jpht
www.jpht.info

Journal of Postharvest Technology
2018, **06**(1): 36-40
http://www.jpht.info

RESEARCH ARTICLE

Evaluation of Packaging Liners in Wooden and Plastic Crates for Handling Tomatoes

Dari, L.[1]*, Nenguwo, N.[2] and Afari-Sefa, V.[2]

[1]Faculty of Agriculture, University for Development Studies, Tamale-Ghana.
[2]AVRDC - The World Vegetable Center, Eastern and Southern Africa, P.O. Box 10 Duluti, Arusha, Tanzania.

Received: 02.10.2017 Accepted: 13.12.2017

ABSTRACT

Postharvest losses of tomato are high and can be attributed to a series of factors which include variety of tomato, harvest treatments, packaging materials, handling techniques, transportation and market availability. Standard wooden crates which are perceived as large (about 90%) are used in the packing and transportation of tomatoes in Ghana which often leaves produce smashed due to the size and internal surface of crates. This research was conducted using plastic crates (50, 30 kg) and wooden crates (large and improvised 30 kg) and packaging liners such as jute hessian material, perforated paper and thin latex foam was used to assess which of the treatments would preserve the fruits. From the results, all treatments had percentages of damaged and undamaged fruits at varying levels. Jute lined 30 kg plastic and paper lined wooden crates and paper lined 50 kg both plastic and wooden proofed effective in curbing losses better than the remaining treatments. The wooden 50 kg control crate however, had more damaged quantities at 55% than all treatments which had damages ranging between 20 - 50. The use of crates with adequate and suitable packing liners could reduce the quantities of damaged fruits in tomato.

Keywords: Cost, benefit, packaging liners, plastic and wooden crates, postharvest losses quality

Citation: Dari, L., Nenguwo, N. and Afari-Sefa, V. 2018. Evaluation of packaging liners in wooden and plastic crates for handling tomatoes. *Journal of Postharvest Technology*, **6**(1): 36-40.

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill) is a popular and important vegetable commodity in Ghana, as it is consumed daily in many households (Horna et al., 2006). Although definitive statistics on area and production of the crop are not readily available in many African countries, tomato is one of the most widely cultivated vegetables on the continent. The total production area in Africa increased from 159,593 ha in 1961 to 660,215 ha in 2007, and production increased from 19,688,12 tons in 1961 to 14,918,554 tons in 2007 (FAO, 2009). FAO predicts, the largest area and highest production in Africa in northern Africa, including Egypt, Morocco, and Algeria, and the smallest area and the lowest production in southern and central Africa, respectively (FAO, 2009). The average yields range from 6 t/ha in central Africa to 34 t/ha in southern Africa, with the southern region higher in productivity mainly because of South Africa (FAO, 2009). There has been an increase in area and production in individual countries over the past 50 years, but at different rates; productivity largely remained low. In Tanzania, the land area increased from 1,400 ha in 1961 to 19,000 ha in 2007, but yield remained stagnant: 7.1 to 7.6 t/ha (FAO, 2009). According to MoFA (2010), the total land size used for the production of tomato is 44.8 hectares while 62.8 hectares of land is used for the production of other vegetables in Ghana. Aside this large area of land used for the production of tomato, tonnes of tomato is imported from neighboring countries such as Burkina Faso and Togo to meet the demand for tomatoes.

* *For correspondence:* L. Dari (*Email: linddari@yahoo.co.uk*)

ISSN: 2348-4330

Postharvest losses of tomato are high and can be attributed to a series of factors which include variety of tomato, harvest treatments, packaging materials, handling techniques, transportation and market availability (Mwaijande, 2017; Dandago et al., 2017; Ndirangu et al., 2017). Packaging materials and packing type plays a vital role in the reduction of postharvest losses in tomato. Standard wooden crates which are perceived as large (about 90%) are used in the packing and transportation of tomatoes in Ghana which often leaves produce smashed due to the size and internal surface of crates. The size also makes it difficult for easy handling. To help curb the losses due to impact in packaging crates during handling and transportation, packaging liners are used especially for mango, pawpaw and pepper to serve as shock/impact absorbers. In an effort to reduce losses that are associated with the current packaging material for tomato, this research was conducted using plastic crates (50, 30 kg) and wooden crates (large and improvised 30 kg) and packaging liners such as jute hessian material, perforated paper and thin latex foam was used to assess which of the treatments would preserve the fruits.

MATERIALS AND METHODS

Experimental design and sampling procedure

Plastic crates (50, 30 kg) and wooden crates (large and improvised 30 kg) and packing liners such as jute hessian material, paper and thin latex foam were used in a complete randomized design to estimate the percentages of losses per treatment. The paper and latex foam were randomly perforated to aid ventilation within the fruits. In the packaging of tomato, a standard crate which is often assumed as been large is used. The 30 kg crates were used in the research to confirm or disapprove the perception that the large wooden crates resulted in the smashing or deterioration of the fruits. In all, there were sixteen treatments with four treatments for each crate type as paper lined, foam lined, jute hessian lined and an unlined crate which served as the control.

Samples were bought directly from traders at Paga on arrival from Burkina Faso (a driving distance of not less than 170 km). All bought crates were sorted into damaged (smashed and rotten) and undamaged (firm and healthy) fruits. The undamaged fruits were repacked into the treatment crates and weighed before transportation to Tamale at a transportation distance of 207 km. In Tamale, which was the final destination, each crate was sorted into damaged and undamaged and the estimates used to evaluate the treatments.

RESULTS AND DISCUSSION

Physical Quality Evaluation

At procurement

At the point of purchase, some fruits were already too soft and had to be sorted. About 10% was sorted from every crate before repacking for transportation. The softening of fruits could be attributed to the harvesting of fruits at the fully ripe stage, lack/inadequate sorting of fruits before packing, quantity packed per crate, handling during transportation and climatic effects (temperature recordings were between 35 – 37 °C).

During Transportation

Packed tomatoes were transported using the usual cargo track in a similar way tomatoes are transported from Burkina Faso into Ghana by traders. Upon arrival in Tamale in less than 24 hrs, about 35% of losses had accrued due to

rotting and softening of fruits which can be attributed to the fact that fruits were bought at the complete ripened stage coupled with high atmospheric temperature and mode of transport.

At Final Destination

All treatments were sorted into damaged and undamaged fruits. From table 1, all treatments had percentages of damaged and undamaged fruits at varying levels. Jute lined 30 kg plastic and paper lined wooden crates and paper lined 50 kg both plastic and wooden proofed effective in curbing losses better than the remaining treatments. The wooden 50 kg control crate however, had more damaged quantities at 55% than all treatments which had a damage range of between 20 – 50%. The nature of damages was in the form of crushed or smashed fruits.

Table 1. Initial weight, damaged and undamaged percentages of treatments

Crate Type/Size	Damaged (%)	Undamaged (%)	Initial weight
Control_30 kg_Plastic	50	50	22.84
Jutelined_30 kg_Plastic	20	80	20.52
Paperlined_30 kg_Plastic	30	70	21.90
Foamlined_30 kg_Plastic	40	60	22.40
Control_50 kg_Plastic	40	60	42.16
Jutelined_50 kg_Plastic	40	60	39.56
Paperlined_50 kg_Plastic	30	70	41.48
Foamlined_50 kg_Plastic	35	65	42.48
Control_30 kg_Wooden	40	60	55.02
Jutelined_30 kg_Wooden	25	75	49.18
Paperlined_30 kg_Wooden	30	70	51.08
Foamlined_30 kg_Wooden	40	60	46.32
Control_50 kg_Wooden	55	45	108.34
Jutelined_50 kg_Wooden	35	65	108.34
Paperlined_50 kg_Wooden	30	70	108.34
Foamlined_50 kg_Wooden	35	65	107.34

From the results, although the size of the packaging crates and nature of the packing liners influenced the level of damage or deterioration, the initial quality of the fruits, handling and prevailing climatic conditions influenced the deterioration greatly.

Cost/Benefit Analysis

The following estimates in table 2 were used in the prediction of the cost benefit analysis of treatments.

Table 2. Estimates of treatments used in the prediction of cost benefit analysis

Treatment description	Cost of materials used for treatments (GH¢)				Total Cost (GH¢)
	Crate	Paper lining	Foam lining	Jute hessian lining	
Control_30 kg_Plastic	45.00	-	-	-	45.00
Jutelined_30 kg_Plastic	45.00	-	-	1.50	45.00
Paperlined_30 kg_Plastic	45.00	1.00	-	-	46.00
Foamlined_30 kg_Plastic	45.00	-	1.00	-	46.00
Control_50 kg_Plastic	65.00	-	-	-	65.00
Jutelined_50 kg_Plastic	65.00	-	-	1.50	66.50
Paperlined_50 kg_Plastic	65.00	1.00	-	-	66.00
Foamlined_50 kg_Plastic	65.00	-	1.00	-	66.00
Control_30 kg_Wooden	10.00	-	-	-	10.00
Jutelined_30 kg_Wooden	10.00	-	-	1.50	11.50
Paperlined_30 kg_Wooden	10.00	1.00	-	-	11.00
Foamlined_30 kg_Wooden	10.00	-	1.00	-	11.00
Control_50 kg_Wooden	12.00	-	-	-	12.00
Jutelined_50 kg_Wooden	12.00	-	-	1.50	13.50
Paperlined_50 kg_Wooden	12.00	1.00	-	-	13.00
Foamlined_50 kg_Wooden	12.00	-	1.00	-	13.00

While all the wooden crate treatments were the cheapest based on cost, their use was once (crates are disposed off with tomato to retailers or other wholesalers). The plastic crate treatments although expensive per cost could be used for not less than five years and also provided equal protection to the fruits compared with the traditional wooden crates. The plastic crates from the experiment, can be classified as the best since its benefits outweighs the cost. All liners proofed effective than the controls except for the 50-kg jute lined plastic crate which had damaged and undamaged values same as some of the controls. Fruits were resold in Tamale at a lower price (about 15% lower) than the initial price at Paga and also excluding the transportation cost, a phenomenon which most wholesalers affirms happens to them all the time.

CONCLUSION

All treatments offered varying degrees of support to reduce losses from the farmgate to the retail point along the value-chain. While The jute lined 30 kg plastic and paper lined wooden crates and paper lined 50 kg both plastic and wooden offered effective support in curbing losses than the remaining treatments, the 50 kg control wooden crate had fruits with more damage than undamaged.

Although traders have access to the categories of plastic crates, they preferred the wooden crates because they were cheap and are used as disposables (tomato fruits are sold out to retailers with the crates) while the plastic crates must be retrieved or collected back. Traders also felt it was a waste of resources and time to line the crates before the fruits are filled. The plastic crates however, provided an avenue for effective stacking which did not produce smashed tomato at the surface which was the reverse in the wooden crates. The plastic crates were cost effective compared with the wooden crates. It can be concluded from this study that regardless of the size of the standard crate used by both farmers and traders, with adequate and suitable packing liners could reduce the quantities of damaged fruits in tomato.

Packaging liners for crates are not commercially available for access and requires individual traders to improvise making their adoption impossible. If suitable packaging liners can be made commercially available at the same venues where the crates are acquired and their benefits made known could encourage traders and farmers alike to line their crates at the point of packing.

Acknowledgements

The authors wish to acknowledge the financial support of USAID through AVRDC - The World Vegetable Centre for this research.

REFERENCES

Dandago, M.A., Ilesanmi, J.O.Y. and Tamme, V. 2017. Effects of packaging and storage conditions on quality and storage life of tomato fruits (*Lycopersicon esculentum* MILL.) in Kura, Kano State, Nigeria. Journal of Postharvest Technology, 5(4): 71-82.

FAO (Food and Agriculture Organization) 2009. FAOSTAT/FAO Statistics Division. Available at: http://faostat.fao.org (Accessed: 31 March 2013)

Horna, D., Melinda, S. and Falck-Zepeda, J. 2006. Assessing the potential economic impact of genetically modified crops in Ghana: Tomato, Garden Egg, Cabbage and in processing tomatoes. Scientia Horticulturae, 27: 189-198.

MoFA (Ministry of Food and Agriculture). 2010. Vegetable production in Ghana. Annual Report pp. 68-75.

Mwaijande, F. 2017. Farmers' adoption and willingness to pay for post-harvest technologies in Tanzania: policy implication for enhancing food security. Journal of Postharvest Technology, 5(1): 1-6.

Ndirangu, S.N., Kanali, C., Mutwiwa, U., Kituu, G., Kamwere, M. and Mung'atu, J. 2017. Determinants of postharvest losses among high moisture content vegetables traders in Kenya. Journal of Postharvest Technology, 5(2): 37-46.