Under glasshouse and field conditions several irrigated scion varieties grafted to Kober 5 BB showed higher rates of photosynthesis compared to ungrafted varieties due to a higher carboxylation efficiency (Fig. 3). But only in 1- and 2-year-old vine varieties this higher CO_2 assimilation rate led to increases of the WUE.

In further experiments we will examine the effects of increasing water stress on gas exchange of grafted and ungrafted scions.

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On the mechanism of vine resistance to low temperatures

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A b s t r a c t : Frost resistance of grapevine is based on its high water confining capacity formed by osmotic forces in result of protective matters being stored in protoplast and with the help of structure ability to lower water activity in prefrozen cells. Colorimetric investigations have shown that before being injured the tissues of the plant contain a high amount of supercooled water. The degree and rate of ice nucleation in tissues depend on their hydration level at the prefrozen period. The low water content promotes the supercooling state of water within living cells of the plant for a longer period and ice nucleation in cells occurs at lower temperatures.

In rehydrated cuttings of frost resistant varieties the first peak – an exothermal rise connected with the beginning of extracellular ice formation after supercooling – is observed at -6 °C. The second low temperature exotherm (LTE) is observed at -22 to -24 °C, corresponding to considerable damage of buds and tissues. In case of dehydrated cuttings (for 5-6 %) the first peak is not observed. The first insignificant peaks are registered at -14 °C, which is perhaps connected with the beginning of extracellular ice formation, for at -14 °C the tissues and buds are alive.

The second exotherm rise is noted only at -26 to -28 °C, when the beginning of strong damages is observed; otherwise the intracellular ice formation begins.

High resistance to low temperatures in frost resistant grapevine varieties is conditioned by higher water confining capacity of cells and more intensive water supercooling in the range of critical temperatures.

Such a mechanism of cell protection does not provide high frost resistance since supercooling state is useful only in moderate frost weather while it is dangerous in long-term hard frosts.