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Fruit growth and photosynthesis are differentially affected by local variation in source/sink relations

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Key words: crop load, photosynthesis, source/sink distances, fruit growth

Abstract

Tree crop load affects carbon acquisition as well as processes like floral induction or fruit growth. Nevertheless little is known about the impact of local variations of source/sink relationships on these processes variability within the tree. This study aims at investigating the effects of local manipulation of source/sink relationships through leaf or fruit removal on photosynthesis and fruit growth.

Experiments were conducted in 2016 and 2017 on adult ‘Golden’ trees planted in the south of France. On trees in either high or low crop loads, 11 leaf or fruit removal treatments were set up early June. Treatments were performed at shoot or branch scales or one side of Y-shape trees. Photosynthesis was measured in June and August on the foliated parts of leaf-removal-treatment trees and on both the fructified and de-fructified parts of fruit-removal-treatment trees. At harvest, mean fruit weight was evaluated on the different parts of the trees.

This study suggests a strong impact of the tree crop load on photosynthesis without any clear impact of the local fruit presence. Moreover, fruit weight was decreased on the defoliated parts when defoliation was performed on branches or on one side of the trees. This could suggest that trees are not able to exchange assimilates at long distances but also that defoliation caused a decrease in water transpiration with possible consequences on phloem-xylem fluxes. Conversely, our results show that long distant transport occurs between fructified and de-fructified parts of the tree. This is probably due to the very low demand of carbon in de-fructified parts which allows carbon fluxes to the fructified parts.

This study gives new knowledge on the effects of source/sink distances on carbon acquisition and transport suggesting that the distance effects could differ depending on the process. These experiments will be used to calibrate a model built to simulate carbon transport within trees.