Postharvest technologies and non-destructive measurement to control and monitor blueberry quality

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1

Content

- Wageningen University and Research
- Blueberry: production and distribution chain
- Challenges
- Postharvest Technologies
- Non-destructive quality assessment

2

Wageningen University & Research

University + Research

#1 in Agriculture & Forestry
QS World University Rankings 2019

Food Safety | Environment | Livestock, Marine | Food and Biobased | Plants | Economics

Post-harvest technology

3

Post-harvest research facility

4

Blueberry

5

Production and supply chain

- Multi-cultivar production and global distribution
- Long distribution duration including 1,5 to 6 weeks
- Wide range of packaging options




Production | Sorting/ Packaging | Storage/ Transport | Supermarket

6

Challenges in the chain

- Meet consumer expectations and constant quality
- Product differentiation and relevant market segments
- Buffer/storage options after harvest?
- What is optimal condition: CA/MAP/AIR?
- Maturity and large batch heterogeneity
  - Measure quality along chain
  - Specific quality parameters: Texture
  - Product damage due to sorting systems

Production | Sorting/Package | Storage/Transport | Supermarket

7

What is a high Quality Blueberry?

- Deep purple-blue
- Uniform appearance such as size
- Crisp texture & good crunch
- Consistent flavour (aroma and sweetness)
- Good shelf-life

What has highest priority??

How to get grip?

8

Non-destructive sensing of fruit quality

9

Example non-destructive measurements

- Evaluate properties of a material or system **without causing damage**
- Synergy of **sensors** and **data analysis**

Destructive

Non-destructive (selectech.co.za)

10

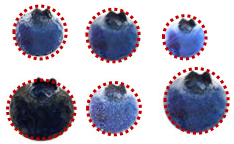
Non-destructive measurements for Blueberry

Physical Measurements
- Size
- Weight
- Color
- Firmness
- Texture

Chemical Measurements
- Brix
- Dry Matter
- Acidity
- Pectin
- Phenolics
- Pigments

11

Color cabinet for product quality

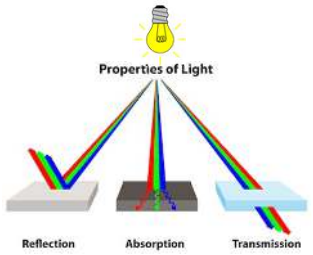


- Primary quality analysis such as **shape** and **size**
- Color analysis can be performed for quality control

12

Near-infrared for post-harvest quality

- Interaction of light with matter
- Can capture physical and chemical properties in fruits
- Light intact as reflection, absorption and transmission



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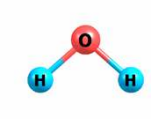
13

How near-infrared works?

- Water example



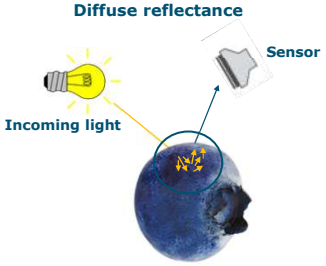
- **Absorption ∝ Concentration × Path length**

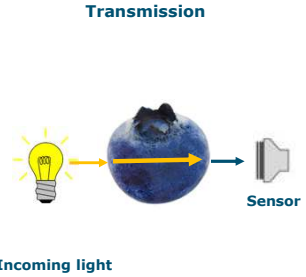
14

14

How it works on blueberry?

- **Visible and Near-Infrared Spectroscopy**
  - 400-2500 nm provides information about pigments and compounds with C-H, O-H and N-H bonds





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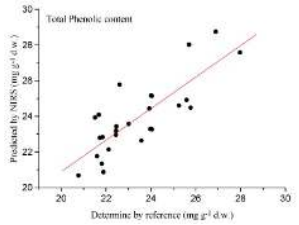
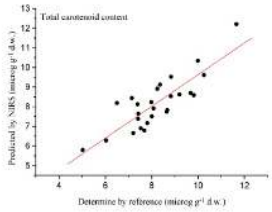
Total phenolic and carotenoid content

- Consumer awareness to phytochemicals and nutraceutical properties
- NIRS in 400-2500 nm





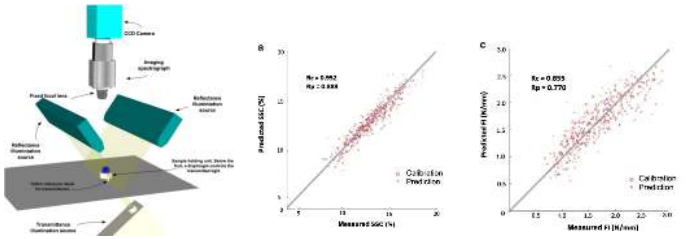
Toledo-Martín, Eva María, et al. "Quantification of total phenolic and carotenoid content in blackberries (Rubus fruticosus L.) using near infrared spectroscopy (NIRS) and multivariate analysis." Molecules 23.12 (2018): 3191.

16

16

Sugar and firmness with hyperspectral

- Sugar and firmness of blueberries is a major quality concern because it promotes mold development and enzymatic browning



Leiva-Valenzuela, Gabriel A., Renfu Lu, and José Miguel Aguilera. "Assessment of internal quality of blueberries using hyperspectral transmittance and reflectance images with whole spectra or selected wavelengths." *Innovative Food Science & Emerging Technologies* 24 (2014): 2-13.

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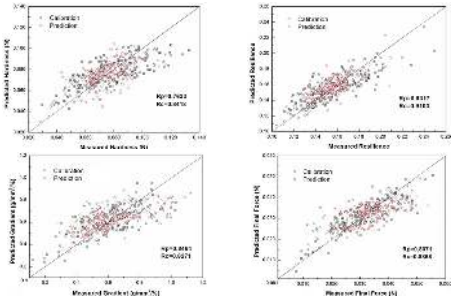
17

Mechanical properties with hyperspectral

- Mechanical properties affect the sensory quality, storability, transportability, resistance to mechanical damage, and susceptibility to spoilage



Hu, Meng-Han, et al. "Estimating blueberry mechanical properties based on random frog selected hyperspectral data." *Postharvest Biology and Technology* 106 (2015): 1-10.

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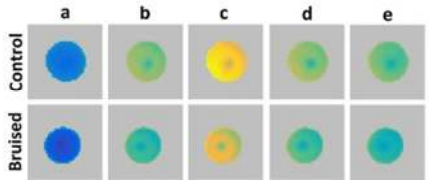
Bruise detection with Thermal imaging

- Blueberries are subjected to mechanical damage from a variety of sources: harvesting system actuators, drops into various containment bins, jolts during transit, the weight of other berries, and so on



Kuzy, Jesse, Yu Jiang, and Changying Li. "Blueberry bruise detection by pulsed thermographic imaging." *Postharvest Biology and Technology* 136 (2018): 166-177.

19

19

Benefits of non-destructive measurements

- Rapid assessment of fruit quality
- Zero food loss
- Chain integration possible
- Decision support on optimal maturity
- Information on batch homogeneity
- Decision support for optimal storage and transport
- Monitor and control performance and quality

20

20

Thank you!

Course

Postharvest Technology

- **6-9 October 2020**

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21

21