A NON-INVASIVE METHOD FOR MEASURING ABSOLUTE WATER CONTENT OF A LEAF

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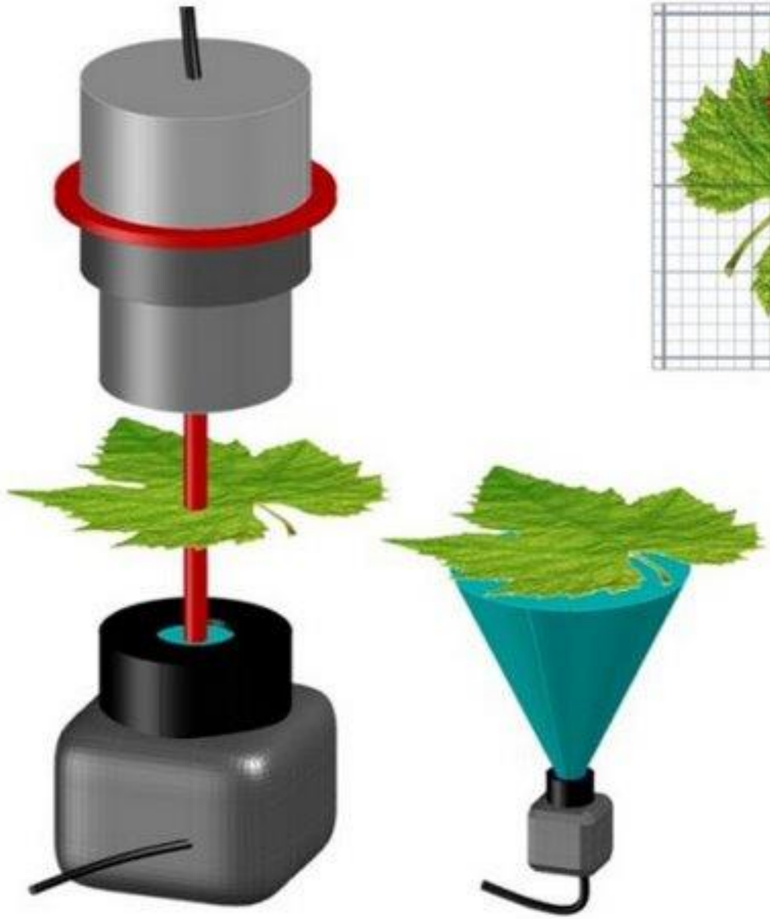
Invention

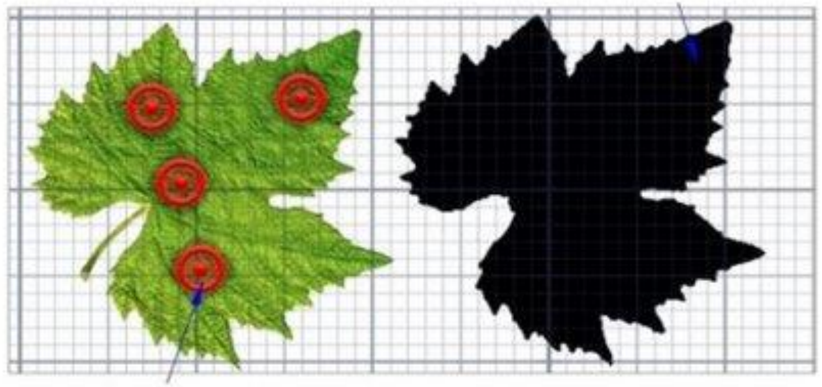
The invention aims to respond to the growing demand for quick and non-invasive tools for measuring the «*plant wellness*» (i.e., the best physiological condition in which the single plant can grow up), by proposing an in-field method for determining the water content of the plant (leaves) and the related apparatus and management tool. The technology employs a Terahertz enhanced vision system based on THz spectroscopy.

The proposed method and apparatus is based on an electromagnetic sensor capable of getting the right information from the inside of the leaf without any contact and translating the internal amount of water into a useful index, i.e., measuring the fundamental parameter to determine if the plant is under suffering. The system is composed of a terahertz (THz) light source, a THz detector, a vision system and a computer for real-time data analysis. Once chosen the leaf to be examined, the Thz light passes through the leaf and reaches the detector, which transforms the light into an electronic signal; then the electronic signal is sent to the computer. At the same time, the vision system measures the coordinates of the leaf relative to the THz light, together with the leaf projective area. The whole acquisition is sent to the computer, which finally derives the amount of water contained inside the leaf.

A first lab-made prototype has been validated in field showing promising results.

Drawings
& pictures





Industrial applications

The availability of water resources is one of the main constraints to plant productivity and plays a key role in the spread of species in a territory. However, the mechanisms of adaptation to different forms of abiotic stress are still the subject of numerous studies. The first response to drought stress is the sudden closure of stomata to preserve the hydration status of the leaf. In the long term, this type of reaction has a negative impact on the photosynthetic activity of the plant and consequently on its growth. The use of new technologies, such as terahertz lasers, can help achieve non-invasive, fast and reliable measurements of leaf hydration status. The patented device can be used in all areas that require monitoring of water status with the need not to damage the plant, for example in:

- Agriculture (irrigation, crop monitoring, harvesting time, …);
- Water management on farming soils;
- High-value cultivars cultivation;
- Plant nurseries.

The invention provides an easy-to-use, fast and reliable instrument suitable for field or laboratory measurements. The measurements are accurate and repeatable (>95%) and can help increase crop yields (in terms of quality and also quantity) and save water resources on agricultural land.

Possible developments

The developed device will be able to be integrated within conventional smart-farming systems, developing a technological platform (motorized *Leafstyle* system, equipped with GPS and robotic arms for remote guidance) able to automatically start an emergency irrigation according to a *pre-screening* performed directly on the green wall. The synergistic interaction with local farmers will help to define the parameters for the quantification of the performance in a medium to long term perspective, in terms of agricultural production (yield and added value of the product), accessibility, benefits for the quality of life of the workforce, attractiveness of the area. Medium-long term objective is to optimize the service/product solutions at nursery and farm level.

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