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# Postharvest Quality of Sweet Corn is Affected by Hydro-cooling and Packaging Type

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## Introduction

Sweet corn or scientifically known as *Zea mays* is a very common horticultural crop in Malaysia. It is among the top ten cash crops planted among growers in Malaysia. The taste and quality of sweet corn depends heavily upon its sugar content. Sweet corn has high respiration rate (Kader, 2002) with rate of 30-51 and 282-435 mg $CO_2$ $kg^{-1}h^{-1}$ at 0 and 25℃, respectively (Gross et al., 2004). High respiration causes sugar content in the sweet corn to reduce by about 6 and 60% in a single day at 0 and 30℃, respectively (Brecht, 2004). So, the quality of sweet corn will rapidly degrade if not handled properly. Lowering internal commodity temperature following harvest is critical in extending postharvest life. This can be done in two-stage process starting with precooling and low temperature storage. Precooling using water as cooling medium (known as hydro-cooling) is recommended to remove field heat and extend postharvest life for sweet corn (Vigneault et al., 2007). However, lack of proper packaging during storage can cause serious deterioration and loss of tenderness and sweetness of sweet corn (Risse and McDonald, 1990). Thus, proper packaging during storage is essential to retain sweet corn quality. However, there was no literature on the effect of hydro-cooled sweet corn followed by packaging.

Therefore, this study was conducted to examine the quality of sweet corn after hydro-cooled and packed using cling wrap and polyethylene bag.

## Materials and Methods

Freshly harvested sweet corns that were uniform in size and color without any defects and disease were taken from Batang Berjuntai, Selangor. Upon arriving at Postharvest Laboratory, UPM, 40 cobs of the corns were placed in a hydro-cooler with water temperature of 4 °C. 20 cobs of sweet corn were removed from cold water when the core temperature of corns reached 13 °C or achieved its 1/2 cooling time in the pre-cooling process. The remaining pieces of corn were removed from cold water when the core reached 5.2 °C or achieved its 7/8 cooling time. For control, 20 cobs of sweet corn without underwent hydro-cooling process were used.

All the corns were minimally trimmed by removing its shank, silk and some husks to expose few rows of kernels. The 20 pieces of sweet corn from respective treatment were then divided into two lots of 10 cobs/lot. One of the lots were packed using polyethylene bag (20 cm x 30 cm with 0.04 mm thickness) with 2 cobs in a bag. Another lots of sweet corn were packed using cling film (0.02 mm thick) with 2 cobs in a pack. The packed corns were then stored in a chamber of 7 $^{o}$C with 70% relative humidity. These sweet corn were analyzed for its quality index (QI), weight loss and soluble solids concentration (SSC) at day 0, 2, 4, 6 and 8. QI of sweet corn was determined using a 9-point scale based on husk, silk and kernel freshness, turgidity and colour (Vigneault et al., 2004).

The experimental design used was a randomized complete block design with three factorial arrangement (cooling time x type of packaging x days of storage). The experiment was repeated for three times. Data was analyzed using analysis of variance (ANOVA). When ANOVA gives the significant F-value at 5% level, Duncan's multiple range test (DMRT) was used to separate the means using Statistical Analysis System (SAS Institute, 1989).

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**Results and Discussion**

The QI and SSC of sweet corn was not affected by interaction between hydro-cooling time x packaging type, hydro-cooling time x storage day, packaging type x storage day and hydro-cooling time x packaging type x storage day (Table 1). However, water loss of sweet corn was affected by interaction between packaging type x storage day.

There was significant different in sweet corn QI between control and corn that achieved 7/8 cooling time (Table 1). However, there were no differences in QI between control and corn that achieved ½ cooling time, and also between the two cooling times used. This indicated that 7/8 cooling time is preferable in retaining packed sweet corn quality. Both type of packaging used in this study did not affect QI of sweet corn. As expected, the QI of sweet corn decreased as storage day progressed, from excellent (score 9) to average (score 4). This indicated that after 8 days of storage at 7°C with 70% relative humidity the husk of sweet corn appeared as pale green and slightly dry while silks showed light browning and little drying. The kernels were dull but not dented and no major defects were found on the cobs. The increase of storage duration caused the produce color change which was due to the action of the light, temperature, oxygen, metal ions, and endogenous enzymes (Stintzing and Carle, 2004). This could explain the degradation of color in sweet corn husk and silk.

Table 1: Main and interaction effects between hydro-cooling time, packaging type and storage day on quality index, water loss and soluble solids concentration of sweet corn during 8 days of storage at 11 °C.

| Factors | Quality index | Water loss (%) | Soluble solids Concentration (%SSC) |
|---|---|---|---|
| Hydro-cooling time (CT) | | | |
| 0 | 6.73 b[z] | 1.63 a | 13.40 a |
| ½ | 7.27 ab | 1.72 a | 12.82 a |
| 7/8 | 7.53 a | 1.63 a | 13.22 a |
| Packaging type (PT) | | | |
| Polyethylene bag | 7.13 a | 1.38 b | 13.35 a |
| Cling film | 7.22 a | 1.98 a | 12.95 a |
| Storage day (SD) | | | |
| 0 | 9.00 a | 0.00 e | 14.08 a |
| 2 | 8.67 a | 0.86 d | 14.07 a |
| 4 | 7.67 b | 1.69 c | 14.20 a |
| 6 | 6.11 c | 2.55 b | 12.68 b |
| 8 | 4.44 d | 3.32 a | 10.72 c |
| Interaction | | | |
| CT x PT | ns | ns | ns |
| CT x SD | ns | ns | ns |
| PT x SD | ns | * | ns |
| CT x PT x SD | ns | ns | ns |

[z]*For each treatments, means within a column and factor followed by the same letter are not significantly different by DMRT at P ≤ 0.05.* ns, *, Non-significant or significant at significant different by DMRT at P ≤ 0.05.

The water loss of sweet corn was significantly affected by interaction between packaging type x storage day (Table 1). At the initial stage of storage, there was no difference between type of packaging (Figure 1). After storage day 6, the sweet corn packed using cling film showed significant

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higher of water loss than corn packed in polyethylene bag. This indicated cling film is not a good packaging material as compared to polyethylene bag in storing hydro-cooled sweet corn at low temperature.

The SSC of sweet corn was not affected by hydro-cooling and packaging type (Table 1). However, storage day had an effect on SSC where SSC of sweet corn decreased by 9.94% after 8 days of storage. Initially, there was no difference in SSC from day 0 until 4, then it dropped significantly after day 6. A similar finding was also reported by Vigneault et al. (2007) where increasing storage days caused decreasing SSC in sweet corns.

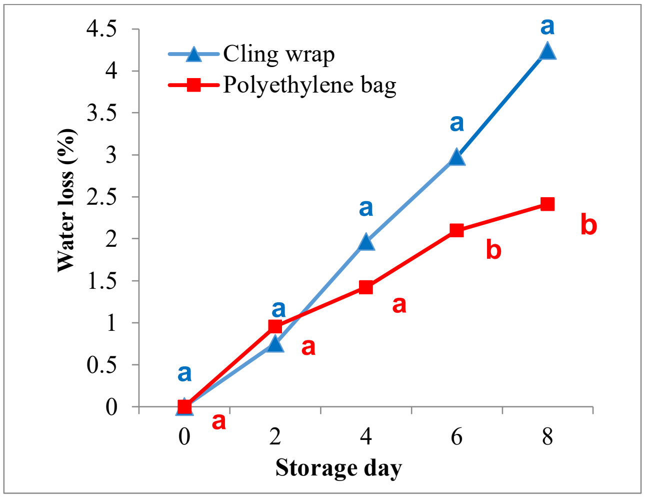


Figure 1: Water loss of hydro-cooled sweet corn packed using cling wrap film and polyethylene bag during storage. Means followed by same letters are not significantly different ($P \leq 0.05$) within the same storage day.

## Conclusion

As conclusion, quality of sweet corn can be retained by hydro-cooling and packing but decreased as storage duration advanced. Thus, it is essential to reduce temperature of sweet corn as fast as possible after harvest and packed with proper material to retain its quality during low temperature storage.

## References

Brecht, J.K. 2004. Sweetcorn. Postharvest quality maintenance guidelines. In: K. Gross, C.-Y. Wang, and M. Saltveit (eds.). The Commercial Storage of Fruits, Vegetables, and Florist & Nursery Crops, 3rd ed. Agriculture Handbook. No. 66. USDA/ARS, Washington, D.C.

Kader, A.A. 2002. Quality parameters of fresh-cut fruit and vegetable products. Fresh-Cut Fruits and Vegetables, p.11-20.

Gross, K., Wang, C.Y. and Saltveit, M. 2004. The commercial storage of fruits, vegetables, and florist and nursery stocks. Agriculture Handbook number 66. USDA/ARS, Beltsville, MD, USA.

Risse, L.A. and McDonald, R.E. 1990. Quality of supersweet corn film-overwrapped in trays. HortScience 25(3): 322-324.

Stintzing, F. C. and Carle, R. 2004. Functional properties of anthocyanins and betalains in plants, food, and in human nutrition. Trends in Food Science & Technology 15(1): 19-38.

Vigneault, C., Gariépy, Y., Roussel, D. and Goyette. B. 2004. The effect of precooling delay on the quality of stored sweet corn. International Journal of Food, Agriculture and Environment, 2(2): 71-73.

Vigneault, C., Goyette, B., Gariepy, Y., Cortbaoui, P., Charles, M.T. and Raghavan, V.G.S. 2007. Effect of ear orientations on hydrocooling performance and quality of sweet corn. Postharvest Biology and Technology 43: 351-357.