



# Western Vegetable Quality

## *WESTVEG NEWS*

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### **1. The Effect of UV-C Radiation on Vegetable Quality**

UV light can produce skin cancer and may deteriorate vision. UV radiation can also be lethal to plant and human pathogens, which is a main reason why this technique has been studied as a disinfecting agent of food. Ultraviolet has recently received FDA approval for use as a disinfectant for surface treatment of foods. Irradiation with UV-C light, in the range of 240-260 nm, may be a more effective germicidal treatment for fresh-cut produce than common disinfectant treatments such as chlorine or ozone. Ultraviolet light can damage DNA structures, however, some microbes may repair themselves when exposed to visible light. UV-C light has also shown good results as a postharvest treatment of intact fruits, reducing the severity of latent pathogens.

Perhaps the weakest point of UV-C light is that it has poor penetrative capacity, thus in most cases this technique in the food industry has been limited to surface applications. Another potential draw back is that it catalyzes oxidative changes that can lead to rancidity and discoloration.

When developing a UV-C protocol for the disinfection of a vegetable, perhaps the most critical factor is to determine the doses to be used. A low dosage may not be effective whereas high doses may greatly reduce the number of microorganisms but can produce discoloration and accelerate the senescence of the product. Doses, or levels, of UV light are affected by the distance from the source of UV to the product and the length of time of exposure. In some cases several minutes are needed to achieve a sufficient decrease in pathogen populations, which could make the technique unfeasible for certain applications.

Normally, we think of using UV-C treatment on vegetables that allow light to easily reach the surface of the product. In some cases, however, there has been a positive effect even in processed vegetables. A recent study published in Food Research International concluded that UV-C radiation at an appropriate dosage could reduce microbial loads without adversely affecting sensorial quality of fresh-cut “Lollo Rosso” lettuce.

At the Yuma Agricultural Center we are investigating the effect of UV-C on fresh-cut cantaloupes and watermelon. Preliminary results with watermelons have shown that this treatment is more effective in commercial settings than common disinfectant agents such as chlorine and ozone. A particular benefit of UV-C for delicate products is that this process doesn't require the “centrifugation” step often used to remove water after application of aqueous treatments, such as ozone and chlorinated solutions. We will be reporting the final results of these investigations later in the year.

## **2. Water Stress May Extend Shelf Life of Vegetables**

Water stress during the growth of plants is known to negatively affect the yields of vegetable crops. As a consequence most growers try to avoid water stress in the field. Recent studies evaluating the effect of water stress on the quality and shelf life of vegetables however, suggest that in some cases “controlled” water stress can produce beneficial effects during postharvest storage.

Recent work by scientists from the UK showed that moisture stress imposed during maturity of broccoli increased shelf life from 2-3 days to as many as 13 days at 15 °C (59 °F). The study revealed different results when water stress was imposed at different stages of the plant growth and at different times in the production season, suggesting that a second variable could be interacting with the effect of water stress. Similarly, other studies with vegetables such as carrots, melons and celery have shown that water stress can improve postharvest quality, but this will depend on when the plants receive the stress.

Clearly, the main question in this issue is to determine whether the increase of shelf life can compensate for the reduction of yields. In the study conducted in the UK, the reduction of weight per broccoli in the treatment that best extended shelf life was near 30%. Clearly, this is an issue with different answers depending on who is being questioned, whether it is a grower or a shipper or a processor. For many businesses, selling product with high water content is a primary goal, but in some market segments, quality is already well rewarded. More studies are needed to elucidate the ideal timing and level of water stress that can improve postharvest quality and produce the least reduction in final weight at harvest.

## **3. Is There a Potential Use for Aminoethoxyvinylglycine (AVG) in Vegetable Production?**

The use of growth regulators in vegetable production is not a common practice. In this newsletter we will be discussing the pros and cons of growth regulator usage and providing some information about new research in this area.

Aminoethoxyvinylglycine (AVG) is a plant growth regulator commercially known as Retain™. This compound is known to competitively inhibit the activity of the enzyme ACC synthase, the enzyme that accelerates the production of ethylene in fruit and vegetables. Plants under high levels of ethylene have accelerated aging processes, including speeding ripening and development of the symptoms of decay. AVG has been mainly used in

climacteric fruits, ---fruits that continue to ripen after harvest--. Applications of AVG have produced delays in the bloom and harvest dates of peaches. It is regarded as an effective product to prevent preharvest fruit drop in apples.

Krista Shellie from USDA –Weslaco, TX, evaluated the effect of AVG applications within two weeks prior to harvest of cantaloupes. Melons harvested from the AVG treatment had lower rates of ethylene production at harvest and after cold storage than the controls. However, in this study no difference was observed in flesh firmness, soluble solids, fresh mass or incidence of decay at harvest or after storage in melons harvested from plots sprayed with AVG. Despite the decline in ethylene production no practical advantage for growers and shippers was obtained. This area probably deserves more research. The author suggested examining AVG at different concentrations and/or timings not evaluated in the study.

One of the goals in Shellie's study was to obtain uniformity at harvest; however, the AVG-treated plants required the same number of harvests that the control plants did. Interestingly, they observed a delay in the initial development of the abscission zone, which merits more research. Little testing has been done with this product on vegetables such as tomato and pepper. More studies are needed to determine whether AVG is feasible or not for vegetable production.

#### **4. The Journal Magnifier:**

##### **- Russet spotting in lettuce delayed with ethylene inhibiting agents**

Premature russet spotting and browning of edges continue to be the main problems affecting quality of lettuces during postharvest storage. New variety development has mainly targeted field-related issues such as tolerance to pathogens and pests. Lettuce produces low amounts of ethylene, the aging hormone in plants, however, its tissue is very sensitive to the effects of ethylene. Russet spotting in midribs has previously been associated with ethylene. Products that reduce the effects of ethylene, such as AVG, potassium permanganate and 1-methylcyclopropene can theoretically alleviate this problem.

The effect of 1-Methylcyclopropene (1-MCP), an ethylene action controller that competitively binds to the ethylene receptor, was tested on postharvest quality of fresh-cut lettuce by researchers at the University of Singapore, in a study published last month in the Journal of Food Science. Applications of 1-MCP were effective in reducing russet spotting and leaf yellowing of shredded butter head lettuce. These results were associated with reductions of the product's ethylene synthesis and respiration rate. In this study, an alginate-based edible coating was also evaluated but no significant difference was obtained. Levels of ascorbic acid (vitamin C) were retained for a longer period of time in 1-MCP-treated lettuces. The storage rooms in this study were provided with potassium permanganate to remove any ethylene released by the product. Other studies have also reported reduction of russet spotting with potassium permanganate.

Unless future breeding programs address the problem of ethylene production and/or the sensitivity of lettuce tissue to ethylene, we will continue observing russet spotting in grocery stores. The latest results with 1-MCP and potassium permanganate seem to suggest that the appearance of russet spotting can be delayed with the use of these two products.

#### **5. Ask the specialist:**

##### **- What levels of E. coli and Salmonella are considered safe for fresh-cut products?**

Information kindly provided by Ralph Meer, Food Safety Specialist at the University of Arizona, indicates that E. coli (total) levels of 100 cfu/gram or greater would be

unacceptable, although less than 10 cfu/gram is considered to be ideal. There should be no ("zero") detectable Salmonella in 25 grams of sample.

It's important to remember that the number of microbes in general may be high and still would not be harmful. For example, the total number of aerobic microorganisms can be considered safe up to 10,000 cfu/gram. The problem is the type of microorganisms that may make up the total microorganism population such as Salmonella and E.coli O 157.

More information on this topic can be found at the following site:  
[http://peaches.nal.usda.gov/foodborne/fbindex/Micro\\_Guidelines.asp](http://peaches.nal.usda.gov/foodborne/fbindex/Micro_Guidelines.asp)

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