AgroFresh and 1-MCP Overview

- AgroFresh is one of the leading experts in ethylene management because of its proprietary 1-MCP (1-Methylcyclopropene) technology
- 1-MCP technology was initially developed from North Carolina State University
- 1-MCP is structurally similar to ethylene and binds at the ethylene receptor thereby preventing ethylene perception and protecting fruits, vegetables and ornamentals as well as growing plants from the effects of ethylene

AgroFresh Brands

- SmartFresh Quality System
  - Quality management tool that maintains and extends the freshness, flavor and appearance of fresh fruits and vegetables

- EthylBloc/Ethylene Buster Technology
  - Quality management tool that keeps flowers, potted and bedding plants fresh throughout shipping and distribution

- Harvista Real-Time Management
  - A preharvest technology that brings ethylene management to the orchard

- Invinsa Crop Stress Protection
  - Invinsa technology protects crop yields during periods of heat and drought stress

The SmartFresh℠ Success Story on Apples:

- Crunchier apples
- Results of tests on 25,000 samples of SmartFresh℠ serviced apples compared to the controls. Apples were kept at room temperature for 14 days.

SmartFresh Apples are 2-4 lbs firmer than untreated control

SmartFresh also prevents storage disorders
Bartlett Pears:
Stored for 7 wks @32F; 0, 7 or 14 d at 68F

Use of SmartFresh™: Storage Temperature
1-MCP protects against temperature abuse during transport

After 1.5m @ 0, 5 or 10C Control fruit at 10C was ripe after 2 weeks

Plum
- Maintain fruit firmness
- Allow long term storage (90 days) e.g. Angeleno
- Reduce chilling injury (internal browning) in plums after long term storage e.g. Black Amber, Larry Ann

Results are predominantly from screening tests conducted in Calif in 2009 by Crisosto & Canton but also some plum research from earlier work.
* In some cases failure of SmartFresh can be attributed to fruit being too ripe at the start of the experiment. This will be tested in more detail this year.
Nectarine ‘Grand Sweet’

Tomato maturity and color

<table>
<thead>
<tr>
<th>Maturity Stage</th>
<th>Mature</th>
<th>Green</th>
<th>Breaker</th>
<th>Turning</th>
<th>Pink</th>
<th>Light Red</th>
<th>Red</th>
</tr>
</thead>
<tbody>
<tr>
<td>USDA Stage</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<td>74</td>
<td>65</td>
<td>48</td>
<td></td>
</tr>
</tbody>
</table>

Ideal Stage for SmartFresh™ Quality System: USDA Stage 4

Color – USDA color chart

Firmness by non-destructive methods

Tomatoes on the vine

Advantages:
- Better vine appearance
- Greener
- 5-10% less water loss from stems
- Less Botrytis on the stem
- Reduced shatter, e.g. on bunched cherry tomatoes abscission was 58% in control fruit vs 14% in SmartFresh fruit (Lichter et al., 2006)

Note: Should be treated when least mature fruit is pink or light red (stage 4 or 5) to reduce variation within a bunch
• SmartFresh® technology is used after ripening fruit with ethylene
• Applied at color stages 2.5 to 3.5

Banana maturity

General appearance and sugar spotting

SmartFresh® technology was evaluated under commercial conditions at a major retailer. 12 SmartFresh® applications were made and quality was tracked over 7 days.

Statistical analyses indicate that SmartFresh® technology significantly maintained overall appearance and reduced severity of sugar spotting compared to untreated control fruit.

Peel color

Statistical analyses indicate that SmartFresh® technology significantly delayed color development compared to untreated control fruit.

Kiwifruit

Extend shelf life and marketable life by reducing:
• rate of fruit softening
• Protect from ethylene
• Reduce shrink in the handling chain

Persimmon quality after 8 days of shelf-life @15°C (storage: 4 weeks @ -0.5°C)

Registration for postharvest products

Registration in California
Registered in at least 1 other country

Apple Cabbage
Apricot Carrot
Asian pear Charimoya
Avocado Cucumber
Banana Date
Broccoli Guava
Kiwifruit Lemon, Lime
Melon Lettuce
Nectarine, Peach Mango
Pear Papaya
Persimmon Paprika
Plum, Plumcot/Pluot Pepper
Pear Tomato Pineapple
Registration in California
Flowers & other ornamentals Squash
Benefits seen on vegetables include:

- Reduced yellowing of leafy vegetables, herbs, beans and broccoli
- Reduced disorders e.g. browning and necrotic spotting of lettuce and spotting of beans
- Better flavor e.g. reduced bitterness in carrots
- Increased shelf life of cucumber
- And probably many more undiscovered benefits...

Flowers were stored for 7 days at 36°F + 6 days at 70°F after exposure to ethylene.