



Western Vegetable Newsletter

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1. Vitamin C in Vegetables May Increase with Sunny Days

Vitamin C – ascorbic acid - is perhaps one of the most important health protective compounds in food. Essentially all of our dietary vitamin C comes from fruits and vegetables. As consumers are becoming more aware of the health benefits of fruit and vegetable consumption, more interest in studying factors that affect the accumulation of nutrients such as vitamin C in produce is emerging. Sunlight may be one major factor directly enhancing the accumulation of ascorbic acid in vegetables.

Although light is not essential for the synthesis of ascorbic acid in plants, the amount and intensity of light during the growing season seems to have a definite influence on the amount of ascorbic acid formed. Ascorbic acid is synthesized from sugars that are formed during photosynthesis. Some researchers go further and generalize that the lower the light intensity during growth, the lower the ascorbic acid content of plant tissues. One example is reported by Makus and Lester from USDA Weslaco TX, who recently observed that vitamin C in mustard greens increased with higher light irradiance.

Despite the positive effect of light, in some cases where crops are grown under high light and high temperature the amount of ascorbic acid in fruit and vegetables is actually reduced. This is because high temperatures decrease levels of ascorbic acid. In Arizona for example, we have plenty of light, however, temperature may negatively affect the accumulation of ascorbic acid in the tissue of perennials. It has been reported that oranges from Arizona tend to have lower vitamin C than oranges from coastal areas of California.

At the Yuma Agricultural Center we have conducted several trials during the last year evaluating the effect of highly reflective mulches on the quality of cantaloupes. Our preliminary observations are showing that at early harvests those cantaloupes grown in mulched fields contain more vitamin C than melons grown without mulch. It is possible that the higher content of vitamin C is due to more light reaching the plants.

2. Rain Affects Microbial Quality of Vegetables

With food safety becoming a critically important issue for the vegetable industry, more attention is being directed to those conditions that increase microbial loads in produce. Humid conditions are known to be ideal for the proliferation of many plant pathogens. Moisture can also enhance clinical pathogens as well. Along this line, vegetables harvested a day after a rainfall event could have more microorganisms than those harvested in dry conditions.

Results from several studies have shown that bacteria such as *E. coli* and *Salmonella* growing in plant tissue are at low levels when weather conditions are dry. Very likely rainfall increases contamination of vegetables due to better survival of bacteria under humid conditions. Portuguese researchers observed that *Salmonella* became undetectable in lettuce 5 days after irrigation was terminated, with generic *E. coli* indicator strains persisting for a longer period. Lettuce harvested 5 days after stopping sprinkle irrigation with treated water had similar fecal indicator bacteria loads as those in lettuce grown in dry conditions.

This past winter we sampled lettuce grown at the Yuma Agricultural Center, before and after a rainfall event and found that the microbial population in lettuce increases after rain. This increase was more evident in head leaves. Microbial population in outer leaves increased but declined rapidly after a few days, perhaps due to the dry conditions and to the effect of UV light.

The results obtained in different studies suggest that in times of rain the harvest should either be delayed or a disinfectant treatment such as a spray of chlorine solution should be used to maintain low levels of microorganisms and deliver safer vegetables to retail sites.

3. Nutritional Quality of Vegetables May Improve During Postharvest Storage

To say that the quality of a vegetable can improve during storage is a statement that is hard for many to digest. When we first learn about postharvest technology we are usually taught that quality can only be *preserved* for a certain time in the best possible scenario. However, “quality” is now conceived as a more complex term, that not only includes sensorial quality – which mainly measures how the product tastes or how it looks - but also microbial and nutritional qualities.

We know that the application of certain treatments during postharvest may enhance visual characteristics of fruits and vegetables. The most common are the application of ethylene to enhance the color of fruits and the use of waxes to make produce surfaces appear more brilliant while reducing the loss of water.

Quality in terms of flavor may also improve during postharvest storage. An example of this is sweetness, which increases in those climacteric fruits – fruits that show an abrupt peak of respiration after harvest that triggers conversion of large carbohydrates into small sugars- such as cantaloupes, tomatoes and bananas.

The latest findings in this topic of “quality improvement of vegetables during storage” are showing that some nutrients such as ascorbic acid and lycopene can increase in some stored vegetables. Our first results in Yuma with cantaloupes are showing an increase in vitamin C during cold storage. It could be that as more carbohydrates are broken down

during respiration more sources for ascorbic acid synthesis become available. Interestingly, no work has linked increased nutrient content with bad handling of produce. In fact, it seems clear that fruits exposed to high temperatures and rough handling quickly lose nutrients. This is one more point supporting the importance of having an adequate postharvest handling system between harvest and the retail point.

4. Expanding Research with the Harpin Protein

Harpin is a protein derived from the bacteria *Erwinia amylovora*. Harpin triggers a cascade of responses in plants that stimulate the salicylic acid pathway and the jasmonic acid pathway, that can help plants survive when exposed to stress conditions. It has also been shown to stimulate nutrient uptake and photosynthesis, resulting in higher yield of certain crops. In those plants in which the protein is effective, the response is initiated within a few minutes of treatment and may continue for several weeks.

Messenger® has harpin as the active ingredient. Several reports have shown that Messenger® can be an effective defense against several plant pathogens, including *Fusarium* wilt, Tobacco Mosaic Virus, Cucumber Mosaic Virus, Bacterial leaf spot and Bacterial Wilt (*Ralstonia solanacearum*). In addition, harpin has also produced lower infestation rates for several pests such as armyworms, aphids and thrips.

New types and new applications of harpin protein are currently being tested. Despite the beneficial effect of harpin reducing plant diseases originated by bacteria, very little has been done to evaluate harpin as a food safety tool. With this idea in mind, a group of researchers from the University of California Davis, Rutgers University and the University of Arizona are initiating studies to determine whether pre-harvest application of harpin can reduce microbial growth in vegetables during postharvest storage.

5. Ask the specialist:

- What techniques can be used for preventing water loss of organic vegetables during postharvest handling?

The single most important technique to prevent water loss of organic vegetables – and conventional vegetables – is to install efficient humidifiers in the storage rooms, capable of maintaining relative humidity as high as 95% and no lower than 85%.

Another alternative is to wax the product. The waxes for organic vegetables must not contain any prohibited synthetic chemical. Acceptable sources include carnauba and wax derived from wood. Plastic bags and films are another way to reduce water loss from produce. Plastics that are accepted in the organic vegetable industry are cellophane and polyolefine materials, among others.

There is an important point that needs to be taken into consideration when using waxes or plastic bags. Not all waxes and plastics will produce ideal results. Waxes that produce a very impermeable layer and plastics of low permeability to gases may yield undesirable results due to anaerobic respiration and accumulation of ethylene.

Trevor Suslow, from the University of California Davis, has compiled information on postharvest handling for organic crops in an extension publication. You can download that publication for free at: <http://www.anrcatalog.ucdavis.edu/pdf/7254.pdf>

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