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Influence of Secondary Packaging on Quality of Carrots During Transportation

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Abstract

The aim of this research is to know the influence of packaging on quality change of carrots during transportation. While this research specifically aims to (1) find out the influence of the type of secondary packaging on quality of carrots during transport, (2) know the influence of the type of secondary packaging on quality of carrots with different transport time. This research uses the packaging plastic baskets, wooden crates and plastic bag. The distance from the production center in Ciherang market to Bogor and later to Kramat Jati market in Jakarta which assumed 1 transport simulation per each is 1 hour and 2 hours. Furthermore from each taken sample then we evaluated the firmness, carrot losses and weight losses. The highest damage in 1 hour and 2 hour occur for samples used plastic bags (30.4% and 48.6%), then the highest weights losses for crate are 1 hour (1.3%), 2 hours (2.0%), the highest firmness found is (2 N) for 1 hour and 2 hours (3 N).

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Keywords: Packaging, carrot, transportation

1. Introduction

Carrot (*Daucus carota*) is one of potential horticultural commodity which has opportunity to be expanded following the increasing of domestic and export demand. Carrots contain nutrients that are needed by the body, especially vitamins and minerals. Carrots has beta-carotene as an important chemical compound to form vitamin A

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or provitamin A. Carrot production from 1997 to 2002 is fluctuative per each year but since 2003 is increased steadily and in 2006 it reach about 440.002 tonnes (CPM 2006) and for export was 369.280 tonnes.

The carrots that have been harvested is still need further treatment before it reach the consumer. Post harvest management is including activities such as cleaning, washing, sorting, grading, packing, storage, transportation and marketing. Like other vegetable commodities, carrot is easily damaged because of after harvested, this plan still doing respiration. The damage occurred during post harvest is unavoidable. Therefore, the possibly efforts can be made by giving them the proper packaging. Good packaging is the packaging that can protect the wrapped product from damage, weight losses and firmness changes during the transportation time. Damage can cause by the Physiological process, mechanical and biological factors.

Purwadaria (1992), stated that shaking during the carriage can lead to small damage and weight losses. Weight losses of carrots in post harvested is between 30-35%. One of the causes of weight losses on the carrot is caused by the transportation activities. Generally, in carrot marketing, this product is being transported by only using minimum packaging standard that sometimes is not securely enough. Therefore, need of the appropriate packaging for carrot has to be done accordingly. Soedibyo (1992) mentioned, imperfect treatment during transportation can cause the damage of the commodity at the time it reach the market destination which approximately 30-50%. In General, this research aims to know the influence of packaging toward change of carrot's quality during transport. While this research specifically aims to (1) find out the influence of the type of secondary packaging toward quality of carrots during transport, (2) know the influence of the type of secondary packaging toward quality of carrots with different transport time.

2. Research Methodology

2.1. Supply and equipment

Main supply used in this research is carrot (local variety) from the farmers in Ciherang, Cianjur District, West Jawa. Carrot is harvested at the age of 90 days after planted. Other supplies used are wooden crate 41 cm x 30 cm x 18 cm, plastic box 38 cm x 25 cm x 15 cm and plastic bag. While equipments used are penetrometer to measure firmness, digital camera, scales mettler PM-4800 and transport simulation tool table shakes with the compressor design by Purwadaria (1992).

2.2. Research Phases

Research phases in this research is started from determining the best outer packaging used for carrot transportation. Initially, carrot is selected and cleaned then weigh it for 10 kg per each plastic baskets, wooden crates and plastic bag packagings. Then do the transportation by putting each package on the table vibrate with a frequency that corresponds to the condition of the road traveled. Transportation time counted from production center in Ciherang, Cianjur District to Anyar market, Bogor and to Kramat Jati market, in Jakarta, which we assumed per each trip taken for 1 hour and 2 hour. Then from the sample taken in each treatment, we further evaluate the carrot quality that including level of damage, weight losses and change of firmness. Package with the smallest level of damage, weight losses and change of firmness is categorized as the best packaging sample.

3. Result and Discussion

3.1. Determining the best secondary packaging

3.1.1. Level of damage

Measuring the mechanical level of damage done after simulation of transportation by seeing the number of broken carrot in each packaging. Figure 1 shows the highest level of damage after 1 hour transported for plastic bag packaging is 30.4%, whereas for wooden crate were 23.3% and the smallest one were for plastic basket (19.3%). Meanwhile, for the two hour showed that, plastic bag has the highest damage which about 48.6%. Pantastico (1989), stated the good packaging will able to protect product from the damage as caused by its handling process and

transportation. The result of analysis shows also that kind of packaging and time of transportation will significantly influenced the level of damage. According to Fischer (1990), Generally the damaged of grape and strawberry during transportation are caused by packaging.

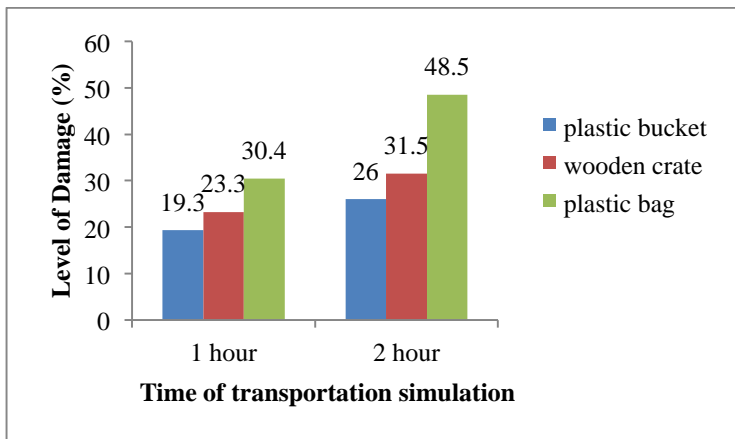


Figure 1. Level of carrot damage after the simulation of transportation in 1 and 2 hours

3.1.2. Weight Losses

After transported within 1 hour (Figure 2) carrot in wooden crate has weight losses about 1.3%, plastic bucket 1.2% and plastic bag 0.9%. Then for 2 hour one, wooden crate has weight losses 2.0%, while for plastic bucket 1.9% and plastic bag 1.7%. Weight losses of carrot are caused by the loss of water due to the transpiration process during the transportation. The weight losses of each packaging are not significantly seen. Mc. Gregor (1989) said that the occurrence of weight losses on agriculture products are caused by rude handling and losses of water. From the analysis result shows that kind of packaging and time of transportation simulation not significantly influenced the weight losses.

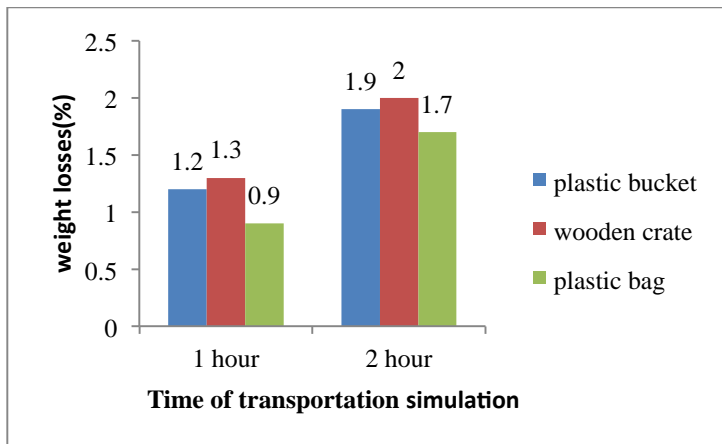


Figure 2. Weight losses of carrot in 1 and 2 hours transportation

3.1.3. Firmness

In the simulation of transportation for 1 hour, the highest change of firmness occurred on wooden crate (2 N), while for plastic bucket and plastic bag per each is 1.5 N and 0.5 N. Likewise, the change of carrot firmness in 2 hour showed that for wooden crate 3 N, plastic bucket 2 N and plastic bag is 1.5 N. Change of firmness is caused by

change of cell composition as effect of turgor cell that made the vegetable became more soften. Change of firmness during the simulation of transportation in each packaging is not significantly seen. Low firmness is seen by small number. The softness of fruit/vegetable are usually caused by changed of protopektin from insoluble to soluble pectin. When the fruit is rape, soluble peknat and pektinat are increased, while pectate substance is decreased. This factor made the change of firmness on fruit or vegetable (Pantastico, 1986).

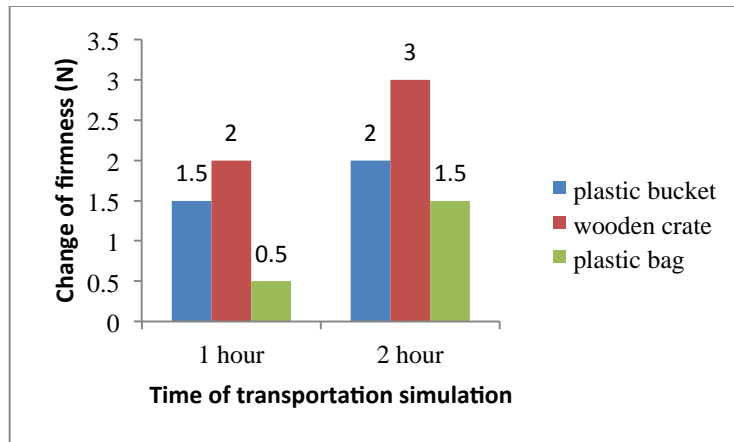


Figure 3. Firmness of carrot after 1 and 2 hours transportation

4. Conclusions of this research are:

The highest level of damage is found on the plastic packaging for transport of 1 hour and 2 hours (30.4% and 48.5%) while the highest of weight losses is occurred on wooden crates for 1 hour and 2 hours of transport, and the highest change of firmness is in wooden crate packaging 1 hour and 2 hours (2n and 3N). The best secondary packaging for transport is using plastic bag

References

- Ali, Asgar. 1989. Experiments packing and transport of white cabbage. Horticulture Research Bulletin 17 (14), 37-47.
- Berlian, N.V.A., Rahayu, E., 1995. Carrots and Turnips. Jakarta: Publisher Organization.
- Budiastra I.W., Purwadaria, H.K., 1993. The post- harvest handling of vegetables and fruit in the packing house. Training materials post-harvest vegetables and fruits. Bogor: Inter University Center, Bogor Agricultural University, 10-15 May 1993.
- Darmawati, E., 1994. Computer Simulation For Corrugated Carton Packaging Design In Freight Fruits. Thesis. Post Harvest Technology Studies Program. Bogor Agricultural Institute.
- Fischer, D., Craig, W., Ashby, B.H., 1990. Reducing transportation damage to grapes and strawberries. Journal of Food Distribution Research. 90:193-202
- Hilton, D.J., 1993. Impact and Vibration Damage to Fruit during Handling and Transportation. In: Champ, B.R., E. Highley and G.I. Jhonson, editor. Conference, Chiang Mai, Thailand, 19 – 23 July 1993.
- Muhammad. 1990. Effect of Quality and Future Shocks Against Save Fruit Salak Sleman in Packaging "Modified Atmosphere" During Simulation Railway Freight. Essay. Faculty of Agricultural Engineering. Bogor Agricultural Institute.
- Mattjik, A.A., Sumertajaya M., 2002. Design of Experiments with SAS and Minitab applications. IPB Press, Bogor.
- Pantastico, E.R., 1986. Physiology of Post Harvest Handling and Use Fruits and Vegetables of Tropical and Sub-Tropical. Yogyakarta: Gadjah Mada University Press.
- Prajawati, N.M., 2006. Effect of Packaging Techniques and Treatment Against Prakemas rate of decline in quality of tomatoes During Transportation. Essay. Agricultural Institute.
- Purwadaria, H.K., 1992. The system transporting fruits and vegetables. Papers Training Post Harvest Fruits and Vegetables, Food and Nutrition PAU IPB, Bogor, February 24, 1992.
- Putu, 2006. Effect of Packaging and Shocks Against Physical Quality of Guava During Transportation. Essay. Faculty of Agricultural Technology. Bogor Agricultural Institute.
- Siregar, W.L., 2004. Transport Packaging Design fruit Salak (*Salacca edulis*) Made From sheaths Salak. Thesis. Graduate School of IPB, Bogor.

- Soedibyo, M., 1991. Packaging and transport of Valencia oranges. *Journal of Horticultural* 1 (2): 49-53.
- Soedibyo, M., 1992. The simulation tool transportation of fresh fruits by car and train. *Journal of Horticultural* 2 (1): 66-73.
- Tarwyati, D.N., 2007. Effect of Packaging Study Physical Damage During Transport of Fresh Cabbage. Thesis. Post Harvest Technology Studies Program. Bogor Agricultural Institute.
- Vursavus, K. and Ozguven, F., 2004. Determining the effect of vibration parameters and packaging method on mechanical damage in golden delicious apples. *Turk Journal Agriculture For* 28 (2004) : 311-320.
- Waluyo, S.B., 1990. Impact Assessment of Mechanical Vibration Freight Trucking Against Orange Packaging. Thesis. Post Harvest Technology Studies Program. Bogor Agricultural Institute.
- Wisnu B., Amiarsi D., Sunarmani and Santausa, S., 1996 Engineering pineapple packing in cardboard packaging to maintain the fresh quality. *Journal of Horticultural* 6 (3): 287-302.