Increasing sugar concentration in tomato juice

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To increase the sugar concentration and resulting marketability of tomato juice, growers have traditionally used techniques such as subjecting plants to salt and water stresses. In a new study published in *HortTechnology* (February 2014), Ken Takahata and Hiroyuki Miura from Tokyo University of Agriculture reported on a prototypic method known as "basal wire coiling" that shows potential as a simple and effective method for increasing the sugar concentration in tomato fruit juice.

"We investigated whether coiling wire around the lower part of the plant stems to reduce the capacity of xylem to transport water to the shoot would result in low shoot moisture conditions and increase the sugar concentration of fruit like salt and water stresses," the authors said. They noted that basal wire coiling is less complex than other treatments, such as subjecting tomato plants to salt or water stress, which can require special equipment and techniques.

Takahata and Miura's study involved coiling bonsai wire around the stems of tomato seedlings between the cotyledon node and the first leaf node. "Eleven days after treatment, the stem diameters immediately above the wire coils were markedly greater in treated plants compared with the corresponding stem regions of control plants," they said. The stems of treated plants were less elongated and developed fewer nodes at 39 and 51 days after treatment than did the control plants.

Several months after the application of the treatment, marketable fruit

harvested from the first to third trusses of the treated plants had average weights that were 49% to 89% of the weights of fruit from control plants. The juice of fruit from the first to third trusses in the treated plants had soluble solids concentrations of 116% to 120%, sucrose concentrations of 263% to 483%, and fructose and glucose concentrations of 135% to 155%, compared with juice from corresponding control fruit. At 112 days after treatment, the shoots and roots of treated plants had weights that were 58% and 32% of those of control plants, respectively.

"Since basal wire coiling in this experiment markedly suppressed root growth, presumably by impeding photosynthate translocation through the phloem to the roots, we assume that water absorption was also decreased by this treatment," Takahata and Miura wrote. "Furthermore, impeding water transport through the xylem to the upper parts of the plant by this treatment should accelerate a reduction in the moisture content of the shoot."

The results suggested that the decrease in moisture content, minor decrease in photosynthate production, activated sugar translocation, and reduced competition for photosynthates resulting from the basal wire coiling technique could increase sugar concentrations in tomato fruit juice.

Takahata and Miura recommended further studies to determine the practical application of basal wire coiling for tomato production; specifically to identify the appropriate location and time for coiling plants with wire, the optimum width of the wire coil, optimal methods for nutrient and water management, and to calculate the economic impacts for producers and consumers.

More information: The complete study and abstract are available on the ASHS HortTechnology electronic journal web site:

horttech.ashspublications.org/ … ent/24/1/76.abstract