Indicators of water stress in grapevine: $^{13}$C/$^{12}$C of must sugars and composition of leaf lipids

**Motivation.** Vegetation undergoes strong environmental stress due to climate change. Grapevine (Vitis vinifera L.) is among the plant species which often suffer from water deficit due to low rainfall as well as high evapotranspiration in the cultivation area. The soil type plays a key role, but global warming in recent years accentuates the risk of abiotic stress in grapevines, seriously affecting the efficiency of photosynthetic CO$_2$ fixation.

The search for reliable indicators of the vine water status is a priority in the effort to optimize irrigation management in the vineyard for obtaining high-quality wine. Several projects were initiated by the IDYST in collaboration with Agroscope Changins-Wädenswil (ACW) to study the biogeochemical response of vine to water deficiency.

**Cultivars:** Chasselas and Pinot noir

**Irrigation treatments:**
- drip-irrigation from bloom to veraison (9 L/m²/week)
- drip-irrigation from veraison to harvest (9 L/m²/week)
- no irrigation
- no irrigation + plastic-covered soil

**Samples:** must sugars and leaves

**Carbon and nitrogen isotope composition of leaves**

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<th>Chasselas</th>
<th>Pinot noir</th>
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<td>$^{13}$C (% VPDB)</td>
<td>-29.0 – -25.6</td>
<td>-27.9 – -25.3</td>
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<td>$^{15}$N (% N$_2$-Air)</td>
<td>0.5 ± 2.8</td>
<td>-0.1 ± 2.8</td>
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**Physiological response of leaves**

- Stressed grapevine: Leaf blades orient away from the sun.
- Non-stressed grapevine: Leaf blades orient to the sun.

The physiological reaction in water-stressed plants to minimize the evapotranspiration may also be accompanied by changes in the amount and distribution of synthesized leaf lipids, which protect leaves from dessication.

**Leaf lipids (epicuticular waxes)**

Chasselas

Pinot noir

**Clear differences are observed in the distribution of lipids in Chasselas and Pinot noir leaves. Saturated fatty acids occur in the C$_{14}$ to C$_{30}$ range with even/odd carbon number predominance and maxima at C$_{24}$ (Chasselas) and C$_{16}$ (Pinot noir). Long chain normal alkanes (wax alkanes) typically occur in the n-C$_{25}$ to n-C$_{35}$ range with characteristic odd/even carbon number predominance and maxima at n-C$_{25}$ (Chasselas) and n-C$_{27}$ (Pinot noir).**