

Multistate Research Project S-294
Postharvest Quality and Safety in Fresh-cut Vegetables and Fruits

2007-2008 Activities Report

Institution: Agriculture and Agri-Food Canada, Summerland, British Columbia

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Introduction:

The research at Summerland has shifted in response to national priority changes within Agriculture and Agri-Food Canada. The salient change, in regard to quality, is that nutritional/functional quality will be emphasized. The work in relation to food safety will focus on environmental movement of pathogens from production to processing. Also the potential interaction of wounded tissue physiology with microbial populations will also be emphasized.

Activities

Objective 1. Develop, evaluate, and standardize subjective and objective quality evaluation methods in intact and fresh-cut fruits and vegetables.

Nothing to report.

Objective 2. Develop new strategies to maintain fresh-cut product quality

Nothing to report.

Objective 3. Improve understanding of biochemical, physiological and molecular mechanisms that affect fresh-cut product quality.

1. Bioaccessibility of antioxidant fractions in fresh cut fruit and vegetables. Bioaccessibility is defined as a measure of what components are soluble and therefore available for absorption in the gut after digestion. A method for performing an in vitro digestion of tissue as been developed. Subsequent to digestion, the samples are fractionated to evaluate the antioxidant value of phenolic and non-phenolic fractions of digestate. Both the Folin-Ciocalteu Reaction Reducing Capacity (formerly called total phenol analysis) and the Hydrogen Atom Abstraction Capacity (chain-breaking capacity) are used to characterize the antioxidant activities of all extracts and fractions. Results to date indicate that slices from different cultivars of apples have differing characters and that they may show differing responses to application of anti-browning dip. Further activity is underway to confirm results in the coming year and to broaden the studies to include fresh-cut vegetables. The bioaccessibility of antioxidant constituents is only a fraction (up to 30%) of what is extractable using solvent extraction. This work will help to better quantify relative biological value of fruit or vegetable tissues, based on what can potentially be absorbed as opposed to the current solvent extract analyses which indicate what is present in the tissue before digestion.

Objective 4. Standardize methods for recovering pathogenic and spoilage microorganisms from intact and fresh-cut produce including tree nuts.

Nothing to report.

Objective 5. Evaluate and control unintentional and intentional microbial contamination of intact and fresh-cut produce.

1. Fate of *E. coli* from manure in soil and lettuce. Romaine lettuce will be grown from transplants in well characterized experimental plots at two research centres (PARC-Agassiz, British Columbia and AFHRC-Kentville, Nova Scotia). Lessons learned in preliminary trials conducted in 2007 will be applied here. Sampling strategies and methods for the recovery of *E. coli* from lettuce and soil will be adjusted in recognition of seasonal differences in plant development and rates of survival for the target bacteria in soil. Test plots will receive liquid dairy cow manure in the spring at least 90 days before planting. Two treatments will be applied: surface application at a rate of 60 kg N/ acre and application at the same rate followed by plowing. Generic *E. coli* and VTEC populations in manure, soil and on lettuce plants will be determined using existing methods for monitoring culturable and non-culturable bacteria. A subset of lettuce will be examined for internalized *E. coli*. Lettuce from the Agassiz site will also be harvested, cut, washed and packaged to examine the fate of *E. coli* during processing and storage of the crop. Isolates will be retained for characterization (genotyping by REP-PCR or PFGE, presence of *stx1*, *stx2*, *e-hlyA* and *eaeA* genes by PCR, serotyping) to examine the association with and persistence of specific genotypes in each sampled environment. (Pascal Delaquis, Susan Bach and Greg Bezanson)
2. Interaction of wounded lettuce surfaces with microbes. The impact of wounded generated oxygen radicals on microbial survival and growth will be assessed using both biochemical analyses and confocal microscopy. Initial studies are planned to quantify and localize the production of hydrogen peroxide on cut surfaces over time, after processing. The data generated will allow analysis of the impact of measured hydrogen peroxide levels on specific bacteria in culture systems. Subsequent analysis will be performed, using confocal microscopy to determine whether chronological changes in bacterial populations can be directly associated with levels of hydrogen peroxide. (Peter Toivonen, Pascal Delaquis).

Publications:

1. Toivonen, P.M.A. 2008. Influence of harvest maturity on cut-edge browning of 'Granny Smith' fresh apple slices treated with anti-browning solution after cutting. LWT - Food Science and Technology (in press) available online at LWT (2008), doi:10.1016/j.lwt.2007.10.005
2. Toivonen, P.M.A. 2008. Application of 1-MCP in Fresh-cut/Minimal Processing Systems. HortScience 43: 102-105.
3. Toivonen, P.M.A. and D. Brummell. 2008. Biochemical bases of appearance and texture changes in fresh-cut vegetables and fruits. Postharvest Biology and Technology 48: 1-14.
4. Hodges, D.M. and P.M.A Toivonen. 2008. Quality of fresh-cut fruits and vegetables as affected by exposure to abiotic stress. Postharvest Biology and Technology 48:155–162.