



LemnaTec High-Content Screening

LETTUCE NIR-PHENOTYPING

LemnaTec GmbH
Matthias Eberius
Schumanstr. 18
52146 Würselen, Germany
Tel. + 49 (0) 2405 / 4126-0
Fax + 49 (0) 2405 / 4126-26
matthias.eberius@lemnatec.com
www.lemnatec.de

Near Infrared Imaging

Near infrared (NIR) or short wave IR-imaging (SW-IR) can be used, for example, to get detailed information on the watering status of plant leaves and their reaction to limited water availability or external drought (e. g. during growth or storage periods). The following image shows how various lettuce cultivars dry down over time, changing the NIR-absorption of the leaves in the NIR-absorption band between 1,450 and 1,600 nm.

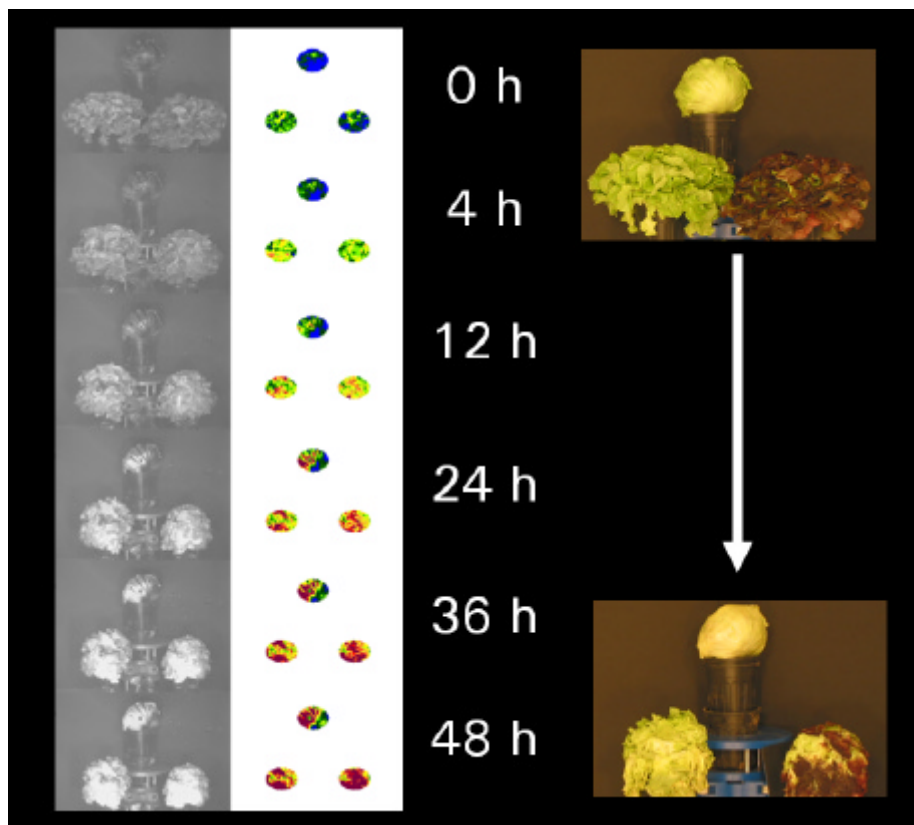


Figure 1: An iceberg lettuce (top row) and two oak leaf lettuces (green and red, bottom row) dry down in warm ambient conditions. NIR-imaging shows a strong increase in reflectance as the water in the leaves is extremely reduced. Blue false colours represent high water content, while red colours symbolise low water content (high reflectance).

This test of various lettuce reactions to the same environmental conditions is just one application example of NIR-imaging; in this case it is used to quantify the water dynamics in plants.

Similar tests can of course be carried out with various plants, even in pots, to assess their reaction to water stress under drought conditions.

The diagram below shows the quantitative data, expressed as false colour classes, of several absorption ranges.

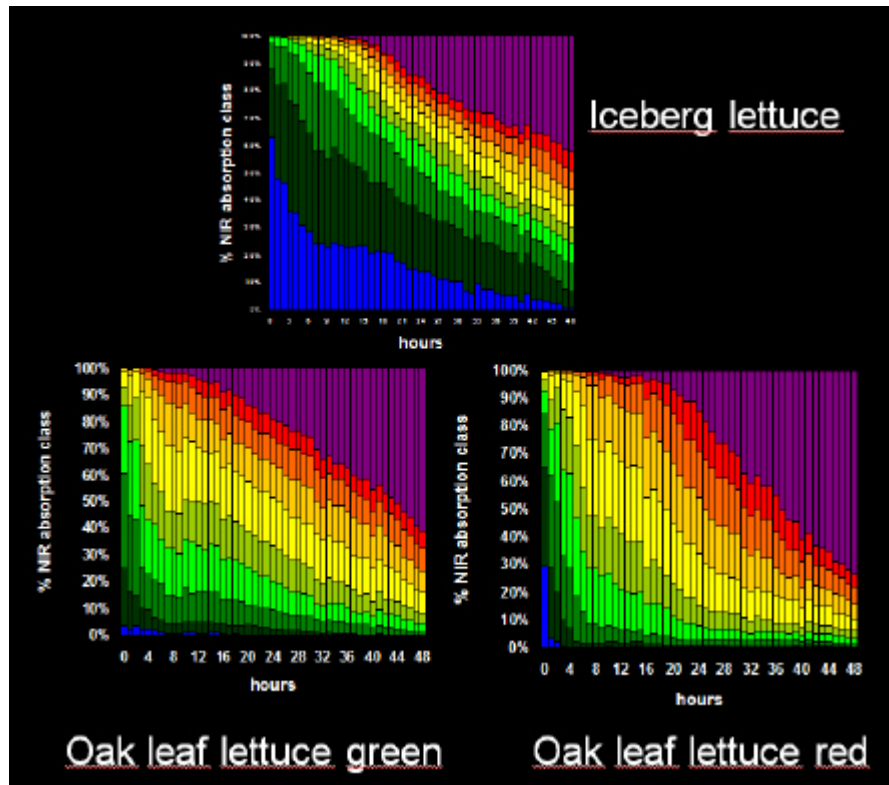


Fig. 2: The drying dynamics of the outer leaves of 3 lettuce cultivars. While keeping the whole head together, only the surface layer (which finally defines the purchase decision of the customer in the shop) is measured. The less blue and the more green/yellow/red/violet colour classes appear the dryer is the lettuce.

Figure 2 shows how non-destructive imaging generates high-content data on water loss dynamics. While the iceberg lettuce contains the highest amount of water (largely blue) and dries out most slowly, the red oak leaf lettuce dries down the most overall during the measurement period. Nevertheless the large number of intermediate values shows that this drought process proceeds more slowly in the first few hours, particularly in comparison with the green oak leaf lettuce. Such profiles emphasise the immense power of imaging to provide different phenotypic patterns.

The sensitivity of the technology is clearly revealed by the fact that within the first few hours significant changes towards drying down are already depicted as major shifts between the colour classes.

These values might be correlated to e. g. sensory data such as crunchiness and good mouth feel, or to agriculturally important traits such as efficient water usage or drought stress tolerance.

Conclusion

The LemnaTec Scanalyzer is a comprehensive phenotyping platform highly suitable to quantify morphological traits e. g. of lettuce – and in fact any other plant – over the whole length of an entire life cycle.

The example above provides only a first impression of the unlimited capabilities of the system concerning the quantitative characterisation of water dynamics in vegetables and other plants. All results based on biologically relevant parameters that are generated in this way will be reproducible.

Moreover, the LemnaTec systems can be customised for various applications, depending on individual research requirements.

For further information please contact

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