# Effects of postharvest treatments on sweetpotato (*Ipomoea batatas*) storage quality

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## Abstract

After harvest, sweetpotato (*Ipomoea batatas*) storage root quality is reduced due to weight loss, sprouting and rots. There are also hidden quality losses relating to loss of nutritional compounds. In order to maintain sweetpotato quality during storage, sweetpotatoes need to be stored at 13 - 15 °C and 80 - 90% RH. However, controlled temperature methods are difficult to achieve for subsistence farmers in less developed countries who have limited access to electric power. This work was undertaken to determine the potential postharvest techniques that would extend sweetpotato storage life without compromising phytochemical concentration. Postharvest treatments investigated in this work were hot water dipping (with or without coating) and ethylene (with or without 1-MCP) treatments. The work was undertaken using mainly 'Owairaka Red' and 'Clone 1820' sweetpotato cultivars. Following treatments, these sweetpotatoes were stored at 25 ˚C and 80 - 90% RH for 4 to 12 weeks.

Hot water dipping (HWD) at 51 ˚C for 11 min delayed sprout growth by 2 weeks but increased weight loss. Coating (carnauba wax 5%) significantly reduced weight loss, but increased sprout growth in 'Owairaka Red'. A combination of HWD and coating was effective in reducing both sprout growth and weight loss. β-carotene content measured in 'Clone 1820' ranged from 17.3 to 25.6 mg/100 g dry weight. The concentration was not affected by HWD or coating, but declined by about 30% during 12 weeks storage. The calculated retinol activity equivalent (RAE) ranged from 363 to 537 RAE, per 100 g of edible portion of sweetpotato. Based on the recommended daily intake for vitamin A, a serve of 100 g would supply more than 25% of daily retinol requirement for all age groups, suggesting that even after storage 'Clone 1820' is a good source of vitamin A. In addition, no treatment adversely affected the phenolic acid and anthocyanin concentrations. Roots that were HWD showed a subtle increase in total phenolic content, phenolic acids and anthocyanin concentration when compared to control roots, but the effect was short-lived.

Previous studies have demonstrated that ethylene is a potential sprout inhibitor, but causes darkening of flesh colour and the development of off-flavours after cooking. Ethylene-induced responses may be inhibited by 1-methylcyclopropene (1-MCP). 1-MCP and ethylene combined effects on sweetpotato physiological, flesh colour and phytochemical variables were assessed during storage. Ethylene treatment with or without 1-MCP inhibited sprout growth, increased root respiration rates by 2-fold, and caused root stem-end split leading to high weight loss and rots. Ethylene treatments also caused flesh darkening, and this was not prevented by a single 1-MCP (1 μL $L^{-1}$) pre-storage treatment. When roots stored in continuous ethylene were subjected to multiple 1-MCP (1 μL $L^{-1}$) treatments, the ethylene-induced root splitting and flesh darkening were delayed/reduced whilst maintaining minimal sprout growth. This implies that ethylene-induced negative responses in sweetpotato can be mitigated with on-going 1-MCP treatment. The sensory results showed that roots stored in air were highly preferred by consumers over roots stored in ethylene; nevertheless, acceptance means scores of all treatments were above five, indicating that ethylene-induced flesh darkening was not severe enough to cause consumer rejection.

Based on these findings, it is proposed that a combination of HWD and coatings can be used to extend non-refrigerated storage life of sweetpotato with no major effect on phytochemical content. The results on ethylene are consistent with previous findings that ethylene suppresses sprout elongation. However, the associated negative effects outweigh the benefits of using ethylene as a sprout control. Future research therefore should focus on finding ways to get the benefit of ethylene for sprout reduction without incurring risk of root splitting.

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***Dedicated to my dad and mum***

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| | |
|---|---|
| 1-MCP | 1-Methylcyclopropene |
| ANOVA | Analysis of variance |
| CIP | International potato centre |
| DW | Dry weight |
| $FeSO_4.7H_2O$ | Ferric sulphate |
| FRAP | Ferric reducing antioxidant power |
| *g* | Gravitational acceleration |
| Gy | Gray |
| HPLC | High performance liquid chromatography |
| HSD | Honestly significant difference |
| HWD | Hot water dipped |
| HWDC | Hot water dipped plus coating |
| OD | Optical density |
| Pa | Pascal |
| PAL | Phenylalanine ammonia-lyase |
| POD | Peroxidase |
| PPO | Polyphenol oxidase |
| RAE | Retinol activity equivalent |
| TPC | Total phenolic concentration |
| WPC | Whey protein concentrate |