Introducing L-PEACH: Tool for understanding peach tree development

November 17 2011

This is a sample screen from the computer-based model shows three-dimensional depictions of simulated peach trees. Credit: Photo courtesy of Theodore DeJong

In peach trees, as in other plants, the energy used to create carbohydrates that support growth and development comes from solar radiation through the process of photosynthesis. Peach tree productivity is therefore dependent on the tree's photosynthetic efficiency and effectiveness in distributing and using carbohydrates. A basic knowledge of carbon assimilation and partitioning concepts at the whole-tree level can aid growers in understanding how peach trees grow and help them adopt cultural practices that maximize production.

Carbon assimilation and partitioning are dynamic, interrelated, complex phenomena. Canopy carbon assimilation is dependent on the physiological stage of the leaves and external factors such as light environment within the canopy and air temperature. The overall partitioning of carbohydrates within the tree is even more complex than the assimilation process. All tree organs require carbohydrates for growth and maintenance, but requirements vary among tree organs and

their stages of development. Although previous carbon-based models have successfully shown the integration of carbon assimilation, organ respiration, reserve dynamics, allocation of assimilates, and growth in trees, the models did not simulate changes in architecture over time.

Researchers from the University of California, Davis, introduced L-PEACH-d, a new model for understanding how peach trees grow (HortTechnology). "To understand how peach trees grow, it is important to understand the dynamic feedback between carbon allocation and tree architecture", explained Theodore DeJong, corresponding author of the study. "This can be obtained with the construction of a functional–structural plant model."

L-PEACH-d is a computer-based model that simulates the growth of peach trees by integrating important concepts related to carbon assimilation, distribution, and use in the trees. While running L-PEACH-d, three-dimensional depictions of simulated growing trees can be displayed on the computer screen and users can easily interact with the model. Data generated during a simulation can be saved to a file or printed for visualization and analysis.

L-PEACH-d also features modeling of the responses to horticultural practices such as tree pruning and fruit thinning. In one simulation, for example, different dates of fruit thinning showed that fruit weight at harvest was higher on earlier-thinned trees compared with later-thinned trees. "This model indicated that fruit thinning should be carried out early in the season to maximize fruit size", said DeJong.

According to the researchers, L-PEACH-d also has merit as a research tool. "L-PEACH-d is a powerful tool for understanding how peach trees function in the field environment, and it can be used as an innovative method for dissemination of knowledge related with carbohydrate assimilation and partitioning", they noted.

LPEACH-d has provided a framework for beginning the development of a 3D simulation model for almond trees, and similar research is ongoing for apple trees. The scientists added that numerous practical outcomes, such as better understanding of responses to fruit thinning, pruning, rootstocks, water stress, and spring and summer temperatures, have already been derived from their research.

More information: The complete study and abstract are available on the ASHS HortTechnology electronic journal web site: horttech.ashspublications.org/ … nt/abstract/20/6/983

Provided by American Society for Horticultural Science