



Grower Summary

Improving cane crop resilience by overcoming the legacy effects on photosynthesis during the recovery from short-term combined stresses

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[The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.]

AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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GROWER SUMMARY

Headline

- Malling™ Bella recovers quickly from mild and transient coir water deficits but a more severe stress event reduces photosynthesis for several weeks

Background

The purpose of the work is to determine whether legacy effects of transient rootzone water deficits limit berry yields and quality in raspberry due to the suppression of photosynthesis. Upon exposure to limiting rootzone water availability, a series of plant adaptive responses are often triggered, and these include a slowing of leaf expansion and partial or complete stomatal closure, the aim of which is to limit water loss due to transpiration until the stress passes. However, these responses can also limit photosynthesis and overall carbon fixation capacity. The suppression of photosynthesis is thought to be due to either stomatal or metabolic limitations or perhaps a combination of the two. A longer-term suppression of photosynthesis after the stress has ended would likely limit Class 1 yield and berry quality.

Summary

Transient coir water deficits were imposed on potted Malling™ Bella primocane raspberries growing at the Water Efficient Technologies (WET) Centre at NIAB EMR to better understand: 1) the physiological responses to coir drying episodes; 2) how long these responses persist following rewetting; 3) how such legacy effects might affect crop productivity, berry quality, resource use efficiency.

Irrigation was scheduled automatically to well-watered plants to maintain coir volumetric moisture contents within a pre-determined narrow range and to achieve a target average daily run-off volume. In plants that are subjected to coir drying, one of the two drippers in each pot was removed so that a rootzone water deficit stress was imposed gradually. Three deficit irrigation treatments were imposed, each of a different severity and duration.

Physiological responses to each of the three deficit treatments were detected. Changes in shoot water balance were the first detectable responses to the coir drying treatments, followed by lowered stomatal conductance and photosynthetic rates. Upon re-watering to restore coir volumetric moisture contents to pre-stress levels, shoot water balance and leaf gas exchange recovered within a few days in plants that were subjected to the short and medium-term stress episodes. However, in plants subjected to a more severe water deficit

stress, legacy effects on rates of photosynthesis persisted for 15 days after plants were re-watered.

The outputs from this research will help to inform BGG raspberry growers' decisions on the optimum rooting volume and pot sizes for commercial raspberry crops, how to better manage tunnel phytoclimatic conditions during hot weather and how to manage irrigation scheduling strategies to ensure that transient or sustained soil water deficits do not limit commercial yields and berry quality via undetected stress legacy effects.

Financial Benefits

Sub-optimal irrigation and resulting transient stress events will reduce raspberry Class 1 yields and berry quality, but the likely financial impact of these effects is not yet known.

Action Points

Growers should ensure that irrigation to raspberry crops is scheduled effectively so that soil volumetric water contents are optimised throughout the day (and night). Growers choosing to implement a water deficit stress to control cane vigour, should be aware that unintended legacy effects may limit commercial yields and berry quality.