The ripening strawberry

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The role of ethylene

Ethylene (C2H4, a planar hydrocarbon) is a gaseous phyto-hormone produced by plant tissues and detected by a membrane-bound receptor.

Solution?
- Studies are often performed upon detached tissues that are enclosed in gas-tight containers for prolonged periods
- Alternatively, some researchers use extracted tissue: extrapolating enzyme activity data.

However, numerous problems are associated with either of these approaches.

CO2-photoacoustic (PA)-LASER spectroscopy has allowed the accurate and continuous determination of low ethylene concentrations from a range of whole attached ripening stages.

Ethylene is evolved throughout ripening in a predictable manner
- With the exception of ripe fruit, ethylene evolution during ripening exhibits a diurnal cycle.
- Ethylene is evolved as:
  - Flowers senesce or ovules are fertilised.
  - Fruit expand from small dark-green fruits to pale-green fruits.
  - As diurnal night-time peak, coinciding with fruit reddening.

Why the confusion?

Strawberries evolve low levels of ethylene that are difficult to detect with accuracy.

Confusion

The peer-reviewed literature conflicts regarding the role of ethylene during ripening.

Ongoing Research.

These results are correlative and warrant testing a causal role for ethylene has still to be done.

To identify ethylene responsive genes in harvested fruit.

Fruit metabolism

Molecular versus proteomic analysis?
- Many different strawberry cDNAs have been cloned.
- Many of these are differentially expressed during ripening.
- Few cloned cDNAs encode proteins involved in fruit flavour.
- A non-molecular strategy was therefore adopted to identify differentially expressed proteins.

The enzymes mCS and mMDH were the focus of further analysis.
- The major strawberry organic acids are citrate (ca. 80 %) and malate (ca. 20 %).
- mCS and mMDH play important roles in energy production via the TCA-cycle.

The TCA cycle is also involved in the production of secondary metabolites.

The secondary metabolites include flavour components such as volatiles and amino acids.

The effectiveness of complementary (proteomic plus molecular) approaches is demonstrated.

The findings by Northern analysis are contrary to the other measurements made: is the translation of mCS and mMDH transcripts blocked during the early ripening stages?

Effective packaging strategies

Modified atmosphere packaging techniques frequently use supra-ambient levels of O2 and/or CO2 to increase the shelf life of fresh produce.

Current research….

…is aimed to identify novel genes whose expression is regulated by O2 and CO2.

RNA from control and 2-24 hours (high O2/CO2) treated fruit is being used in a subtractive (SSH) molecular analysis.