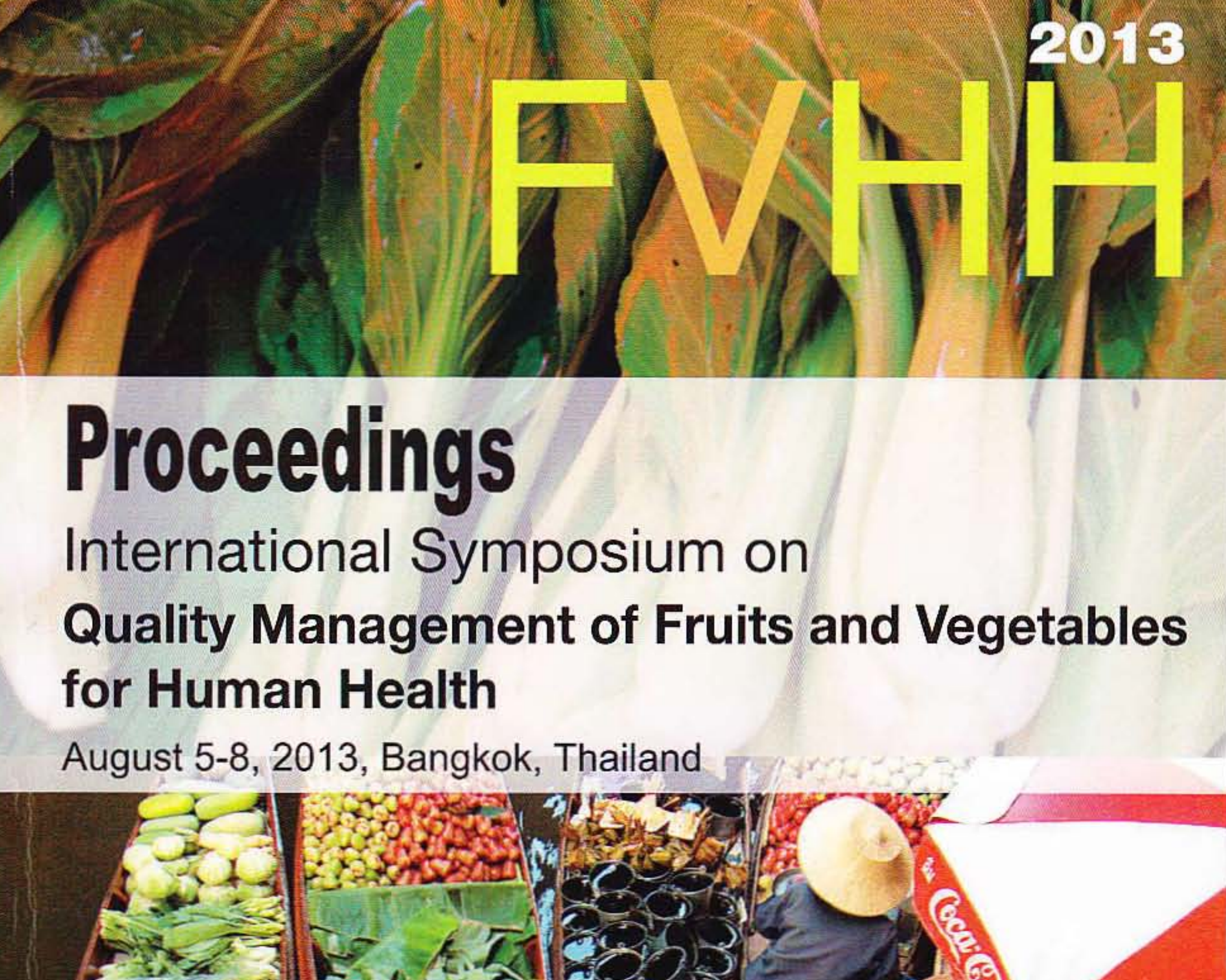

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August 5-8, 2013, Bangkok, Thailand

Editors
C. Wongs-Aree
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Sirichai Kanlayanarat
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King Mongkut's University of Technology Thonburi
Chulalongkorn University
Phuket Rajabhat University
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Postharvest Technology Innovation Center

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Packaging of Curly Chilies During Transportation and Temporary Storage for Domestic Market in Indonesia

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Abstract

Supply chain of curly chilies from production center to market in Indonesia are usually carried out at ambient temperature, lack of postharvest handling method and take more than 2 days depend on the distance to the market. In this study, effect of packaging method commonly used by the actor of supply chain of curly chilies in Indonesia during transportation and temporary storage, on the quality of curly chilies was examined. Sample of packaging materials were plastic net, plastic sack and ventilated cardboard box. Sample of curly chilies were harvested from farmer orchard. After sorting, three kilogram of curly chilies were transported to the laboratory in 5 hours and stored at ambient temperature condition. Change in weight loss, firmness, color, vitamin C and visual appearance were measured during storage period. Among the packaging materials, the longest postharvest life observed for curly chilies packed in ventilated cardboard box. The damage of curly chilies was found at days 13, 7 and 5 for ventilated cardboard box, plastic sack and plastic net, respectively. There were no significant differences for changes in firmness, color and vitamin C of curly chilies among the packaging materials up to 5 days storage. Minimum weight loss was found for curly chilies packed into ventilated cardboard box. This study recommended the use of ventilated cardboard box for distribution and temporary storage of curly chilies for domestic market in Indonesia.

Keywords: Curly chilies, postharvest life, packaging, temporary storage, supply chain

INTRODUCTION

Supply chain of chilies in tropical developing country are generally indicated by bulky transportation packaging, lack of postharvest handling, high postharvest losses and involves many supply chain actors. Supply chain of chilies from the production center to the market in Indonesia are usually carried out at ambient temperature, lack of postharvest handling and take about 2 days depend on the distance to the market. Sometimes, chilies have to be transported by ship to other island and this needs more than 2 days for transportation. This is one of the reasons why postharvest losses of fresh agricultural products are still high in Indonesia. Our study in the chilies production center in West Java showed that during harvesting, transportation, sorting and temporary storage, postharvest losses were vary from 20.2 to 22.6% (Purwanto et al., 2012). Many studies related on the postharvest of chilies were carried out by some researchers (Lownds et al., 1994; Krajayklang et al., 2000; Nyanjage et al., 2005; Kan et al., 2007; Tano et al., 2008; Rahman et al., 2012). Tano et al. (2008) reported that temperature at 6°C was suitable for chilies storage condition. Lower weight loss occurred for chilies stored under lower temperature storage (Lownds et al., 1994; Tano et al., 2008) and packaging did not significantly affect color retention (Nyanjage et al., 2005).

Supply chain activities for chilies in Indonesia generally are carried out as follows: in case of free market, farmers market their chilies to small-scale collectors around their villages, large-scale collectors, or directly to wholesale markets. The small-scale collectors collect any horticultural products required by markets. These include chilies, potatoes, cabbages, leeks, etc. The collectors have two ways to gather chilies from the farmers, i.e. they directly collect the chilies from the field or the farmers deliver their chilies to the collector's location. Every packed is 40 to 60 kg. Activities conducted by small-scale collectors vary depends on the market conditions. The collectors only perform repacking and deliver the repacked products to large-scale collectors if the demand and the price are high. When the chilies price is low and the production decreases, the collectors sort and temporarily stored the chilies to obtain an economical quantity before transporting the chilies to the market.

Postharvest activities carried out by large-scale collectors are sorting and repacking. Sorting is conducted to separate unhealthy, rotten and overripe chilies from the good ones. Large-scale collectors deliver chilies to wholesale markets. Loading and unloading activities could degrade chilies quality because plastic sacks that usually used to pack the chilies are flexible. Therefore, they cannot stand impacts that may happen. In addition, the sacks are usually ordered and placed on the floor by slamming them down. This causes mechanical injury of the chilies, especially at the bottom part. Traders/large-scale collectors perform supply chain activities for other islands; therefore, they are also the actors in inter-island markets. This results in the same purchasing price between actors of inter-island markets and at large-scale collectors. However, a higher selling price occurs because of high operational costs, such as shipping cost.

Packaging method is still the main problem during transportation and temporary storage. Farmer usually pack in the capacity range of 40 to 60 kg in plastic sack, plastic net or recycle cardboard. There is no standard for packaging in the farmer level. This will result both qualitative and quantitative losses during transportation and temporary storage. Proper packaging method is expected to reduce postharvest losses and to extend postharvest life. In this study, the effect of packaging method for curly chilies commonly used by the actor during transportation and temporary storage in Indonesia, on the postharvest losses was examined.

MATERIAL AND METHODS

Sample Preparation

Curly chilies, local cultivar of Hibrida TM 99, were harvested from farmer orchard at chilies production center area in West Java. Curly chilies were harvested at 7:00 to 10:00. After being harvested, sample of curly chilies were sent to the packing house and pre-cooled in the ambient temperature during 1 to 2 h. The sample of curly chilies was then sorted to remove the unhealthy chilies.

Procedure

Three kilogram of sample of curly chilies were packed into plastic net of 35 x 55 cm, plastic sack of 45 x 75 cm and ventilated cardboard box of single wall with the thickness of 6 mm and dimension of 30 x 28 x 22 cm. Chilies was then transported to the laboratory in the night time during 5 h at ambient temperature. This transportation time was the same as the time needed to bring the chilies from production center to the market in Jakarta city. After transporting to the laboratory, the sample of chilies was then place in the ambient temperature. We simulated this as temporary storage for chilies before delivering to the consumer. During temporary storage, the change in weight loss, firmness, color, vitamin C and visual appearance of sample were monitored. Surface color of sample was measured as reflected color ($L^*a^*b^*$) using a Colorimeter model CR-300 (Minolta, Osaka-Japan). Three replications were carried out for all experiment conditions.

RESULTS AND DISCUSSION

Among the packaging materials, the longest postharvest life observed for curly chilies packed in ventilated cardboard box. The damage of curly chilies was found at day 13, 7 and 5 for ventilated cardboard box, plastic sack and plastic net, respectively. This indicated that the use of cardboard resulted the longest postharvest life of curly chilies.

Weight Loss

Fig. 1 shows the change in weight loss of curly chilies in plastic net, plastic sack and cardboard during storage period. Weight loss of curly chilies increased during storage for all temperature conditions. The highest weight loss occurred for curly chilies pack into plastic net. It was considered that plastic net packaging allowed the highest interaction between chilies and ambient temperature condition. This caused that transpiration of chilies was easier than that other packaging materials.

Firmness

Fig. 2 shows the change in firmness of curly chilies in plastic net, plastic sack and cardboard during period storage. It was considered that at day 0 or just after harvesting, the firmness for all conditions were almost the same, however, at day 1 the highest losses of firmness was observed on plastic net then following by plastic sack and cardboard.

Color

Table 1 shows the change in color for curly chilies in plastic net, plastic sack and cardboard. L*, chroma and hue angle indicated general changes in color for different color stages. Chroma and hue angle in all experimental conditions showed the similar trend. The lowest speed to become fully red was found for chilies packed in cardboard. The similar tendency of the change in lightness, L* values, was found in all experimental conditions. In general, if the transportation period and temporary storage was considered during 5 days, the curly chilies were still in good condition for all experimental conditions.

Vitamin C

Fig. 3 shows the change in vitamin C of curly chilies among packaging methods during storage. All vitamin C change's patterns almost the same. In the beginning of storage period, vitamin C content increased up to day 3 and after that tended to decrease. This change occurred chilies experienced a physiological change because during storage period.

CONCLUSIONS

Among different packaging materials, the longest postharvest life was curly chilies packed in ventilated cardboard box. The damage of curly chilies was found at day 13, 7 and 5 for ventilated cardboard box, plastic sack and plastic net, respectively. There was no significant difference on firmness change of curly chilies among packaging materials. Minimum weight loss was found in curly chilies packed in ventilated cardboard box. This study recommends using ventilated cardboard box for distribution and temporary storage of curly chilies.

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Table

Table 1. Color change of curly chilies in plastic net, plastic sack and cardboard during period storage.

Day	Plastic net			Plastic sack			Cardboard		
	L*	Chroma	Hue angle	L*	Chroma	Hue angle	L*	Chroma	Hue angle
1	35.66	41.81	0.45	35.91	42.22	0.45	36.53	43.67	0.45
3	35.21	38.92	0.42	35.54	42.46	0.43	34.75	42.20	0.43
5	36.22	40.84	0.36	34.17	39.32	0.41	34.82	41.83	0.42
7				34.48	37.19	0.39	34.60	39.81	0.40
9							34.69	39.42	0.40
11							35.27	39.99	0.39
13							34.40	38.69	0.38

Figures

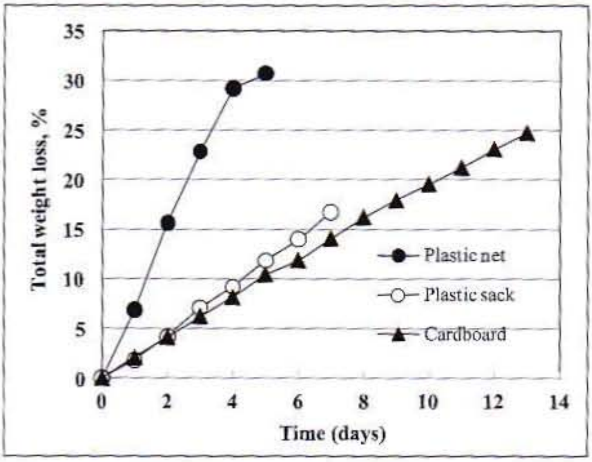
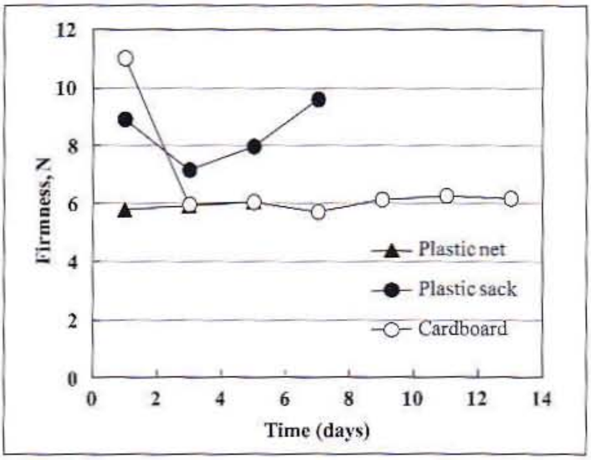
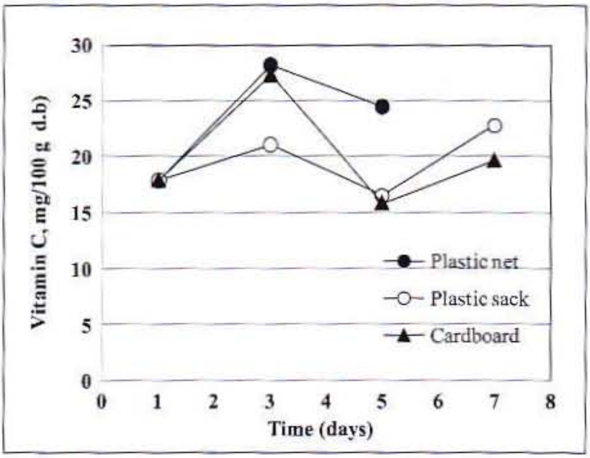


Fig. 1. Total weight loss of curly chilies in plastic net, plastic sack and cardboard during storage period.



ig. 2. Firmness of curly chilies in plastic net, plastic sack and cardboard during period storage.



ig. 3. Change in vitamin C of curly chilies in plastic net, plastic sack and cardboard during period storage.

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