Approximately 20% of our calories come from snacks!

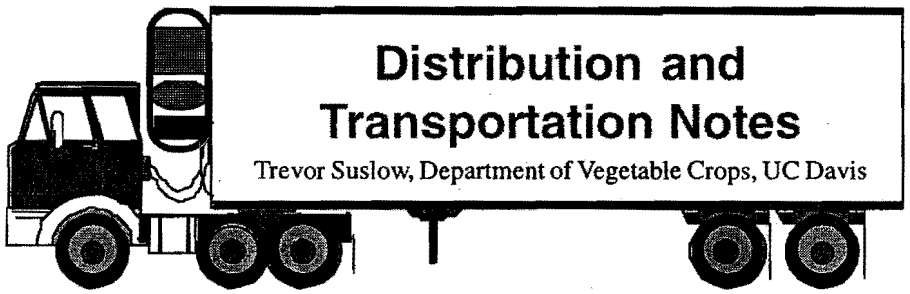
Trend 9: "Do-It-Yourself" Health

Americans are attempting to self-medicate through their food, and the functional, fortified and performanc-enhancing markets are booming. Almost half of all shoppers try to control their cholesterol, and many are also interested in managing their weight, and reducing salt and sugar.

Trend 10: Clean, Pure, Natural and Safe

Consumers are worried about mad cow disease, BSE, food poisoning, GMOs etc. and these fears are driving the cleaner, purer food market. Many consumers try to avoid pesticides and additives and shop at natural food stores or food co-operatives. One-third of mainstream shoppers buy organic food to "maintain health".

Ms. Sloan concludes that as the population ages, Americans will be concerned about health and weight, but they will also look for more balance, fun and enjoyment from their food. Wise business-persons will take heed of these trends!



Distribution and Transportation Notes

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Asparagus Handling and Display

Maintaining quality of fresh asparagus depends on several aspects of proper handling working together, but the key is good temperature management (See Produce Facts at http:// postharvest. ucdavis.edu). Additionally, asparagus is highly perishable and prone to becoming limp and flaccid, rapid toughening, yellowing, loss of flavor, and decay if it is not properly displayed at the retail level. Asparagus is generally displayed on a refrigerated shelf, often under mist, with the cut end (butt-end) down and in contact with a wet absorbent pad. To maintain the greatest spear weight and quality, a recent display trend has been to place asparagus in deep waxed or plastic-coated paper trays. The trays hold water from initial hydrocooling, at the shipping point, to retail display. The butt-end can be successfully, although briefly, held in water. However, soft rot and slime develop rapidly if temperatures are too warm during distribution and in a non-refrigerated display. Above 45°F (7°C), bacterial decay can be a problem that begins during storage and shipping and may become visible in just a few days during sub-optimal retail handling.

In this brief note, two research activities related to asparagus handling and soft rot caused by the bacterial pathogen *Erwinia carotovora* subsp. *carotovora** are reported.

Erwinia Growth is Affected by Spear Physiology

To evaluate the interaction of post-hydrocooling temperature management and decay caused by *Erwinia* (not reported here), it was necessary to reassess the susceptibility of asparagus tissue at different positions on the spear that would experience varying environments in simulated retail display,

especially in water trays. Our results confirmed earlier reports (See Lipton 1990) that susceptibility to decay was lower at the butt-end of green asparagus (if some white tissue was present) and highest at the tip (Figure 1). Growth of the pathogen was restricted at the butt-end relative to growth at the tip during 3 days holding at 59°F (15°C). After 72 hours, water soaking, an early sign of decay, was apparent around a small wound-site at the tip, created during inoculation with a low concentration of *Erwinia* at each spear position. No symptoms of decay were apparent at the butt-end, under the test conditions, even though an increase from the initial population was observed.

Calcium Treatments May Delay Decay

Various treatments are being evaluated to explore the recommended handling options for the use of water-trays in shipping and retail display. Issues of postharvest decay and microbial food safety are under investigation. One of the treatments being evaluated is the use of calcium amendments to the water reservoir. Various forms of calcium have been reported to prevent or delay postharvest disease or spoilage by improving or maintaining natural pathogen resistance and firmness. Improvements in decay control have been observed when using calcium hypochlorite rather than sodium hypochlorite or chlorine gas in various postharvest handling systems. The firming effect of calcium is thought to result from the formation of complexes within the cell wall, specifically cross-linking polygalacturonic acid residues of the middle lamella, which retains or even temporarily increases structural integrity. In addition, cell wall breakdown components, that are signals to pathogens, are greatly reduced. As an example from our investigations, 0.5% chelated calcium (calcium metalosate; Albion Lab., Utah) was added to the water reservoir of trays holding freshly cut asparagus spears. No calcium was added to control trays. Known concentrations of *Erwinia* were added to both trays and the spears were held at 59°F (15°C) for 3 days. Our preliminary results (Figure 2) showed that the calcium addition reduced the buildup of bacteria at the cut end, which is an essential step before decay can develop. Early symptoms of decay were weakly visible in the controls at this time point. Interestingly, the population of *Erwinia* recovered from the water was higher with the addition of calcium than in water samples from the non-treated tray. On-going studies will evaluate the potential for combined water disinfection treatment and supple-

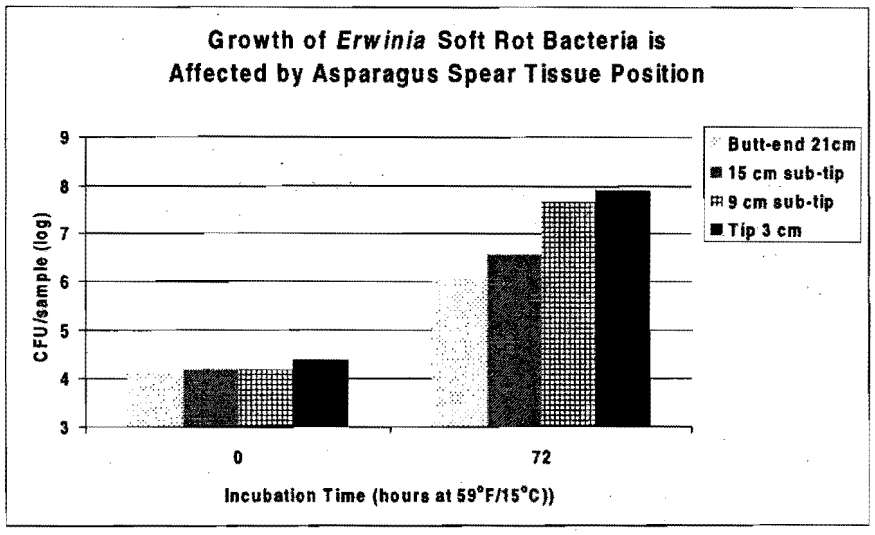

Figure 1. The soft rot pathogen *Erwinia carotovora* subsp. *carotovora* was inoculated into a small, superficial wound at each position on a standard 9 in. (22.8cm) green asparagus spear. Bacteria were recovered from a 5mm cross-section around the point of inoculation and enumerated using standard techniques on selective/differential media.

mental calcium additions to water for their performance in maintaining asparagus quality and microbial safety over a full range of retail handling and display conditions.

* the proper name for *Erwinia carotovorum* has been changed, by taxonomic authorities, to *Pectobacterium carotovorum*.

Lipton, W.J. 1990. Postharvest biology of fresh asparagus. Hort. Reviews. 12:69-155.

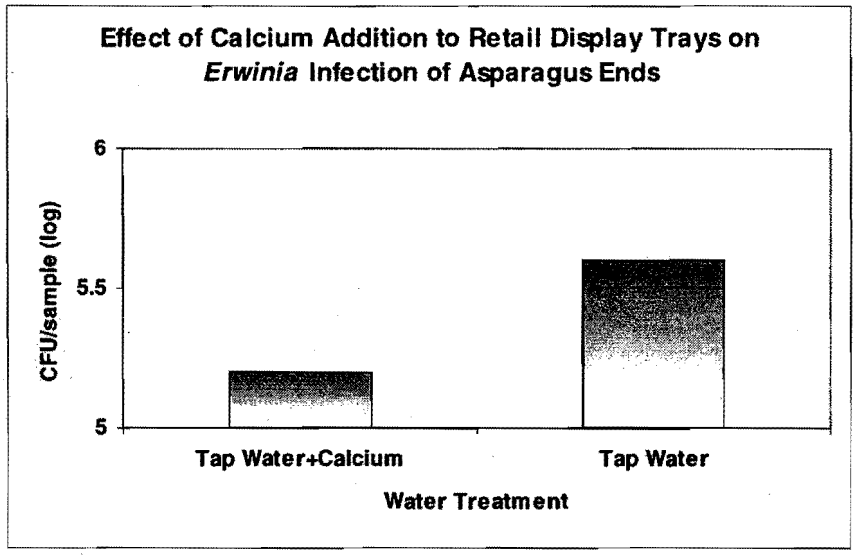

Figure 2. The addition of 0.5% calcium metalosate to water, in a shipping and retail display tray, reduced the growth of the soft rot pathogen *Erwinia carotovora* subsp. *carotovora* in the asparagus spear tissue at the cut end during a three day period at 59°F (15°C). Typically, decay is not apparent to the unaided eye until the pathogen levels reaches log 5.8 CFU (colony-forming units). Small population differences can have a striking impact on decay progression. In this experiment, the differences were significant at P=0.001 in comparing ten replicated spears for each treatment.

Recent Publications

Apples

Dixon, J. and E.W. Hewett, 2001. Temperature of hypoxic treatment alters volatile composition of juice from 'Fuji' and 'Royal Gala' apples. Postharv. Biol. Technol. 22:71-83.

Fernandez-Trujillo, J.P., J.F. Nock, and C.B. Watkins. 2001. Superficial scald, carbon dioxide injury, and changes of fermentation products and organic acids in 'Courtland' and 'Law Rome' apples after high carbon dioxide stress treatment. J. Amer. Soc. Hort. Sci. 126:235-241.

Gonzales, J.J., R.C. Valle, S. Bobroff, W.V. Biasi, E.J. Mitcham, and M.J. McCarthy. 2001. Detection and monitoring of internal browning development in 'Fuji' apples using MRI. Postharv. Biol. Technol. 22:179-188.

Bananas

Yang, C., S. Fujita, K. Kohno, A. Kusubayashi, MD. Ashrafuzzaman, and N. Hayashi. 2001. Partial purification and characterization of polyphenol oxidase from banana (Musa sapientum L.) peel. J. Agric. Food Chem. 49:1446-1449.

Cactus Pears

Corrales-Garcia, J. and P. Gonzalez-Martinez. 2001. Effect of gibberellic acid and (2-chloroethane) phosphonic acid on glochid abscission in cactus pear fruit (*Opuntia amyclaea* Tenore). Postharv. Biol. Technol. 22:151-157.

Cherries

Shellie, K.C., L. G. Neven, and S.R. Drake. 2001. Assessing 'Bing' sweet cherry tolerance to a heated controlled atmosphere for insect pest control. HortTechnology 11:308-311.