Suggested Test Protocol for the *E.G.G.*

The produce industry has known for years that ethylene is a significant factor in efforts to extend the post harvest life of their product. Ethylene, as a ripening hormone, is effective down to levels of less than 1 part per million. Produce storage warehouses go to great expense to keep ethylene levels below that amount. In the home refrigerator, since the ethylene producing varieties are enclosed in a small area – rather than an orchard, it is not uncommon to find ethylene levels of 20 parts per million. It is no wonder that the removal of ethylene from the refrigerator is so effective in extending the storage life of produce in them.

Of course, there are relatively easy ways (e.g. GC) to test for ethylene to show the effectiveness of the *E.G.G.* in removing ethylene. But since the point of removing the ethylene is to extend the life of produce, it makes more sense to empirically observe the storage life of produce with and without the *E.G.G.*. In confirming the effectiveness of the *E.G.G.* on storage life there are three critical factors to consider: storage temperature, storage humidity, and presence of ethylene.

In order to produce valid aging comparison test results:

- the temperature history of the two samples must be the same
- the humidity of the two samples must be maintained the same
- there must be a source of ethylene - i.e. a produce variety that gives off ethylene as it ripens
- there must be an ethylene sensitive variety in the test container

We use a very simple approach to making the comparisons, based on the above observations. We have a series of polycarbonate 2 liter canisters with tight fitting lids. We place a damp sponge on the bottom of each of the canisters, for humidity control. We then put one egg (from the *E.G.G.*) into every other canister. We place 1/2 apple into each canister as the ethylene source. We then cut the produce to be compared in half, putting half of each into the first two containers; then cut the next specimen in half, putting half of each into the next two containers, etc. The canisters are stored together throughout the test period insuring the same temperature, humidity, and lighting conditions for all of the test containers. Since produce is alive and is consuming oxygen, we open the containers for a few minutes every day to assure the samples do not suffocate. Photos are taken every 24 hours. We stop the test when the first piece of produce in a comparison becomes "inedible".

We have varied the ethylene source varieties including apples, avocados, bananas, pears, tomatoes and a variety of other fruits with no change of outcome. For consistency, we have standardized on split apples as the ethylene source.

Since the ethylene effect is cumulative, and since it is impossible to tell the exposure history of an individual piece of produce in the store, we split the sensitive produce samples in two. i.e. If the subject produce is lettuce or broccoli, etc., we cut one head in half; if it is a banana, we use two samples from the same bunch, etc. Each piece is placed in one of the two comparison containers. Before we began splitting the produce - thus controlling for the cumulative exposure problem, we often obtained widely different results in the same tests. Of course, the post harvest laboratories discuss this effect, but having seen how dramatic it can be, we acknowledge that this is not mere academic theory.

The easiest and most dramatic comparisons are the ethylene producing, ethylene sensitive (auto ripening) varieties like apples, avocados, bananas, pears, etc. In those comparisons, the fruits were put in the test containers without any other variety present, since the ethylene source is the test sample. An "egg" was present in one container and not the other.

In the non-ethylene producing, ethylene sensitive varieties, like lettuces, cabbages, cauliflower, carrots, etc. the result is always consistent with the results reported by the post harvest laboratories. However, there is a great deal of variability in times to the "end point". We have concluded that this is apparently the cumulative exposure affect.

The procedure outlined above is very simple, quite inexpensive, can be done anywhere and will reliably reproduce the results reported by the academic and industry post harvest laboratories. The resulting comparisons are very graphic and are fun. But, the real fun is in seeing the result in your own refrigerator.

**There are several websites that provide links to the academic and industry research papers that explore the ethylene phenomenon. I would recommend the University of California at Davis and the Sydney Post Harvest Laboratories as the richest resources.*
Http://postharvest.ucdavis.edu/Produce/Storage/index.shtml or
http://www.postharvest.com.au/Produce_information.htm

***Attached please find a summery table of ethylene producing/ethylene sensitive varieties. More complete tables are available on the above web sites.*

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The E.G.G. (Ethylene Gas Guardian)
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