

Innovations in F & V on a global market



Ernst Woltering



Fresh Produce Innovations
ernst.woltering@wur.nl



"Aangespoelde bananen naar Dierenpark Emmen"



Global sourcing to please the consumer

Some reasons for Global Sourcing

- More species, varieties
 - Year round availability
 - More favorite growth conditions
 - Cheap labor
 - Available space
- Consequence: Extensive long-distance transport
- **Necessity of Quality management**



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Innovations on a global market

- F&V consumption/need for innovations
- Ethylene and ripening
- Ripening in-transit
- Conclusions



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F&V consumption

- It is generally agreed that a diet with sufficient amounts of F&V promotes health
- G&F contain among others:
 - Antioxidants
 - Vitamins
 - Other bioactive components
 - Fiber
 - Low calories (lots of water)
- Protect against:
 - Cancer (lung, ...)
 - Coronary heart diseases
 - Diabetes type 2
 - Obesitas (and related health problems)
 - High blood pressure



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F&V consumption is low

G&F consumptie:

- Decrease since 1988 by approximately **1% per year!!**
- Current Intake:
 - Vegetables 120 g/day
 - (recommended 200)
 - Fruit 102 g/day
 - (recommended 200)
- Huge potential market !



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F&V consumption

- It has been calculated that an increase in F&V consumption up to the recommended amount will significantly improve health and expected life
- There is huge interest by the government to stimulate the use of more F&V in food products and to stimulate F&V consumption

Ons eten gemeten, RIVM 2004



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How to increase consumption?

Campaigns "Eat more F&V" have not been very successful



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To increase consumption ...

Make the Healthy choice the easy choice

Better Quality (taste, looks, health, freshness)
More choices (varieties ,different colors, shapes, taste, .)
Convenience (fresh-cut, lightly processed, ready to eat, ready to cook, snacks)



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Does it taste as good as it looks?

For many globally sourced F&V
this is not the case !!

Does it taste as good as it looks?

Ripening not complete?
Ripening processes not synchronized?

Quality globally sourced produce

Delicate balance between

- Features of specific species/varieties
- Ripening stage at harvest in relation to growing conditions
- Transport time and conditions
- Shelf life conditions
- Needs better collaboration through the chain
- Innovations in ripening control and quality management



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Transportation energy costs

Product km per energy quotum

• Car	1
• Air	43
• Truck	740
• Railroad	2400
• Container Ship	3800



- Half the value of a perishable product may be transportation costs

Attractiveness of container transport

Pro's

- Relatively cheap
- Lots of capacity
- Excellent climate control (T, RH, atmosphere)
 - also in the case of delays
- Transport mode of choice for e.g. Melon, Avocado, Mango, Pineapple, Banana, some vegetables



Con's

- Takes long time
- Quality of end product often disappointing!



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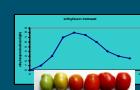


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Ethylene

Green >>> Yellow
 Starch >>> Sugar
 Cell wall loosening
 Flavor Production

Cell death
 Off-flavors
 Pectin degradation

Banana ripening in practice

Immature

0% acceptable

Ripe

100% acceptable

Suggested Guide for Banana Ripening

SMART RIPE®

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WAGENINGEN UR
 For quality of life

Rijk Zwaan

the Greenery

Ripening behaviour of fruit

- Unripe bananas have the capacity to ripen fully when exposed to ethylene and elevated temperatures
- How about other fruits??

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Rijk Zwaan

the Greenery

Ripening behaviour of fruit

- If harvested too immature these fruit will never ripen completely
- If stored too long at low temperature fruit will lose the capacity to ripen properly

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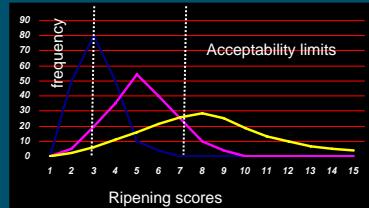
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Rijk Zwaan

the Greenery

Consequences

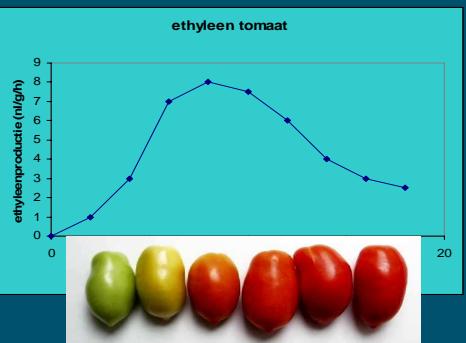
- Fruit cannot be harvested very immature as in banana
- Fruit in variety of maturity stages is shipped
- Transport under very strict ripening-inhibiting conditions
- Slow ripening during transport
- Great variability end product
- Needs additional sorting or “after ripening”



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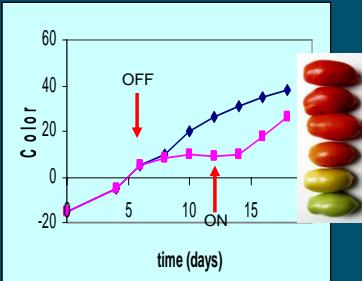
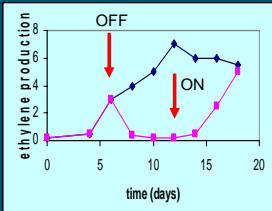
Ethylene production during ripening



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Manipulation of ripening



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Manipulation of ripening

- Ethylene is required throughout the ripening process to drive and synchronize biochemical and biophysical processes
- Can we manipulate ethylene production during transport to control ripening?

– Quest Pro project run by Janneke de Kramer (WUR A&F)



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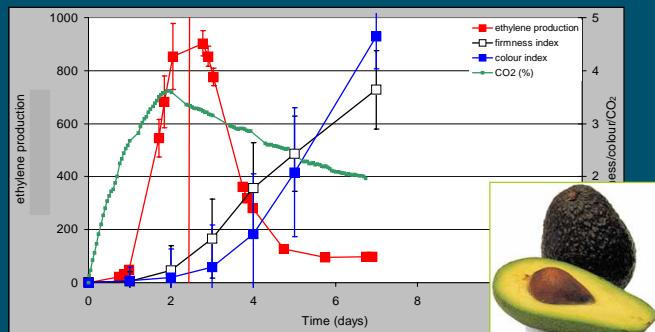
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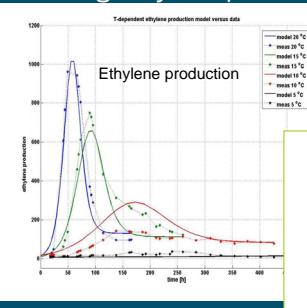
Avocado ripening



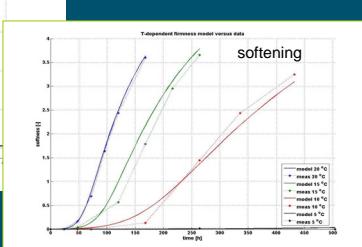
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Modelling ethylene production and softening



Prediction of softening through measurement of ethylene



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Experimental setup to control ripening

A computer controlled product research barrel (simulation of container transport):

- Temperature, CO₂ and O₂ control
- Ventilation and circulation
- On-line measurement of:

Temperature, RH, O₂, CO₂, Ethylene



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Quest Pro controller

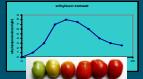
- By using the known relations between temperature, ethylene production and firmness a software tool was developed
 - Calculates temperature setting each 2 h based on predicted actual firmness (through ethylene) to reach a desired firmness of end product
- Proof of Principle
 - In a lab scale experiment desired firmness of end product was achieved using the Quest Pro controller
- Outlook
 - Incorporate ethylene and anti ethylene treatments (CO₂, O₂, MCP)



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Conclusions (1)

- Quality of globally sourced produce is often disappointing
- Innovations in maturity determination and in-transit ripening control may facilitate
 - Delivering "on demand"
 - More uniform product
 - More flexibility
 - Making profit out of transportation by adding value
 - Better quality to consumers
 - Reduce needed distribution center capacity
 - ...



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Conclusions (2)

- Quality of globally sourced produce is often disappointing
- Innovations in maturity determination and in-transit ripening control may facilitate
 - Delivering "on demand"
 - More uniform product
 - More flexibility
 - Making profit out of transportation by adding value
 - Better quality to consumers
 - Reduce needed distribution center capacity
- We need:
 - Better insight in ripening behavior of fruit and reliable ripening markers (TRS, NIR, volatiles)
 - Improved sensor technology (ethylene, ethanol, specific ripening volatiles,...)
 - Improved models and software tools



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**The future is here:
Banana ripening in-transit with
Carrier SmartAir system**

