Influence of storage conditions and bunch position on green-life period of bananas

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Research project ‚The intelligent container: Linked intelligent objects in logistics'

🔵 Consortium of 6 research institutes and 15 industrial partners

🔵 supported by the Federal Ministry of Education and Research, Germany

🔵 Project objectives

🔵 Development of new technologies for innovative logistic processes

🔵 Reduction of losses during container transport of perishable food

🔵 Application of dynamic FEFO (First Expires First Out) in real world logistic processes

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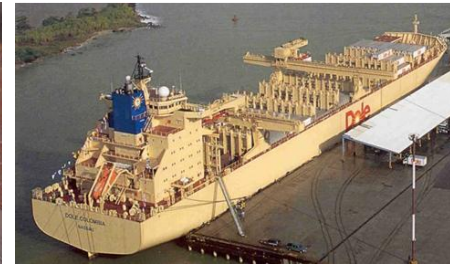
Postharvest chain of bananas

Harvest **Packaging** **Transport** **Ripening**

In cooling chamber or container
(14°C, high rH, CA / MAP)

Costa Rica **Europe**

2-3 weeks 5 days

Problems during banana shipment

● Early ripening or fruit infestation

Objectives of the studies at ATB Potsdam

- Determination of the remaining storage life after harvest

- Development of a green-life prediction model

  - Influences on green-life period during transport

    - maturity stage at harvest (bunch position and harvest time)

    - storage conditions (temperature, humidity, atmosphere)

Influence of temperature and humidity on green-life period

● **Material and methods**

● 'Cavendish' bananas (bunch age 14 weeks) from Costa Rica (Dole Company), container transport to Germany,
not treated with ethylene)

● Bunch position of fruits: top   (hand 2+3)

bottom (hand 6+7)
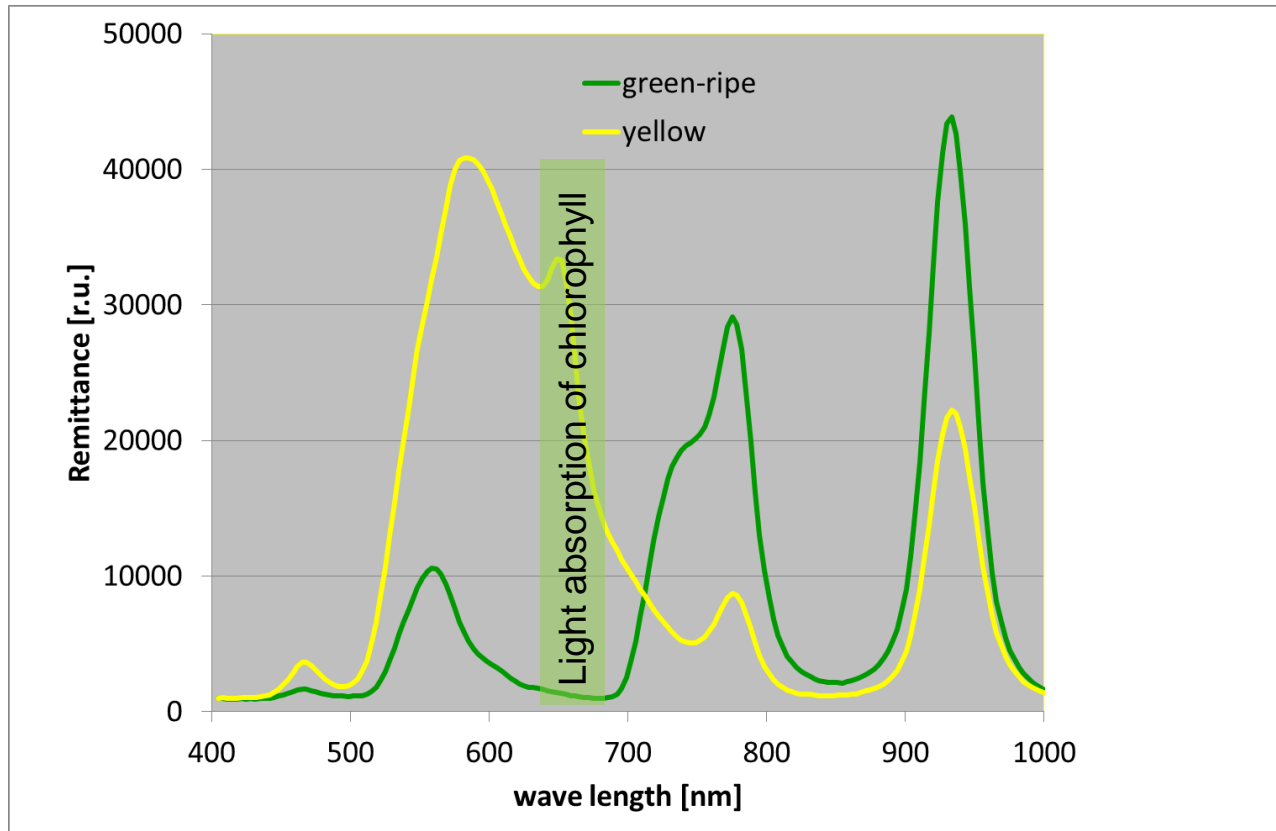

● Storage conditions
- ● Effect of temperature: 12°C / 15°C / 18°C /20°C rH>98%
- ● Effect of humidity: 50-60% rH / 88-90% rH at 18°C

● Measurement parameters: NDVI, CO_2-production

Bananas from Costa Rica after arrival in Germany

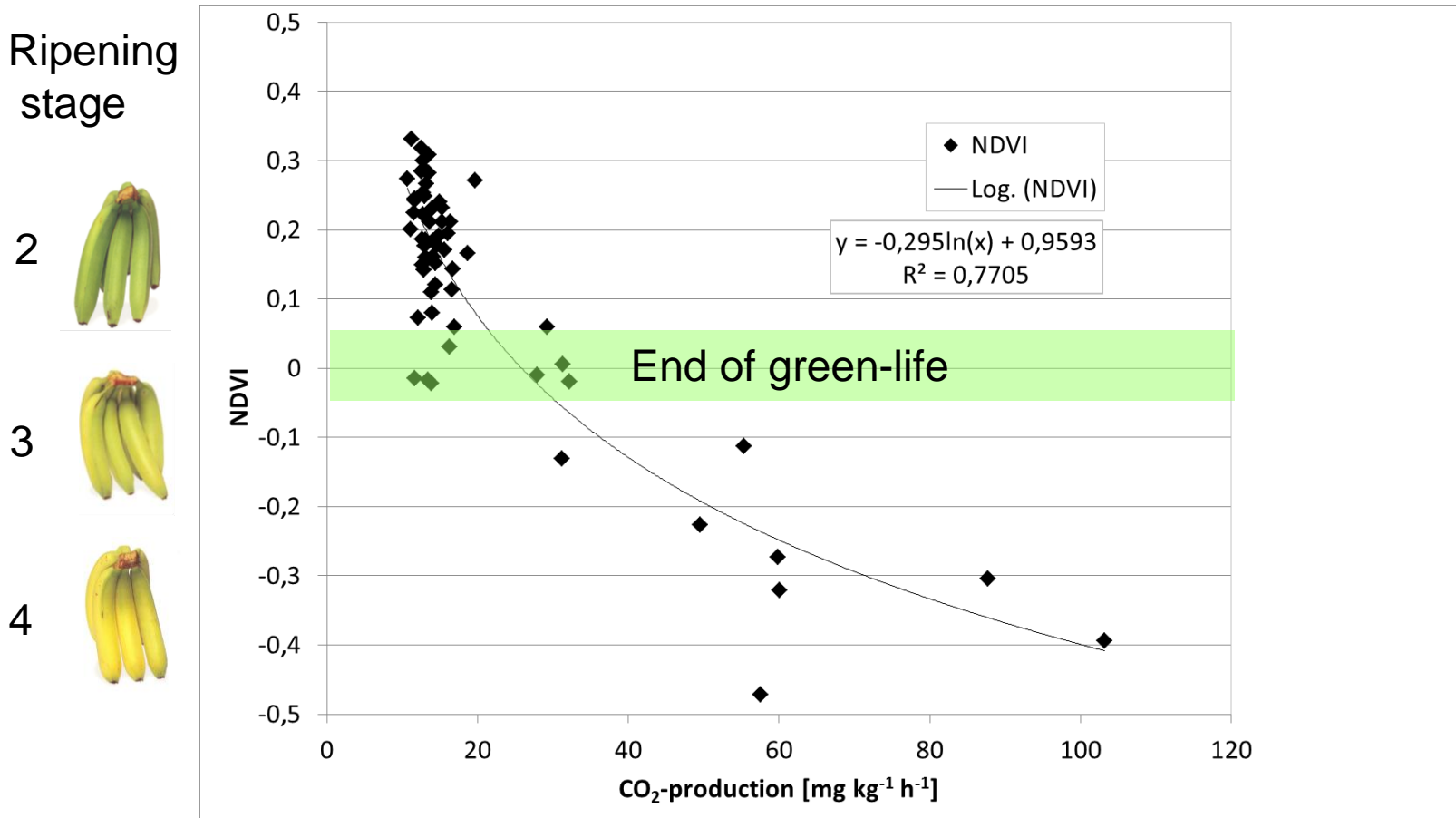# Spectral analysis for determination of fruit ripening

Pigment Analyser
(CP Falkensee)

NDVI =
Normalized Difference
Vegetation Index

$$= \frac{R780 - R680}{R780 + R680}$$
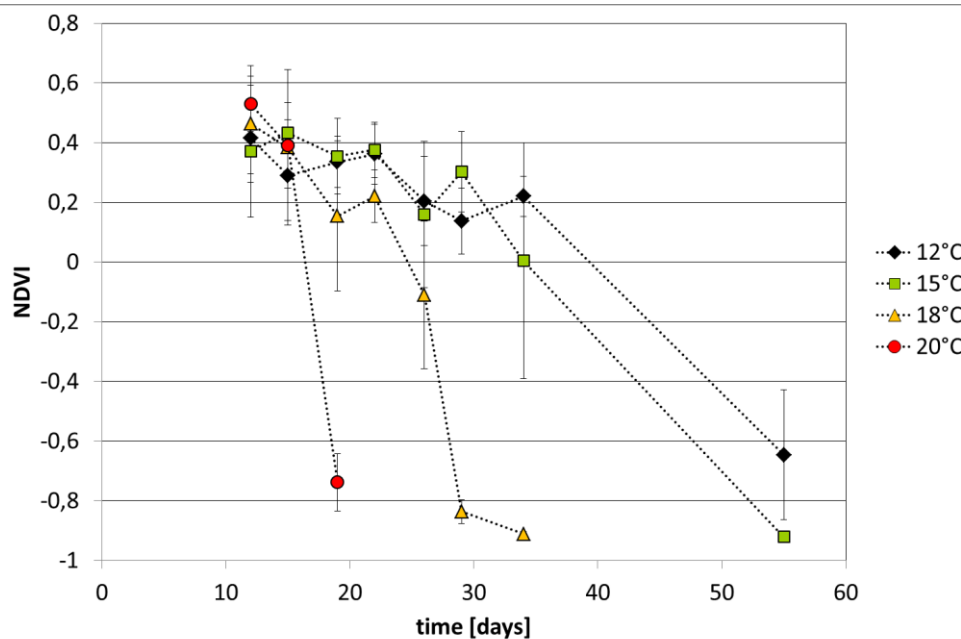
NDVI and respiration of ripening bananas

🔵 Banana fruits without ethylene treatment stored at 18°C

Ripening stage

2

3

4

$y = -0,295\ln(x) + 0,9593$
$R^2 = 0,7705$

End of green-life

- ◆ NDVI
- — Log. (NDVI)

NDVI

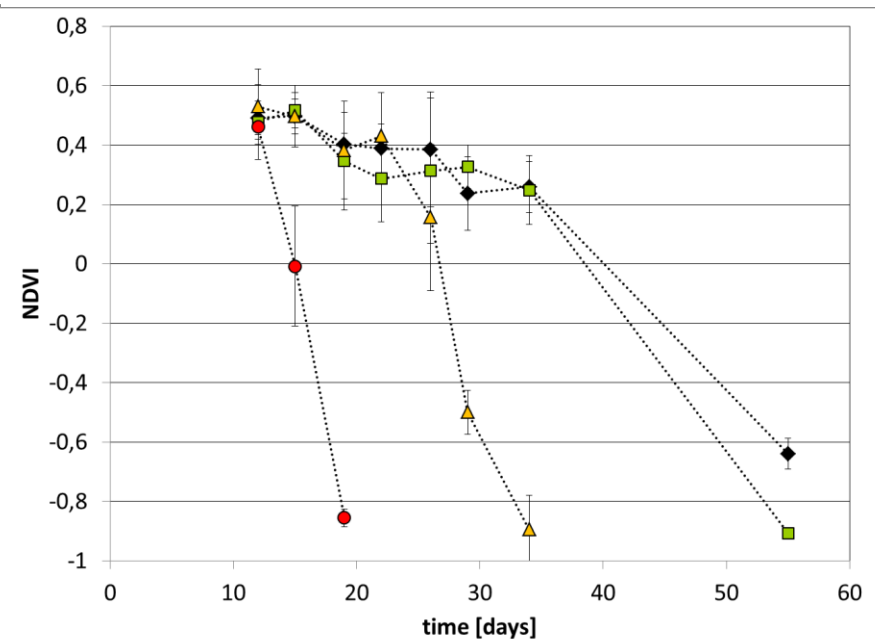CO_2-production [mg kg^{-1} h^{-1}]

Ripening of bananas stored in different temperature

🔵 Green-ripe fruits without ethylene treatment

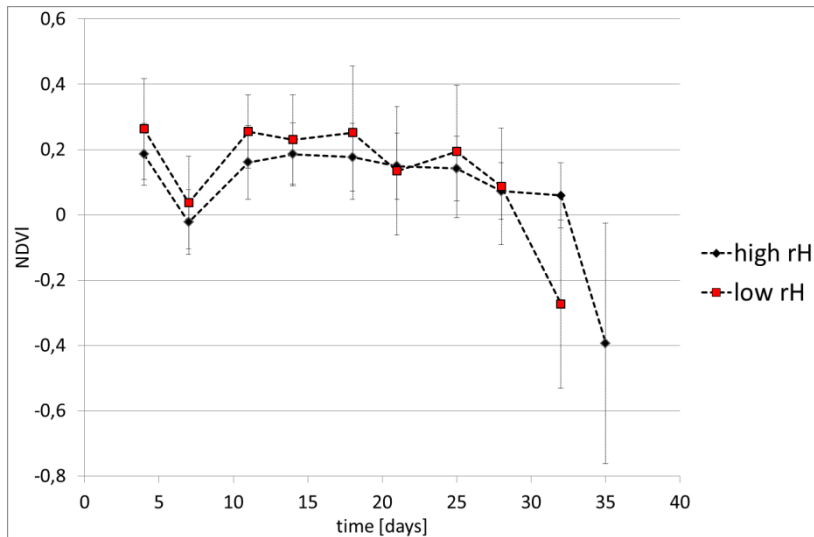Fruits from the top of the bunches

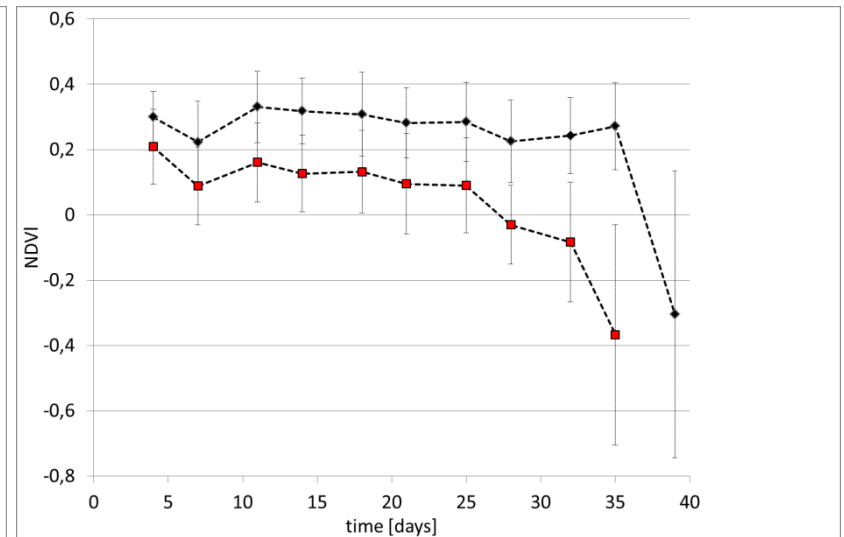Fruits from the bottom of the bunches

Ripening of bananas stored in different humidity

🔵 Green-ripe fruits without ethylene treatment
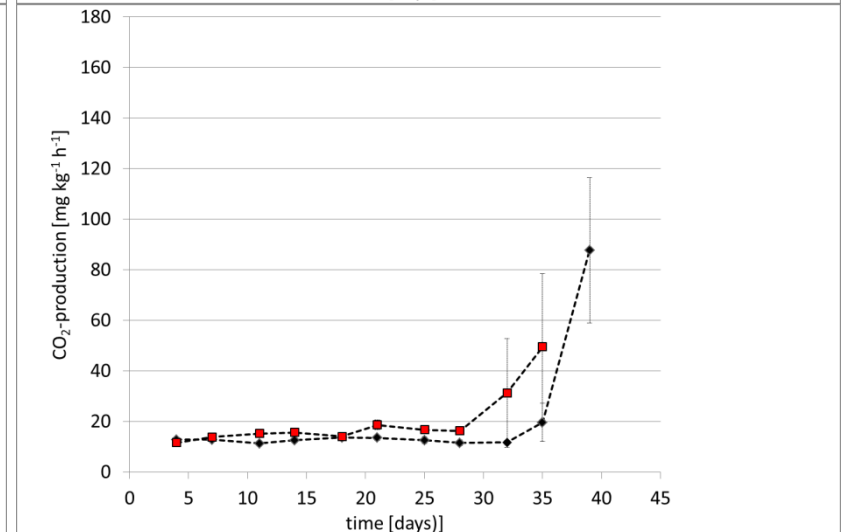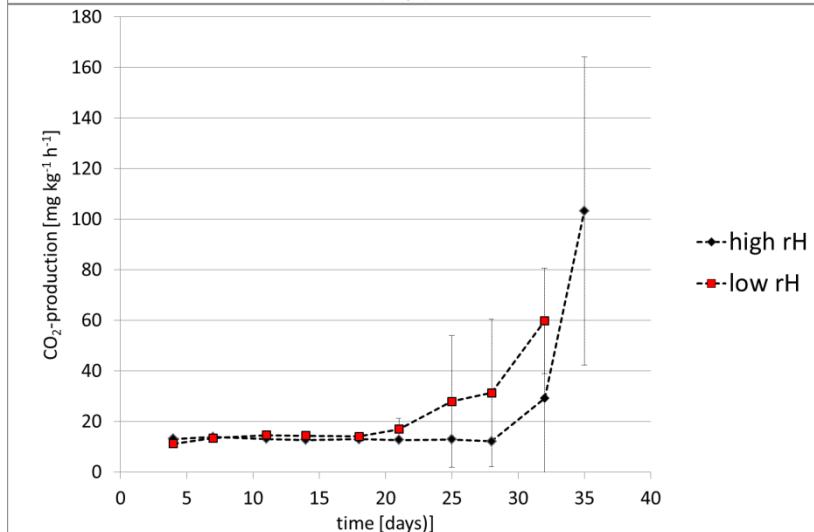

top of the bunches

bottom of the bunches

NDVI

CO_2-prod.

Influence of transport temperature on ripening behaviour of bananas

- **Material and methods**

- Cavendish' bananas from Costa Rica (Dole Company), container transport to Germany in march 2011, 2 weeks
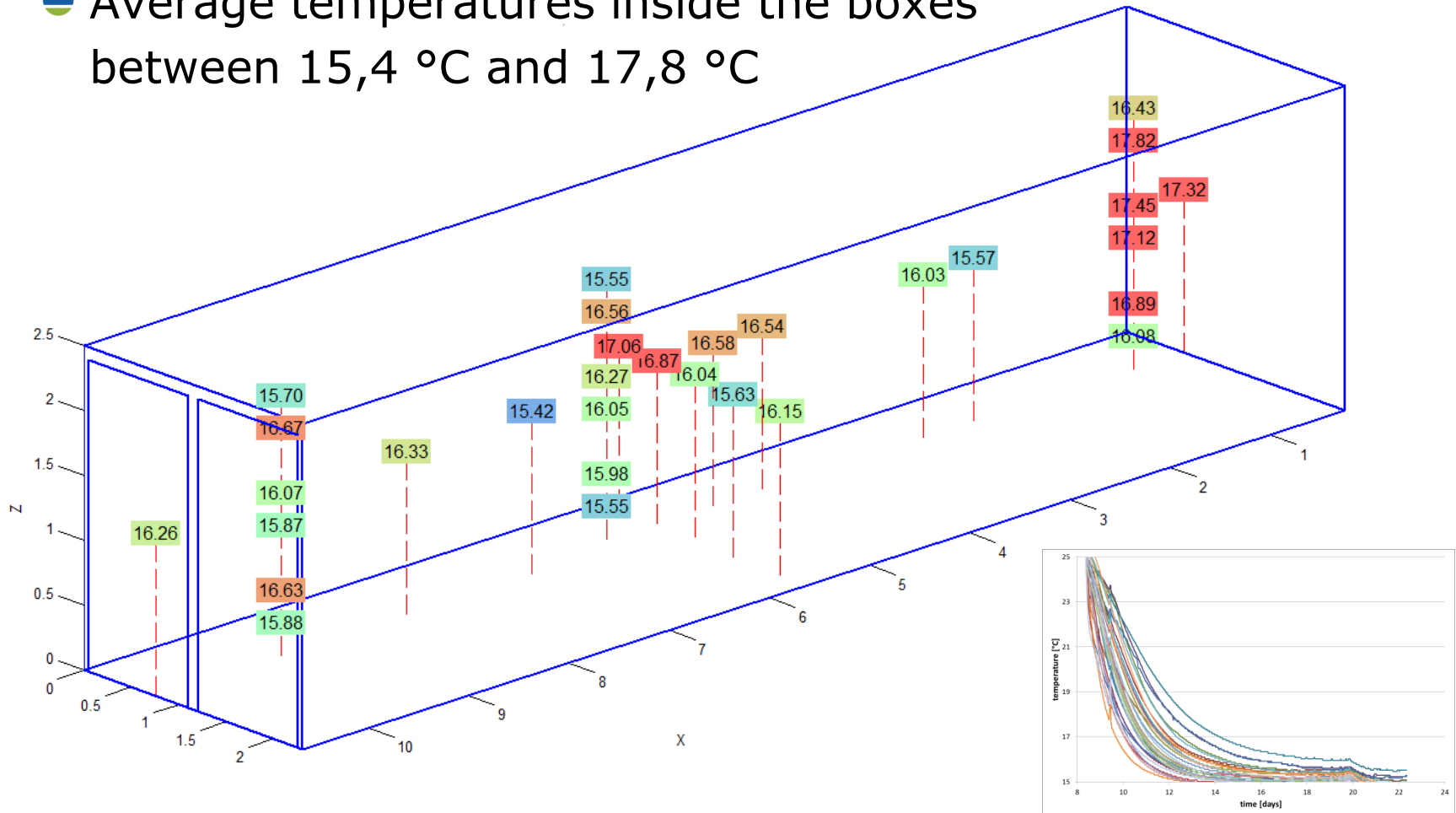
- Temperature recording in 31 banana boxes

- Ethylene treatment of bananas in ripening rooms

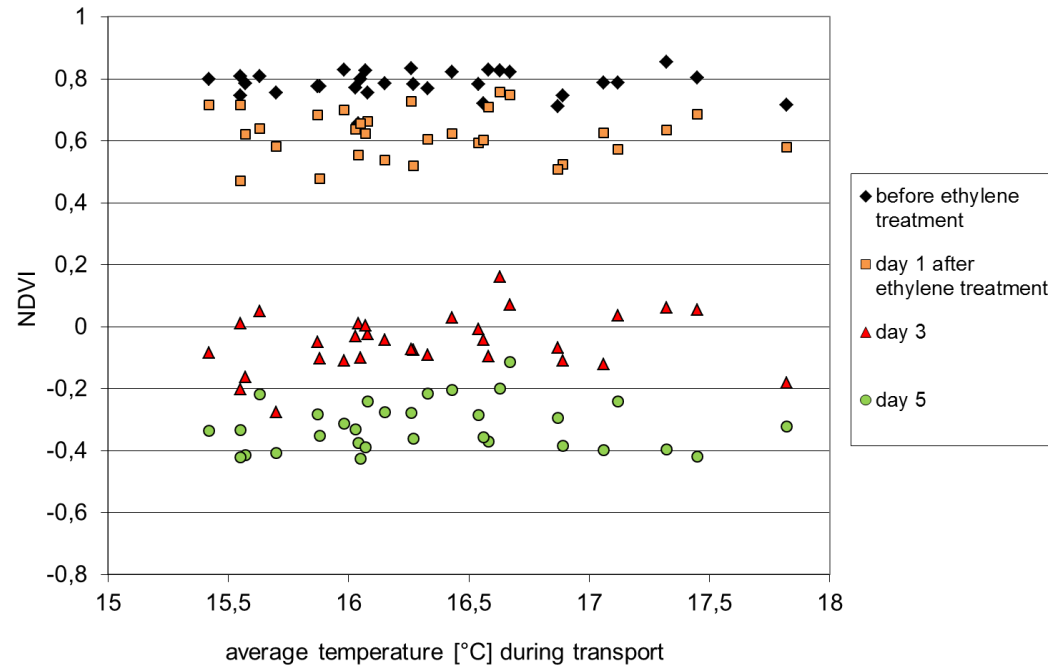- Measurement parameters for ripening assessment: NDVI, TSS, elasticity

Temperature at different positions during a container shipment

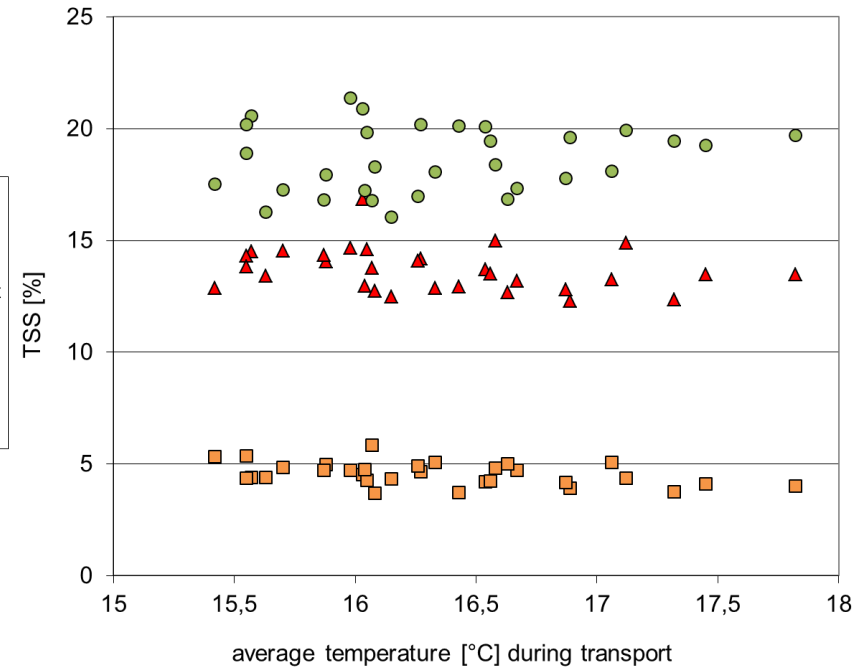- Average temperatures inside the boxes between 15,4 °C and 17,8 °C

Relation between average transport temperature and ripening behavior of banana fruits

NDVI before and after ethylene treatment

TSS after ethylene treatment

Summary

- At optimal temperature of about 14°C and high humidity green-life period of banana fruit takes up to several weeks.

- Increasing temperatures to 20°C shorten green-life period to 13 days.

- Low relative humidity of 50 to 60 % reduces green-life period about one week compared to 90 %. In this test the bananas grown at the top of the bunches showed accelerated ripening compared to the bottom.

- Differing average transport temperatures of 2.5 K in the boxes during a container shipment from Costa Rica to Europe did not influence the ripening process after the ethylene treatment.

Thank you for your attention !
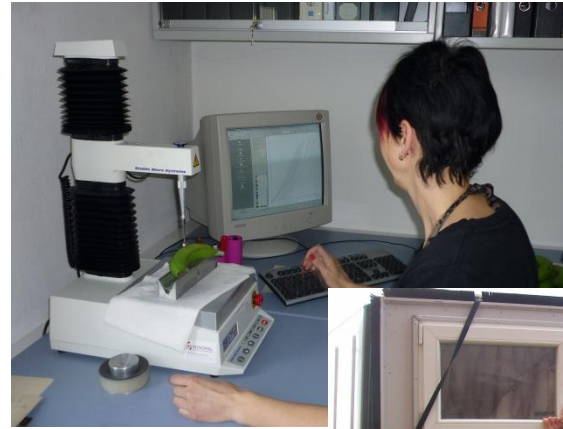
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