Advance Sustainable Science, Engineering and Technology (ASSET)
Vol. 5, No.1, April 2023, pp. 0230113-01 ~ 0230113-07
ISSN: 2715-4211 DOI: https://doi.org/10.26877/asset.v5i1/15435

The Effect of Combination of Coconut Water and Sugarcane Water on Freshness Duration and Solution Absorption In Cut Chrysanthemums

Ipah Budi Minarti[1*], M. Anaz Dzakiy[2], Siti Muthoharoh[3]

[123]Biology Education, Universitas PGRI Semarang, Jl. Sidodadi Timur No. 24, dr. Cipto, Semarang, Central Java 50125, Indonesia

* ipeh_mi2n@yahoo.co.id

Abstract. Indonesia has fertile natural conditions, providing great potential for developing horticultural commodities, one of which is ornamental plants. Chrysanthemum is an ornamental plant that has high economic value and is in high demand, so it must be balanced with the quality and quantity of the flower itself. Chrysanthemum flowers are very susceptible to physical damage after harvesting. The purpose of this study was to see the effect of giving a combination of coconut air and sugarcane air on freshness and absorption of cut chrysanthemum solution. This study used a completely randomized design (CRD) using 1 factor with 4 treatments with 3 replications.P0: 1 liter water (control), P1: 200 ml / l coconut water + 25 ml / l sugarcane juice + 775 ml air, P2: 400 ml / l coconut water + 35 ml / l sugarcane juice + 565 ml air P3: Coconut water 600 ml / l + 45 ml / l sugarcane juice + 355 ml air. Research data on the shelf life of hedge flowers were good and the solution was most absorbed in the P1 treatment with a combination of 200 mL / L coconut water and 25 mL / L sugarcane water with flower freshness reaching 13.3 days. and the absorbed solution was 66.67. Based on the research, it can be denied that there is an effect and interaction of coconut water and sugarcane juice on the freshness and absorption time of the cut chrysanthemum solution.

Keywords: *coconut water, sugarcane water, cut chrysanthemums, freshness duration and solution absorption*

(Received 2023-05-17, Accepted 2023-05-21, Available Online by 2023-05-17)

1. Introduction

The fertile natural conditions in Indonesia can provide great potential for developing horticultural commodities, one of which is ornamental plants. Ornamental plants have their own beauty and charm. In addition to the beauty and attractiveness of ornamental plants, they also have high economic value. Cut chrysanthemum flower is an ornamental plant that has high economic value and is in great demand. Based on the 2016 Horticultural Production Statistics, 2016 chrysanthemum production was 433,100,145 stalks with a harvested area of 10,914,154 m2.

The determining factor for the quality of cut flowers is postharvest handling of cut flowers. The quality of the cut flower itself is determined by the length of the stalk, the bloom of the flower, the durability of the flower during storage and display where a good flower appearance with a long shelf life is the hope

Advance Sustainable Science, Engineering and Technology (ASSET)
Vol. 5, No.1, April 2023, pp. 0230113-01 ~ 0230113-07
ISSN: 2715-4211 DOI: https://doi.org/10.26877/asset.v5i1/15435

of both traders and consumers but, in reality the freshness of cut chrysanthemum flowers can only last for 2-4 days on display at room temperature depending on variety and quality (Sutater & Darliah 1994).

The problem that is often experienced by producers and consumers is in maintaining the freshness of cut flowers. Freshness is determined by the number of nutrients contained in the storage media for cut flowers (Evan, 2010). For traders, the short shelf life of interest is a big obstacle because it will result in a short marketing time. If cut flowers don't sell fast, the freshness of the flowers that decreases will cause a decrease in prices and even the flowers won't sell well. This of course will be detrimental to the cut chrysanthemum flower traders themselves.

The decline in the quality of cut flowers after postharvest is caused by respiration, evaporation, microorganisms and lack of nutrients (Sukartawi, 1996). In order for the quality of the flowers to be maintained in the hands of consumers, cut flowers need to be given post-harvest handling so that the quality of the cut flowers remains good. The basic ingredients of preservative solutions for cut flowers generally consist of several components such as sugar, bactericidal or germicidal, salt, metal, respiration inhibiting compounds and acidic compounds to lower the pH of the water (Sarwono, 2002).

At present there have been many studies examining post-harvest handling to extend the freshness of flowers, one of which is research conducted by Cintya (2016). According to the results of research data (Cintya, U.D.2016) explained that the freshness level of cut chrysanthemum flowers was highest in immersion with a concentration of 40% coconut water and starfruit extract at a concentration of 25%, which was an average of 13.66 days, while the freshness level was the lowest in the control (100% distilled water), that is, an average of 8.33 days. In the parameter of the absorbed solution, the highest amount of absorbed solution was in the K2F3 treatment, namely the concentration of 40% coconut water solution and 25% star fruit extract, which was 24.66 ml, while the least absorbed solution was in the control treatment (100% distilled water), namely 14.66 ml.

In contrast to research conducted by Cintya, in research conducted by Wiraatmaja and Astawa (2007) that the use of a preservative solution with a composition of 2.7% sucrose and 400 ppm citric acid can cause the freshness of cut chrysanthemum flowers for 13.02 days. Sucrose in solution acts as a source of nutrition for cut flowers, giving sucrose can cause bacteria to arise, to inhibit bacterial growth by adding citric acid.

Proper postharvest handling in maintaining the freshness of cut chrysanthemum flowers for a short time during demonstration will reduce the risk of higher losses. There is a need for an alternative in the postharvest handling of cut chrysanthemums during demonstration that is able to maintain the freshness of the cut chrysanthemums, has a cheap price and is easy to find, so as to provide a solution to the relatively short shelf life problem during demonstration. This research will use coconut water pulshing materials with the addition of sugarcane juice and antibacterial as a soaking solution.

Coconut water, sugar cane water is used as a soaking solution because coconut water can lower the pH of the solution, where a low pH solution can help absorption by cut flowers. According to Shanan (2017) a low pH can increase nutrient absorption. Sugarcane juice is used as a soaking solution as the main source of nutrition and energy for cut flowers for the continuity of metabolic processes because it contains sucrose. According to Wiraatmaja, et al (2007) the high sucrose content in the soaking solution allows for the availability of sufficient carbohydrates for the respiration activity of cut flowers, while antibacterials are used to control mussels or microorganisms. From various studies that have been carried out using sucrose as a soaking solution, it allows the availability of sufficient carbohydrates for the respiration activity of cut flowers. In this study the material used as an alternative to sugar as an energy source is by using sugarcane juice which is relatively cheap and easy to obtain. Sugarcane stalks consist of several components such as 0.5-1.5% monosaccharides, 11-19% sucrose, 0.15% organic matter, 65-75% water, and 12% other ingredients (Primahandana and Hendroko, 2008).

This study used coconut water and sugarcane juice as a medium for cut flowers. The use of materials that are easy to find and relatively cheap from an economical point of view is an added value

Advance Sustainable Science, Engineering and Technology (ASSET)
Vol. 5, No.1, April 2023, pp. 0230113-01 ~ 0230113-07
ISSN: 2715-4211 DOI: https://doi.org/10.26877/asset.v5i1/15435

so that traders only need to pay a little extra. Based on this problem, this study intends to extend the life of cut flower freshness by using cheap and easy-to-obtain ingredients so as to minimize losses for cut flower traders.

2. Methods

This study used chrysanthemum plants taken from the chrysanthemum garden in Wisata Kampung Krisan Clapar on Jl. Kendalisodo, Candi, Kec. Bandungan Semarang, Semarang, Central Java. The research was conducted at the Laboratory of SMP N 1 Sukolilo. The subjects of this study were 12 stalks of cut chrysanthemums taken from the chrysanthemum garden in Kampung Krisan Clapar Tourism, Bandungan with the criteria that the chrysanthemum flowers used in the study had a stalk length of 60 cm with the provision that the flower harvest had 2-3 flower petals in bloom or the inside of the flower had stretched (half bloom).

This study was an experimental study using a Completely Randomized Design (CRD) with the experiment consisting of a combination of coconut water and sugar cane preservative solutions at 4 treatment levels with 3 replications. Thus producing 12 experimental units. In the treatment of preservative solution composition includes T0: 1 liter of water (control); T1: 200 ml/l coconut water + 225 ml/l sugarcane juice + 775 ml water, T2: 400 ml/l coconut water + 35 ml/l sugarcane juice + 565 ml water, T3: 600 ml/l coconut water + water sugar cane 45 ml/l + water 355 ml/l. Research design as follows:

Repetition (R)	Treatment (T)			
	T1R1	T3R1	T0R2	T2R2
	T1R3	T0R3	T3R2	T1R1
	T2R1	T2R3	T0R1	T3R3

Information :
T0 : Water 1 Liter (control)
T1 : Coconut water 200 ml/l + sugarcane juice 25 ml/l + water 775 ml
T2 : 400 ml/l coconut water + 35 ml/l sugarcane juice + 565 ml water
T3 : Coconut water 600 ml/l + sugarcane juice 45 ml/l + water 355 ml

The procedure in this research is as follows:

1) Prepare cut chrysanthemums and uniform the diameter of the cut chrysanthemums to 40-45 mm with 2/3 petals in bloom or half-opened flowers.
2) Cut each Chrysanthemum flower with a length of 60 cm from the tip of the stem to the top
3) Measure the volume of the solution before soaking the chrysanthemum flowers
4) Put the cut chrysanthemum flowers into the combined preservative solution as much as 1 liter/bottle and measure the pH of the preservative solution for each bottle.
5) Soak the cut chrysanthemums in a preservative solution with a different combination of coconut water and sugarcane juice for each bottle.
6) Check the sample and fill each bottle with 1 flower stalk.
7) Store at room temperature 27˚C-30˚C.
8) Make observations every day on the length of freshness of flowers during storage, counting when the flowers are fresh until they show symptoms of wilting and measure the amount of solution absorbed by measuring it at the end of the demonstration by calculating the difference in the initial volume and the final volume.

3. Results and Discussion

Result

Research data regarding the effect of giving a combination of coconut water and sugarcane juice on the freshness of the cut chrysanthemum flowers on the shelf life of the cut chrysanthemums and the absorption of the cut chrysanthemum solution with the following data:

Table 1. Storage period data for cut chrysanthemum flowers at an average storage temperature of 28˚C.

Treatment

Advance Sustainable Science, Engineering and Technology (ASSET)
Vol. 5, No.1, April 2023, pp. 0230113-01 ~ 0230113-07
ISSN: 2715-4211 DOI: https://doi.org/10.26877/asset.v5i1/15435

Repeat Number	T0	T1	T2	T3	Sum
R1	12	13	8	10	43
R2	12	13	8	11	44
R3	13	14	8	10	45
Number of Treatment	37	40	24	31	132
Treatment Average	12,3	13,3	8	10,3	43,9

Based on Table 4.1, it can be seen that the effect of giving a combination of coconut water and water as a soaking solution as a preservative on the storage period (Vase life) of cut chrysanthemum flowers during the demonstration period at room temperature expressed in days gave the longest flower storage period results in the combination treatment P1 with combination treatment of 200 mL of coconut water and 25 mL of sugarcane juice with an average flower storage period of 13.3 days. The shortest flower storage period was in treatment P2 with a combination of 400 mL of coconut water and 35 mL of sugarcane juice with an average storage period of only 8 days.

Table 2. Data on the effect of coconut water and sugar cane water on the absorption of the solution

Repeat Number	Treatment				Sum
	T0	T1	T2	T3	
R1	54	59	32	45	190
R2	54	63	32	49	198
R3	57	60	37	44	198
Number of Treatment	165	182	101	138	586
Treatment Average	55	60,67	33,67	46	48,84

Based on table 4.6 it can be seen that giving a combination of coconut water and sugarcane water as a soaking solution for preservatives for the absorption of the solution, gave the most absorption results in treatment T1 with a combination of 200 mL/L coconut water and 25mL/L sugarcane water treatment which had an average absorption of the solution as much as 60.67 mL and the lowest average absorption of solution was in treatment P2 with 400 mL of coconut water and 25 mL of sugarcane juice.

Discussion

In this study the most effective combination of coconut water and sugarcane juice in maintaining the freshness of cut chrysanthemums was treatment P1, namely coconut water 200 mL/L + sugarcane juice 25 mL with an average storage of 13.3 days, which was significantly different from treatment T2, namely 400 mL/L coconut water + 35 mL sugarcane juice with an average storage of 8 days and T3 treatment, namely 600 mL/L coconut water + 45 mL of sugarcane juice with an average storage of 10.3 days. In treatment T1, a concentration of 200 mL of coconut water and 25 mL of sugarcane juice was the most optimal for soaking cut chrysanthemum flowers because giving too much coconut water would

Advance Sustainable Science, Engineering and Technology (ASSET)
Vol. 5, No.1, April 2023, pp. 0230113-01 ~ 0230113-07
ISSN: 2715-4211 DOI: https://doi.org/10.26877/asset.v5i1/15435

accelerate the damage of cut flowers because the high concentration of coconut water causes more sugar content. This facilitates the proliferation of bacteria on the chrysanthemum flower stalks. Factors that cause wilting of cut flowers can occur due to a water supply that is not smooth due to the covering of the tissue on the flower stalks by microorganisms, for example: bacteria or fungi such as bacteria which are yellowish white and round in shape. This statement is supported by Durkin (1979 in Suciati, 2002) which states that the inhibition of absorption of the solution causes it to wilt quickly, due to lack of water. So it is also necessary to add enough citric acid to prevent the presence of bacteria. Citric acid can be found in coconut water. Microorganisms can cause injuries which trigger the release of ethylene gas which can accelerate the process of withering flowers and yellowing of leaves, causing the shelf life and freshness of cut flowers to decrease (Andayani, 2011). This is also in accordance with research conducted by Yulianti (2019) where 4% coconut water and 400 ppm citric acid is the best treatment that can maintain the freshness of cut chrysanthemum flowers for 11 days.

Treatment T1 had the longest flower storage period because treatment T1 with 200 mL/L coconut water + 25 mL teb water was the longest dose in maintaining the storage period of cut chrysanthemum flowers. According to Halevy and Mayak in Triyanto (2000) the use of sucrose as a holding (between 0.5% and 2%, while according to Sabari, et al (1997) and Tirtosoekotjo (1996) the best use of sugar concentration as a holding solution is a refresher given to flowers continuously for a long time, for example during display for cut roses is 3 percent.

Treatment T1 with 200 mL/L coconut water + 25 mL of sugarcane juice showed that the concentration of the solution outside the cell was lower than the concentration of the solution inside the cell so that water from outside the cell would enter the cell. The entry of water into the cell can cause the cell to be tugid (rigid) which in this condition is the best condition for plant cells (Cambell, 2008). The nature of this rigid cell allows the flower stalks to remain rigid so that the shelf life of the flowers will be longer, apart from the fact that the composition of the solution is suitable for the length of the storage period in the T1 treatment, it is also influenced by the availability of sufficient nutrients for metabolic processes during the flower display period. In addition, the use of sugarcane juice as a source of nutrition for kruang flowers is effective because it will cause a lot of mucus which will inhibit the passage of water to enter the stem, so it is more effective to use sugarcane juice with a low concentration.

Treatment of T2 with 35 mL of sugarcane juice and treatment of T3 with 45 mL of sugarcane juice even though there are nutrients as metabolic materials but has a short storage period, this is possible because the sucrose content in the sugarcane water given to the soaking solution is too high so it will cause the soaking solution to become concentrated. According to Ichimbra and Pun (2003) the higher the soaking composition will inhibit the absorption of the flowers because the higher the composition of the solution, the more concentrated the solution will be so it will be more difficult to absorb. effective in maintaining the freshness of cut chrysanthemum flowers because the more sugarcane juice is given, the more mucus will be produced on the flower stalks which can block the passage of water into the chrysanthemum stems.

The best solution absorption treatment was treatment T1 with an average absorption of 60.67 mL, this was not significantly different from treatment T2 with an average treatment of 33.67 mL. There is a significant difference between the T1 and T2 treatments because the two treatments have solutions with different pH. The T1 treatment had a pH of 4.3 while the T2 treatment had a pH of 5. According to Shanan (2017) a low pH (3.0-4) can increase nutrient absorption. the stem will increase, reducing embolization and inhibiting the growth of microorganisms. An increase in pH provides a low absorption rate so that in this study the most absorption was in the T1 treatment due to the ability to have a low pH. Whereas in treatments P2 and P3 the concentration of coconut water and sugarcane juice was higher, even though these treatments contained a source of nutrients in the form of coconut water, but if the use of coconut water solution was too high, the solution would be hypertonic in cut flowers (Farah, 2012). The solution is hypertonic because the concentration of liquid in the immersion solution is higher than

Advance Sustainable Science, Engineering and Technology (ASSET)
Vol. 5, No.1, April 2023, pp. 0230113-01 ~ 0230113-07
ISSN: 2715-4211 DOI: https://doi.org/10.26877/asset.v5i1/15435

the concentration of the solution inside, which will trigger osmosis. Water molecules are sucked out due to differences in osmotic pressure. This will cause the stalk to lose fluid. In addition, the use of sugarcane juice that is too high can also cause mucus on the flower stalks, thus blocking the entry of nutrients into the cut chrysanthemums. In the control treatment using 1000 mL distilled water, water moves from high potential to low potential so that there will be a balance between the two but there are not enough nutrients to carry out metabolism.

4. Conclusion

From this study, we conclude that:

a. The combination of coconut water and sugarcane juice given as a soaking solution has a significantly different effect on maintaining the freshness of cut chrysanthemum flowers with the most optimal concentration in treatment T1 (200 mL/L coconut water + 25 mL/L sugarcane juice + 775 distilled water) mL) which is able to maintain freshness for 13.3 days.
b. Giving a combination of coconut water and sugarcane juice which is given as a soaking solution has a significantly different effect on the absorption of the solution on cut chrysanthemum flowers with the most optimal concentration, namely in treatment T1 (coconut water 200 mL/L + sugarcane juice 25 mL/L + distilled water 775 mL) with a solution absorption of 60.67 mL.
c. It is necessary to sterilize coconut water used in making preservative solutions by heating it to remove microorganisms present in coconut water.

References

[1] Amiarsi, D. and Sunarmani. 2011. The use of pulsing soaking solution to maintain the freshness of tuberose flowers at room temperature. Proceedings of the Bogor Floriculture National Seminar.
[2] Amiarsi, D., and Tejasarwana. 2011. Preservatives to Maintain the Quality of Rose Cut Flowers During Storage. J. Hort.
[3] Astutik, "The Use of Coconut Water in Banana Tissue Culture Media". Science World. Vol. 8. No. 1. Th. 2008.
[4] Campbell. 2003. Biology Volume 1 Fifth Edition. Jakarta: Erlangga.
[5] Chen, James. C. P. And Chou, 1993, Cane Sugar Hand Book, 12th edition, Jhon Willey and sons: New York.
[6] Directorate of Floriculture Cultivation and Postharvest. 2011. Guidelines for Postharvest Handling of Chrysanthemum Cut Flowers. Ministry of Agriculture.
[7] Evan. 2010. "Post Harvest Cut Flowers". http://z47d.wordpress.com/. accessed on 1 February 2020.
[8] Farah Meita Pratiwi, and Pande Ketut Sutara. "Ethnobotany of Coconut (Cocos Nucifera L.) in the Denpasar and Bandung regions." Journal of Symbiosis 1, no. 2 (2013): 102–11.
[9] Gomez, K.A. and Gomez A.A. (1995). Statistical Procedures for Agricultural Research. Second Edition. Jakarta : UI – Press.
[10] Hashemabadi, D. 2013. “Effect Of Silver Nanoparticles On The Vase Life And Quality Of Cut Chrysanthemum (Chrysanthemum morifolium L.) Flower” in European. Journal of Experimental Biology
[11] Iriani, F. 2009. Formulation of a preservative solution for cut flowers of chrysanthemums, carnations and gerbera. J. Agriculture.
[12] Lakitan, B. 2011. Fundamentals of Plant Physiology. Jakarta: Raja GrafindoPersada.
[13] Mattjik, N.A. 2010. Cultivation of Cut Flowers and Ornamental Plants. Bandung: IPB Press.

Advance Sustainable Science, Engineering and Technology (ASSET)
Vol. 5, No.1, April 2023, pp. 0230113-01 ~ 0230113-07
ISSN: 2715-4211 DOI: https://doi.org/10.26877/asset.v5i1/15435

[14] Nento, R., Tiwow, D. S., and Demmassabu, S. L. 2017. Application of a Preservative Solution on the Quality of Cut Flowers of Krisam (Chrysantemum sp). Journal. Manado: Sam Ratulangi University.
[15] Nofriati, D. 2005. Study of the packaging system of cut roses (Rosa hybrida) during storage to extend the shelf life. Graduate School. Bogor Agricultural Institute.
[16] Nuryanto, H. 2007. Cultivation of Chrysanthemum Plants. Bekasi: Geneca.
[17] Permana, S.B. 2010. The Effectiveness of Concentration and Frequency of Giving Compost Tea from Coffee Peel Waste and Coconut Water in Increasing the Success of Cocoa Flowers to Fruit. Jember. Jember University Faculty of Agriculture.
[18] Plantus. 2006. Coconut Water Promotes Orchid Growth and Flowering. Http://anekaplanta.wordpress.com/2010/01/19/air-kelapa-pemacumbuh-dan-pembungaananggrek/, accessed on 20 October 2019.
[19] Purwanto, A. W. and Martini, T., 2009. Chrysanthemum Flower of a Thousand Colors. Canisius. Yogyakarta.
[20] Rahardi, Wahyuni and Nur cahyo, Ornamental Plant Agribusiness, (Jakarta: Independent Spreader, 2001).
[21] Rismunandar. 1995.Cultivation of Cut Flowers. Jakarta: Independent Spreader.
[22] Rukmana, H.R. 2003. Various Processed Coconut. Yogyakarta: Kanisius.
[23] Sarwono, B. 2002. Producing Prime Quality Cut Orchids. Jakarta: Agromedia Pustaka.
[24] Soekarwati, 1996. Cut Flower Agribusiness Management. press UI. Jakarta.
[25] Sugiyono. 2015. Educational Research Methods. Bandung: Alphabet.
[26] Warisno. 2004. Easy and Practical to Make Nata de Coco. Jakarta: Argomedia Pustaka.
[27] Wiraatmaja, I.W., I.N.G. Astawa., and N.N.Deviantri. 2007. Extending the Freshness of Chrysanthemum Flowers (Dendranthema grandiflora Tzvelev.) With Sucrose and Citric Acid Soaking Solutions. Agritop 26 (3):129 – 135. Faculty of Agriculture Udayana Denpasar, Bali.