



Western Vegetable Newsletter

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Coming Next Issue: Rainfall Affects Microbial Quality of Vegetables

1. Cytokinins in Vegetable Crop Production

The application of growth regulators is not a common practice in vegetable fields. Very few growth regulators are approved for vegetable production in the western states. Michael Rethwisch, University of California - Riverside County, indicated recently, at a vegetable meeting held in Holtville, CA, that no work has been done during the last 15 years in the low desert to address the use of growth regulators in vegetable production.

The minimal research targeting immediate applications of growth regulators in vegetable production that has been conducted has often yielded inconsistent results. Despite this situation, among the growth regulators, it has been suggested that the cytokinins have the potential to improve early seedling vigor, root growth, increase stress resistance, crop uniformity, and size and juvenility of vegetables.

At the Yuma Agricultural Center we are investigating the effects of different cytokinins on vegetable yield. Preliminary results from studies with lettuce showed that cytokinins applied after head formation improved yield, in terms of weight and diameter of the heads by over 5%. These results were observed in two parallel experiments that included different formulations of cytokinins. These experiments will be repeated next season, including evaluation of timing and frequency of application.

2. Nutritional Quality of Cantaloupes Enhanced with Foliar Application of Potassium

Gene Lester from USDA-Weslaco, Texas, presented results from a preliminary study on the effects of foliar potassium on cantaloupe quality at the last Albion's® Conference on

Plant Nutrition this past January. Fruits receiving weekly applications of amino acid-chelated potassium after fruit set were ready to be harvested two days earlier and had higher soluble solid concentrations (Brix), vitamin C, beta-carotene content, K content and total sugars than the untreated fruits.

Interestingly, the increased sweetness in those fruits receiving the K foliar application was connected with an increase in the amount of fructose in the fruit pulp. Sucrose and glucose were not affected by the treatment. Lester explained that fructose is perceived to be 42% sweeter than sucrose and 57% sweeter than glucose, explaining why high-fructose melons taste sweeter.

Although, in this study the shelf life of the melons was not evaluated, it seems reasonable to think that those fruits treated with foliar K, could have a longer shelf life. Ascorbic acid (vitamin C), which was higher in the treated plants, plays an important role in delaying the aging of plant tissue. A similar situation could be happening with beta-carotene.

This is probably the first work reporting positive effects of potassium fertilization on the nutritional quality of vegetables, other than sugar content. In another recent work, Pilar Flores and other researchers from CSIC, Spain, evaluated the effect of calcium, nitrogen and potassium applications on the vitamin C, beta-carotene and lycopene content of red peppers. They found that potassium had no effect on the pepper's nutritional quality.

There is a lot that is not known about the effect of fertilization on the nutritional and "medicinal" qualities of vegetables. We should see more and more research along this line in the coming years.

3. Titanium Dioxide as Food Safety Tool

Titanium dioxide may become an important tool for the fresh food industry, particularly, for its quality control and food safety programs. Titanium dioxide particles exposed to UV light generate a strong oxidizing power that has been shown to effectively kill a wide spectrum of organisms including viruses, bacteria and fungi.

A photobioreactor, which extends the shelf life of fruit and vegetables by combining the actions of UV light and titanium dioxide, was developed by NASA and the University of Wisconsin at Madison and has been used successfully in shuttle missions for the last 10 years. Currently this technology, which clinical studies have shown to effectively eliminate air-borne microorganisms and allergens, is mainly used in medical/healthcare applications.

It has been noted that titanium dioxide breaks down the ethylene gas produced in storage rooms into carbon dioxide and water. It is starting to be used to treat the air in fruit, vegetable, and cut flower storage areas to prevent spoilage and increase the product's shelf life. Korean researchers found that illuminated titanium dioxide photocatalysts are effective against food-borne bacteria such as *Vibrio* sp., *Salmonella* sp. and *Listeria* sp, suggesting that future use of this technique will likely target food safety issues.

We are not aware of any shipping/cooling company in the southwest using the UV-titanium dioxide technology. We are planning to test this technology in applications related to our area. This technology might have benefits in extending shelf life of produce grown in the western region by eliminating ethylene in the environment, and by preventing spoilage and microbial contamination of produce such as melons.

4. The Journal Magnifier:

- No Tipburn in Fast-Growing Lettuce

A group of researchers from the Crop Physiology Laboratory at Utah State University attempted to maximize productivity of lettuce by increasing light, temperature and carbon dioxide in controlled conditions while avoiding tipburn by blowing air onto young leaves. Their work was recently published in the Journal of the American Society of Horticultural Sciences.

Their article explained that a limitation with improving production systems in lettuce is that the acceleration of lettuce growth increases the risk of causing tipburn. Excessive turgor pressure within the cells surrounding buds and leaf tips, accompanied with weak cell walls produces cell burst which produces the common darkened tipburn symptom.

Calcium is moved with water through the xylem. Younger leaves, which are the ones affected by tipburn, have lower transpiration rates than the older, outer leaves. Thus, in times of high growth rates the lack of transpiration in inner leaves prevents enough calcium from reaching the tips, which combined with the weak cell walls provides the perfect climate for tipburn to occur. Higher levels of light radiance increase tipburn because more calcium is needed in cell walls of leaves' tips. High humidity can increase tipburn by reducing transpiration and thus the water stream that transports calcium. On the other hand, low humidity at night diminishes plant turgor, resulting in less calcium being moved to leaf tips during the early morning. For similar reasons, high salinity reduces the turgor of plants and reduces the amount of calcium transported to the young leaves.

The Utah researchers hypothesized that wind around the young leaves could reduce tipburn at high growth rates by causing more transpiration. Their results showed that lettuce growth and development was increased 4 fold with high light, higher temperature and high carbon dioxide, while observing that tipburn was eliminated by blowing air on the tips.

In practical terms, this study provides insight into why tipburn occurs in lettuce and what can be done to prevent it. The study suggests the need of certain practices, such as control of water availability and addition of foliar calcium, when field conditions include high humidity and high temperatures.

5. Ask the specialist:

- How efficient is ozone for fresh food sterilization?

Ozone is an oxidizer which is theoretically 1.5 times stronger than chlorine, the most common disinfectant. However, ozone is highly unstable. Once in water solution, ozone will decompose into molecular oxygen unless its highly reactive oxygen reacts with an oxidizable substance. This unstable nature is appealing because ozone does not form potential toxic byproducts when decomposed as chlorine does. Trevor Suslow from University of California, Davis, indicates in an extension bulletin, that ozone loses half of its activity in less than 20 minutes. In highly alkaline solutions or in solutions with large amounts of iron, manganese and soluble organic material the degradation of ozone is highly accelerated.

Recommended doses for disinfection of produce are commonly in the range of 1-4 mg/L. These rates are often difficult to maintain by systems with on-site generators, due in part to its unstable nature and in part due to the limited capability of some generators currently in the market. The effectiveness of ozone is also substantially reduced in systems that involve sugary solutions, as sucrose markedly limits the microbial reducing potential of ozone.

In summary, ozone appears to be a strong contender of common disinfectant agents such as chlorine, however, the efficiency of ozone as disinfectant of fresh produce depends on having an appropriate system. The good news is that several modern ozone-generating systems now have the capability of producing high concentrations of ozone. In addition,

more information is now available indicating for which type of applications (produce) ozone is best suited.

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www.cals.arizona.edu/crops/



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