TREE CARBOHYDRATE BUDGET . METHODS FOR SUSTAINABLE MANAGEMENT OF ALMONDS UNDER CHANGING CENTRAL VALLEY CLIMATIC CONDITIONS

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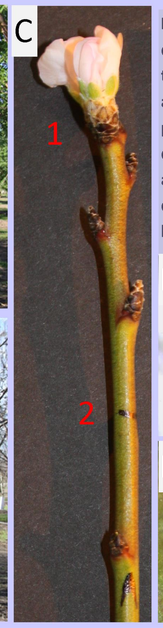
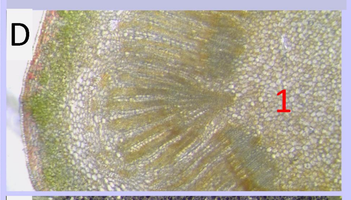
CARBOHYDRATES : FUEL FOR PLANTS

PHOTOSYNTHESIS → SUGARS → GROWTH, REPRODUCTION, STORAGE

COST OF PERENNIALITY

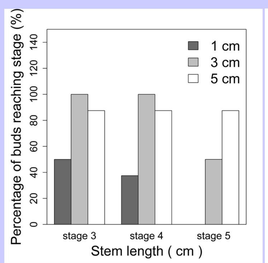


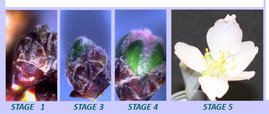
In plants, photosynthesis provides carbohydrates that ensure vegetative and reproductive growth (A). A balance between those usage and storage of starch is necessary for perennial plant like almond trees. To survive dormancy and ensure a successful greening and flowering in the spring, trees have to acquire and store an adequate supply of carbohydrates, often in the form of starch.

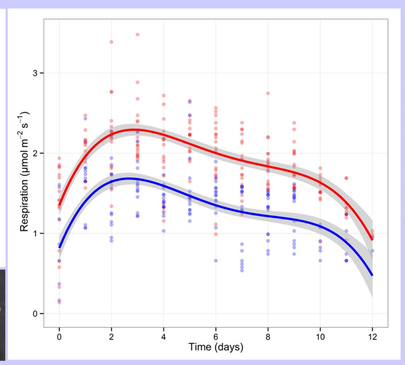


In the spring, fast and efficient mobilization of stored carbohydrates is necessary for successful blooming and initiation of growth (B). Thus, spring bud break depends on starch hydrolysis and an increase in soluble carbohydrate content (C). Cross sections were performed on the cutting in Fig. C on position 1 and 2 and stained with Lugol, a dye that stains in black starch. A local depletion of starch was observed (D).

ESTIMATING THE BUDGET OF A FLOWER





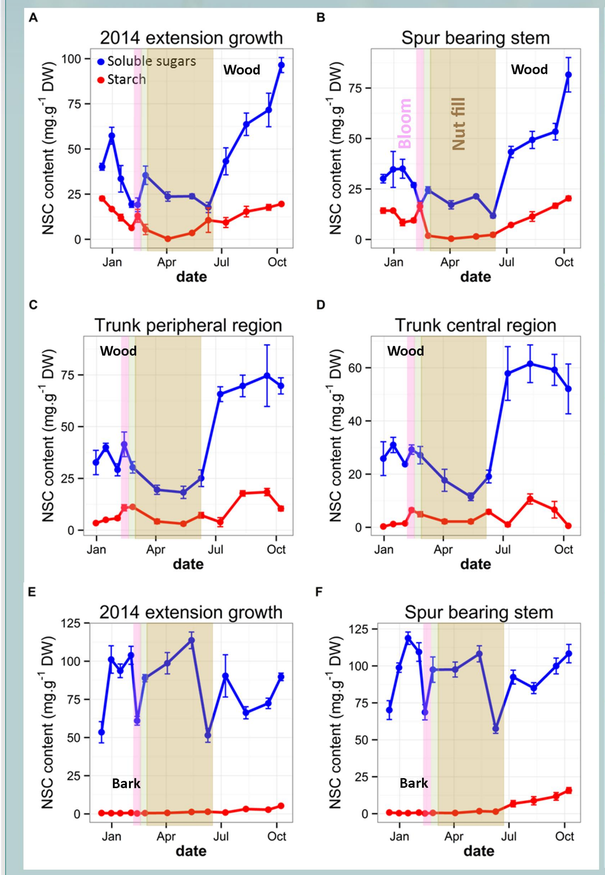


Flowers mobilize carbohydrates from wood for development and maintenance respiration

RESERVES FROM LOCAL AND REMOTE SOURCES IN WOOD

SEASONAL TRENDS OF CARBOHYDRATES METABOLISM IN ALMOND

CARBOHYDRATES CONTENT

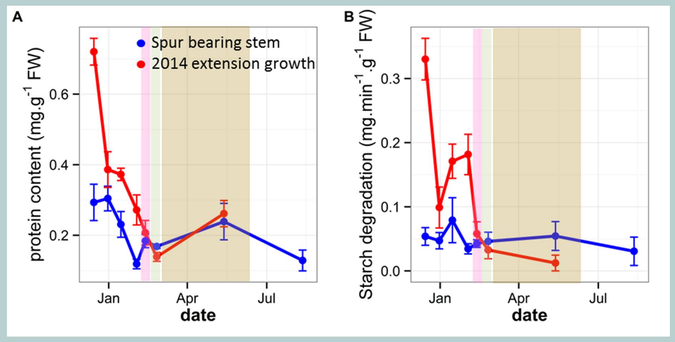


Seasonal variations of non structural carbohydrates (NSC) in the wood and bark of extension growth of almond trees (n=5).

Pink line represent blooming time.
Green line represent leafing.
Brown area represent nut fill.

- Mobilization of wood carbohydrates during winter
- Accumulation of starch in wood during budbreak
- Mobilization of soluble sugars during budbreak
- Nuts drain the carbohydrates during nut fill
- After nut fill carbohydrates accumulate in the wood (storage compartment)
- 3 waves of bark soluble sugars mobilization : winter, nut fill, and end of summer for the storage of carbohydrates
- Accumulation of starch in bark during fall.

PROTEIN CONTENT AND STARCH DEGRADATION RATE



Seasonal variations of protein content and starch degradation enzymes rate. Protein were extracted from the wood of almond trees branches.

- Mobilization od storage proteins
- High starch metabolism was observed prior to budbreak.

EFFECT OF MILDER WINTERS

CLIMATE CHANGE

TEMPERATURE INCREASE → INCREASE RESPIRATION RATE, INCREASE STARCH DEGRADATION RATE

DEPLETION OF CARBOHYDRATE RESERVES :

- EFFECT ON YIELD : LESS FLOWER, STERILE FLOWERS
- EFFECT ON SURVIVAL : LESS RESILIENCE OF ORCHARDS TOWARDS DROUGHT STRESS

FUTURE PROJECTS

ARE STARCH GRAINS THE SAND OF THE HOURGLASS COUNTING DOWN CHILLING HOURS ?

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