rates and, subsequently, consumers' decisions to purchase products in the market. Based on this background, it is necessary to conduct research on the Effect of Maturity Level on the Quality of Smooth Cayenne Varieties of Pineapple (Ananas comosus L. Merr.) During the Storage Period.

2. RESEARCH METHOD

This research was carried out at the Laboratory of the Faculty of Agriculture, Swadaya University, Gunung Jati. This research was carried out from July to August 2024. The material used was pineapple fruit obtained from the Pineapple Garden in the Mekar Sari Maju Farming Group, Sarireja Village, Jalancagak District, Subang Regency. 0.1 N iodine, 1% starch, and distilled water, while the tools used include camera, stationery, analytical scales, hand refractometer, thermohygrometer, penetrometer, burette, pipette, beaker, measuring cup, Erlenmeyer glass, glass funnel, spatula, spray bottle, knife, sieve, mortar, spirit lamp, plastic container, tissue and calipers.

This research uses an experimental method with a Completely Randomized Design (CRD). The treatments were various levels of maturity which consisted of 3 types of treatment levels: (1) TK 1: 20% of the pineapple fruit color at the base was yellow, (2) TK2: 30% of the fruit color at the base of the fruit changed to yellowish orange, and (3) TK3: 40% of the eyes became yellowish orange. Each treatment level was repeated 9 (nine) times so that in total there were 27 experimental units. The pineapple samples used in each experimental unit were 3 pineapples, so that the total number of pineapples needed in this study was 81 pineapples.

Harvesting is done early in the morning to maintain the quality of the pineapples. Pineapples are harvested using a sharp knife by cutting the base of the fruit stalk horizontally or at an angle. Harvesting by breaking the fruit stalk can cause the durability and storability of the fruit to decrease. Harvesting is done carefully so that the fruit is not damaged or bruised. The harvest method must be able to minimize mechanical damage that occurs to the pineapple fruit, such as avoiding placing it by throwing it into a basket or throwing it into a stacking area.

The pineapples sampled in this study were pineapples with a level of maturity according to the treatment, namely:

- TK 1: 10% of pineapples are yellow at the base
- TK2: 20% of the fruit color at the base of the fruit changes to yellowish orange
- TK3: 30% of eyes become yellowish orange

DOI: https://doi.org/10.55173/agriscience.v8i2.155

Vol. 8 No. 2 March 2025
ISSN : 2597 - 8713 (ONLINE)
ISSN : 2598 - 5167 (PRINT)
Agricultural Science
Journal Of Agricultural Science And Agriculture Engineering
Faculty of Agriculture, Merdeka University Surabaya,Indonesia
Available on :
https://agriculturalscience.unmerbaya.ac.id/index.php/agriscience/index

Other criteria are that the pineapple fruit has relatively the same size and shape, is smooth, has no mechanical damage, is free of pests and disease, has a fruit stalk per stalk of at least 5 cm and the crown of the fruit is still intact and fresh. The weight of the pineapple that will be used as a sample in this research is pineapple with a weight of ± 800 grams per item.

The research sample of pineapple with a weight of ±800 grams per item was based on the consideration that the weight of ±800 grams per item was *grade* dominant or the class that many farmers produce in the period from June to August, which is the dry season weather condition.

The next stage is to put the pineapple in a plastic basket with holes measuring 60 cm x 40 cm x 20 cm which at the bottom of the basket and on the left and right sides of the basket have been covered with newspaper as a cushion. The pineapple fruit is put into the basket slowly so that there is no physical collision between the fruit which can cause damage. The fruit that has been put into the basket is then taken to the bamboo hut belonging to the Mekar Sari Farmers Group to remove the heat from the garden (*cooling down*) for 2 hours before being transported to the car to be taken to Cirebon.

The process of transporting fruit from the Pineapple Garden in the Mekar Sari Maju Farmers Group, Sarireja Village, Jalancagak District, Subang Regency, is carried out using an air-conditioned car to . Product Processing Technology Laboratory, Faculty of Agriculture, Gunung Jati Swadaya University, Cirebon, for further testing.

Furthermore, during the research process, pineapple fruit according to the treatment was stored for 15 days in an air-conditioned room at a temperature of 23^{the}C.

Observations were made on the 5th, 10th and 15th days which included fresh weight, weight loss, total dissolved solids and vitamin C levels. Experimental data were analyzed using the F test in analysis of variance, if the treatment tested showed a real effect then the test was continued with the DMRT Test (Duncan Multiple Range Test) at a significance level of 5%. Data analysis was carried out with the help of SPSS version 26.0.

3. RESULTS AND DISCUSSION

Fresh Weight

After being harvested, pineapple fruit still carries out metabolic processes, such as the respiration process, using the food reserves contained in the fruit. As a result of this metabolic process, food reserves in the fruit will continue to decrease and cannot be replaced because the fruit has separated from the tree. The ongoing metabolic process in pineapple fruit will

DOI: https://doi.org/10.55173/agriscience.v8i2.155

Vol. 8 No. 2 March 2025
ISSN : 2597 - 8713 (ONLINE)
ISSN : 2598 - 5167 (PRINT)
Agricultural Science
Journal Of Agricultural Science And Agriculture Engineering
Faculty of Agriculture, Merdeka University Surabaya,Indonesia
Available on :
https://agriculturalscience.unmerbaya.ac.id/index.php/agriscience/index

accelerate the process of losing the fruit's nutritional value and speed up the ripening process. The weight of fruit for each level of maturity can be seen in table 1.

Table 1. Weight of Pineapple Fruit for Each Level of Ripeness at Each Observation

No	Maturity Level		Fresh Weight (g)		
		Day 1	Day 5	Day 10	Day 15
1	Maturity Level 10%	816,67	808,33	791,67	770,00
2	Maturity Level 20%	823,33	816,11	798,33	774,44
3	Maturity Level 30%	873,89	866,11	848,33	826,11

Based on Table 1. So at each level of maturity the pineapple experienced a change in weight starting from day 1 to day 15 of observation. Fruit and vegetables after being harvested will experience physicochemical changes due to metabolic processes, including respiration and transpiration which result in water loss. Water loss causes stress in the tissue so that the rate of cell membrane disintegration increases. Excessive water loss can result in softening, shrinking and loss of brightness of the fruit skin (Gumaran, et. al. 2023).

Winarno (1993) *in* Kalsum, et al. (2018) explained that weight loss in fruit and vegetables during storage is caused by water loss as a result of the evaporation process and carbon loss during respiration, causing damage and reducing the quality of the product. Furthermore (Bapat et al., 2010 *in* Gumaran et. al. 2023) that pineapple is a type of climacteric fruit where the respiration rate will increase after entering the ripening phase and increase ethylene production

Weight Loss

Weight loss is a condition caused by respiration and transpiration of post-harvest fruit as a biological process where oxygen is absorbed to burn organic materials in the fruit to produce energy, followed by the release of combustion residues in the form of carbon dioxide gas and water which undergoes evaporation (Alexandra and Nurlina, 2014 in Sulistyowati, et al. (2019).

The results of the analysis showed that the maturity level treatment had a real influence on weight loss on the 5th and 10th days of storage, whereas on the 15th day it did not have a real influence. The results of the analysis are presented in Table 2. Table 2 shows that weight loss increased in line with the length of time the pineapple was stored. According to Novita et al., (2012) in Kalsum et al. (2018), in their research on tomatoes, stated that weight loss in tomatoes tends to increase with the length of storage.

DOI: https://doi.org/10.55173/agriscience.v8i2.155

Vol. 8 No. 2 March 2025
ISSN : 2597 - 8713 (ONLINE)
ISSN : 2598 - 5167 (PRINT)
Agricultural Science
Journal Of Agricultural Science And Agriculture Engineering
Faculty of Agriculture, Merdeka University Surabaya,Indonesia
Available on :
https://agriculturalscience.unmerbaya.ac.id/index.php/agriscience/index

Table 2. Effect of Maturity Level on Weight Loss

No	Maturity Level	Weight Loss (%)		
		Day 5	Day 10	Day 15
1	Maturity Level 10%	0,69 a	2,49 a	4,88 a
2	Maturity Level 20%	1,09 b	3,20 b	5,93 a
3	Maturity Level 30%	0,92 ab	3,04 ab	5,70 a

Information : The average number is accompanied by letters in the column indicating that it is not significantly different based on the Duncan Test with a significance level of 5%

From the results of this research, the weight loss of pineapple fruit with a maturity level of 20% was higher than that with a maturity level of 10%, but not different from a maturity level of 30%, both on the 5th and 10th day. On the 15th day, it is assumed that the rate of the respiration process is relatively constant so that the weight loss of the three levels of maturity is not significantly different.

According to Rahayu and Bintoro (2021) the respiration rate is influenced by the level of fruit maturity. Weight loss during storage is caused by transpiration and respiration processes which cause water loss (Wills et al., 1981).

The length of storage causes an increase in weight loss of potato tubers, this is in accordance with the statement (Asgar and Asandhi, 1992 *in* Purnomo, 2017) which states that the longer potato tubers are stored, the greater the loss.

Winarno (1993) *in* Kalsum, et al. (2018) explained that weight loss in fruit and vegetables during storage is caused by water loss as a result of the evaporation process and carbon loss during respiration, causing damage and reducing the quality of the product.

Furthermore, Lestari et al. (2013) *in* Gumaran, et al. (2023) explained that during storage the transpiration and respiration processes cannot be inhibited so that the fruit experiences an increase in weight loss. Symptoms of water loss in tissues are caused by changes in the vapor pressure of the surrounding air. The transpiration process causes loss of cell turgor which results in softening of the fruit. A similar statement was also conveyed by Royana et al., (2012) *in* Andreani, et al, (2018) that an increase in respiration rate can cause weight loss in fruit. Increasing the respiration rate will cause the breakdown of compounds such as carbohydrates in fruit and produce CO_2, energy and water evaporate through the surface of the tomato skin and cause weight loss.

DOI: https://doi.org/10.55173/agriscience.v8i2.155

Vol. 8 No. 2 March 2025
ISSN : 2597 - 8713 (ONLINE)
ISSN : 2598 - 5167 (PRINT)
Agricultural Science
Journal Of Agricultural Science And Agriculture Engineering
Faculty of Agriculture, Merdeka University Surabaya,Indonesia
Available on :
https://agriculturalscience.unmerbaya.ac.id/index.php/agriscience/index

Total Dissolved Solids

The total soluble solids content can indicate the level of fruit maturity. Ripe fruit generally has a higher total dissolved solids value than immature total dissolved solids.

Table 3. Effect of Maturity Level on Total Dissolved Solids

No	Maturity Level	up to Brix ( )		
		Day 5	Day 10	Day 15
1	Maturity Level 10%	10,67 a	10,11 a	9,56 a
2	Maturity Level 20%	11,33 a	10,56 a	9,67 a
3	Maturity Level 30%	14,67 b	14,33 b	13,33 b

Information : The average number is accompanied by letters in the column indicating that it is not significantly different based on the Duncan Test with a significance level of 5%

From the results of analysis of variance, it was found that the level of ripeness of pineapple fruit at harvest had a significant influence on total soluble solids on the 5th, 10th and 15th days of storage. The 30% maturity level has a higher total dissolved solids compared to the total dissolved solids at the 10% and 20% maturity levels. Furthermore, the results of the Duncan Test showed that in each observation period, the total dissolved solids at the 30% maturity level were significantly different from the fresh weight at the 10% and 20% maturity levels.

According to Wiles (2000) in Kalsum (2018) that in the ripening process during fruit storage, starch is completely hydrolyzed into sucrose which then turns into reducing sugars as substrates in respiration.

as much vitamin C

The research results in Table 4 show that the levels of vitamin C in pineapple fruit do not show significant differences in various treatments at the level of fruit maturity.

Table 4. Effect of Ripeness Level on Vitamin C Levels

No	Maturity Level	Up to Vit. C (%)		
		Day 5	Day 10	Day 15
1	Maturity Level 10%	18,37 a	22,23 a	21,27 a
2	Maturity Level 20%	19,33 a	25,13 a	23,20 a
3	Maturity Level 30%	22,23 a	26,10 a	25,13 a

According to Kartika (2010), the decrease in vitamin C content when the fruit is ripe is due to the oxidation of ascorbic acid to dehydroxy ascorbic acid, and it will undergo further changes to

DOI: https://doi.org/10.55173/agriscience.v8i2.155

ISSN : 2597 - 8713 (ONLINE)
ISSN : 2598 - 5167 (PRINT)
Agricultural Science
Journal Of Agricultural Science And Agriculture Engineering
Faculty of Agriculture, Merdeka University Surabaya,Indonesia
Available on :
https://agriculturalscience.unmerbaya.ac.id/index.php/agriscience/index

form ketogluconic acid. Oxidation of vitamin C occurs because in plant cells there are enzymes that can increase the speed of oxidation, namely the enzyme ascorbic acid oxidase or the enzyme ascorbic acid oxidase. Due to the activity of the ascorbic acid oxidase enzyme, harvested crops will result in a decrease in vitamin C levels in ripe fruit.

These results are also in accordance with research by Dewi (2018) which states that the more ripe the tomatoes, the lower the vitamin C levels will be. This is because vitamin C is the vitamin that is most easily oxidized and this process is accelerated by light, heat, alkali and the age of the fruit. The same thing was also reported by Rahman, et al (2015) who reported that increasingly KIND mango fruit fake and golek mango, then vitamin C levels will significantly decrease.Decreased levels vitamin C as the level of mango ripeness increases podang can due to The biosynthesis of vitamin C is greatly influenced by the activity of the ascorbate oxidase enzyme that occurs spontaneously. As for The spontaneous oxidation mechanism is the oxidation reaction of monoanions of ascorbic acid to produce dehydro ascorbic acid (L-dehydroascorbic acid) and hydrogen. peroxide. L-dehydroascorbic acid is unstable so it easily changes into 2,3-L-diketogulonate (DKG) which no longer has the activity of vitamin C.

4. CONCLUSION

Differences in pineapple maturity levels provide differences in fresh weight, weight loss, and total soluble solids content. High fresh fruit weight and weight loss were obtained at a maturity level of 20%, while high total soluble solids were obtained at a maturity level of 30%. Vitamin C levels showed no differences at various stages of maturity.

REFERENCES

Alam, I., Warkoyo, W., & Siskawardani, D. D. (2022). Characteristics of the Maturity Level of Robusta Coffee Fruit (Coffea canephora A. Froehner) and Arabica Coffee Fruit (Coffea arabica Linnaeus) on the Quality and Taste of Brewed Coffee. *Food Technology and Halal Science Journal*, *5*(2), 169-185.

Andriani, E. S., Nurwantoro, N., & Hintono, A. (2018). Physical changes in tomatoes during storage at room temperature due to coating with agar. *Journal of Food Technology*, *2*(2), 176-183.

Astija, A. (2021). Vitamin C Content of Tomatoes at Different Ripe Levels. *Bio Generation Journal*, *6*(2), 92-98.

 DOI: https://doi.org/10.55173/agriscience.v8i2.155

ISSN : 2597 - 8713 (ONLINE)
ISSN : 2598 - 5167 (PRINT)
Agricultural Science
Journal Of Agricultural Science And Agriculture Engineering
Faculty of Agriculture, Merdeka University Surabaya,Indonesia
Available on :
https://agriculturalscience.unmerbaya.ac.id/index.php/agriscience/index

Condro, N., & Stefanie, S. Y. (2022). SUGAR CONTENT OF HONEY PINEAPPLE (Ananas comosus L. merr) FRUIT AT DIFFERENT LEVELS OF MATURITY. *DYNAMIC*, *19*(2), 125-130.

Fadhilah, M. N. M. T. (2022). *EMPOWERMENT OF PINEAPPLE FARMING GROUPS IN PARARAPAK VILLAGE, DUSUN SELATAN DISTRICT, SOUTH BARITO DISTRICT, CENTRAL KALIMANTAN PROVINCE* (Doctoral dissertation, Institute of Domestic Government).

Gumaran, S., & Hutabarat, F. T. (2023). Tomato Fruit Coating Application (*Solanum tomato*) Chitosan Based with the Addition of ZnO Nanoparticles. Journal of Agricultural Processing Technology, 5((1)), 20–26.

Helmiyesi, H., Hastuti, R. B., & Prihastanti, E. (2008). Effect of storage time on sugar and vitamin C levels in Siamese orange fruit (Citrus nobilis var. Microcarpa). *Anatomy Physiology*, *16*(2), 33-37.

Julianti, E. (2011). The effect of maturity level and storage temperature on the quality of Dutch eggplant (Cyphomandra betacea). *Indonesian Horticulture Journal*, *2*(1), 14-20.

Kalsum, U., Sukma, D., & Susanto, S. (2020). Effect of chitosan on the quality and shelf life of tomatoes (Solanum lycopersicum L.). *Journal of Precision Agriculture (Journal of Precision Agriculture)*, *2*(2), 67-76.

Manurung, N. A. (2022). *Analysis of Pineapple Farming (Ananas Comosus (L.) Merr.) in Siabal-Abal Ii Village, Sipahutar District, North Tapanuli Regency* (Doctoral dissertation, Medan Area University).

Nofriati, D., & Asni, N. (2015). The influence of packaging type and level of ripeness on the quality of orange fruit during storage. *Indonesian Journal of Agricultural Postharvest Research*, *12*(2), 87-92.

Prasetyo, N. A., Surtono, A., Junaidi, J., & Pauzi, G. A. (2021). Computer Vision Based Non-Destructive Pineapple Ripeness Level Identification System. *Journal of Energy, Material, and Instrumentation Technology*, *2*(1), 1-10.

Purnomo, E., Suedy, S. W. A., & Haryanti, S. (2017). Effect of storage method and time on weight loss, glucose content and carotenoid content of consumption potato tubers (Solanum tuberosum L. Var Granola). *Anatomy and Physiology Bulletin*, *2*(2), 107-113.

Rahayu, D., Bintoro, N., & Saputro, A. D. (2021). Modeling of climacteric fruit respiration rates during storage at various temperatures. *Agrointek: Journal of Agricultural Industrial Technology*, *15*(1), 80-91.

Retno, H. T. (2023). Rate Of Change In Maturity Of Pineapple (Ananas Comosus) Fruit With Palm Palm Stearin Coating At Low Temperatures As An Export Commodity.

DOI: https://doi.org/10.55173/agriscience.v8i2.155

ISSN : 2597 - 8713 (ONLINE)
ISSN : 2598 - 5167 (PRINT)
Agricultural Science
Journal Of Agricultural Science And Agriculture Engineering
Faculty of Agriculture, Merdeka University Surabaya,Indonesia
Available on :
https://agriculturalscience.unmerbaya.ac.id/index.php/agriscience/index

Rusmanto, E., Rahim, A., & Hutomo, G. S. (2017). Physical and chemical characteristics of tomatoes resulting from coating with taro starch. *AGROTECHNICAL: JOURNAL OF AGRICULTURAL SCIENCE (e-journal)*, *5*(5), 531-540.

Santosa, B., & Hulopi, F. (2008). Determination of physiological maturity and wax coating as an effort to prevent damage to the fruit of the Gading cultivar salak during storage at room temperature. *Continent of Science*, *8*(1), 27-36.

Sari, L. D. A., Kurniawati, E., Ningrum, R. S., & Ramadani, A. H. (2021). Vitamin C levels of tomatoes (Lycopersicum esculentum Mill) at each stage of maturity based on days after planting. *Indonesian Journal of Pharmacy and Pharmaceutical Sciences*, *8*(1), 74-82.

Sulistyowati, A., Sedyadi, E., & Prabawati, S. Y. (2019). Effect of Adding Ginger Extract (*Zingiber Officinale*) As an Antioxidant in Canna Starch Edible Film (*Canna Edulis*) and Aloe Vera (Aloe Vera .L) on Tomato Fruit Storage Time (*Edible tomato*).

DOI: https://doi.org/10.55173/agriscience.v8i2.155