Pruning effects on canopy growth and photosynthesis in young peach trees (Prunus persica L. Batsch)

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What's the point?

Context

By modifying the architecture of the aerial parts, shoot pruning profoundly affects tree growth and photosynthesis. Accelerated growth of shoots is generally observed after pruning and, depending on growth conditions, an equilibrium between shoots and roots can be reached. While an enhanced photosynthesis of the remaining leaves is observed after pruning, very few data are available at the whole tree canopy level because of the difficulty of such studies, especially on trees.

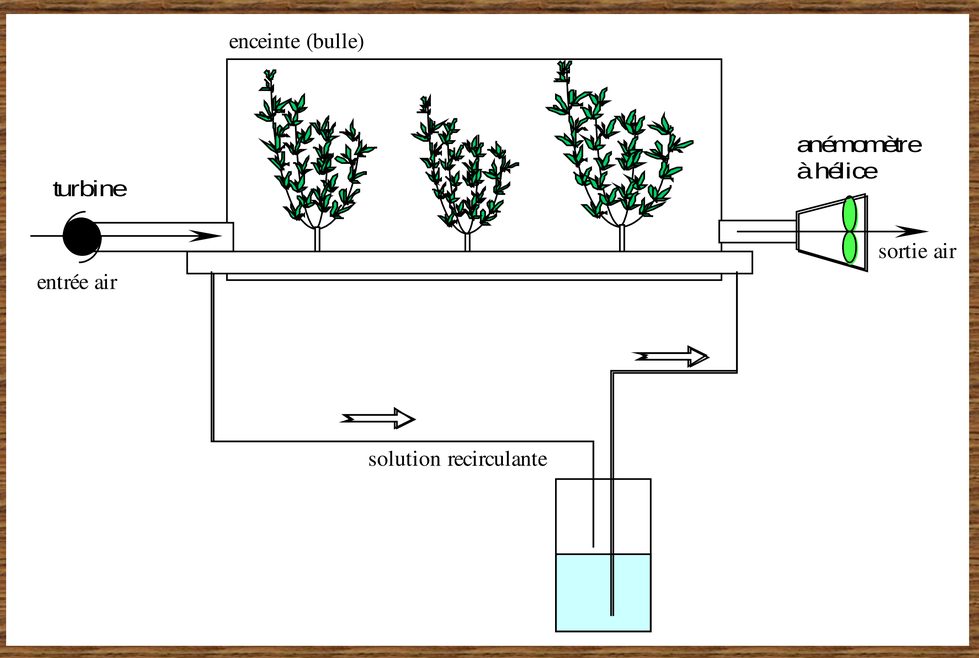
Objectives

Since there are indications that the carbon (C) status of trees is scarcely modified by pruning (Médiène et al. 2002, Tschaplinski and Blake 1994), it is necessary to evaluate C acquisition and use at the whole tree level in order to quantify the compensatory response of pruned trees. Our objectives were (i) to quantify the canopy photosynthesis of pruned peach trees throughout the growing season and (ii) to evaluate the impact on the parameters of canopy photosynthesis.

We used an original experimental setup…

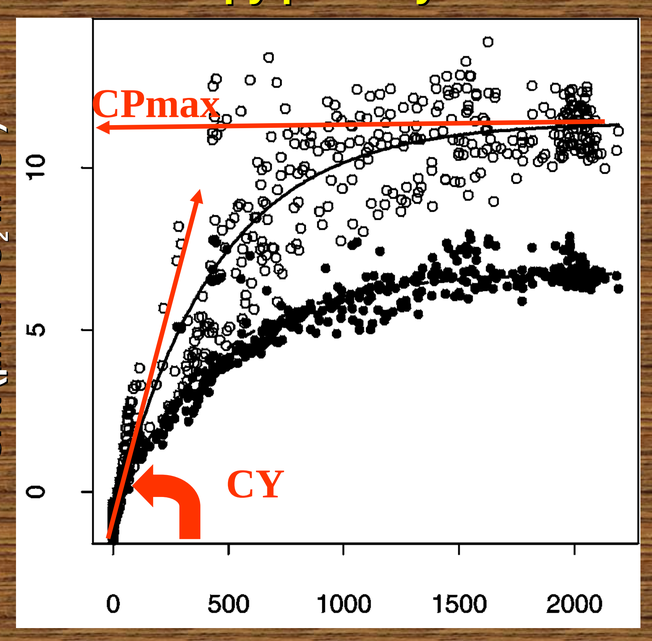
… to control N uptake and **measure CO_2 exchanges at three tree level** on pruned and unpruned trees. Two parameters of canopy photosynthesis, i.e. the light-saturated rate of net canopy photosynthesis per unit leaf area (CPmax) and the light yield (CY) were calculated by fitting an asymptotic exponential to the light response of net canopy photosynthesis per unit leaf area (CPa) at four dates.

Principle of C and N uptake measurements



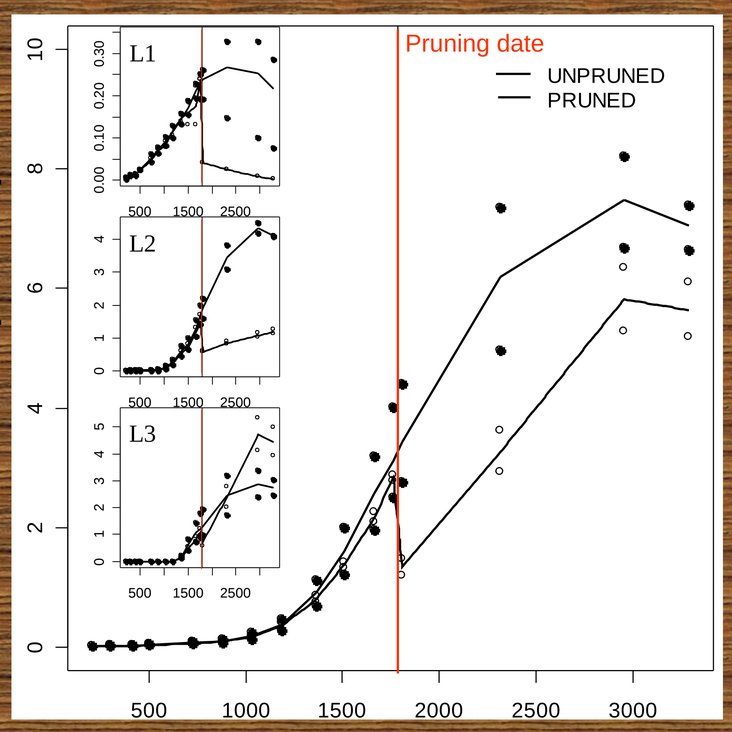
Experimental design

Determination of the parameters of canopy photosynthesis

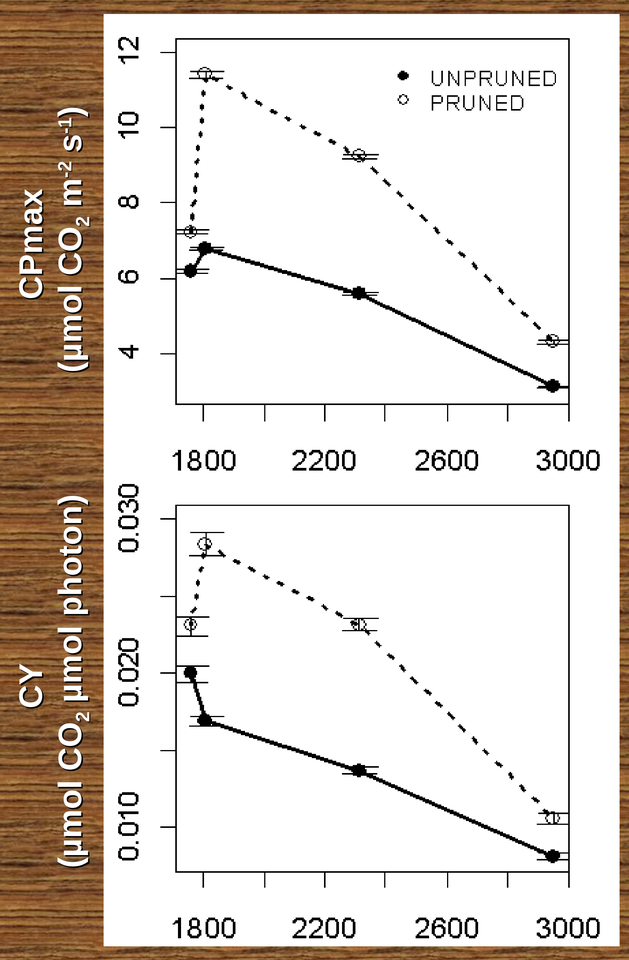


What are the pruning effects on:

1. the total leaf area and the different order contribution



2. the parameters of canopy photosynthesis



- Pruning removed about 55% of the total leaf area and CPa strongly increased, with an increase of 58% and 23% for CPmax and CY.
- Differences progressively decreased between treatments. New axes, mainly tertiary, were produced. At about 2300°Cd (*i.e.* twenty one days after pruning), CPmax and CY of pruned trees decreased, with CY returning to its value before pruning whereas CPmax remained greater than before pruning.

In conclusion, pruning induced a response in two phases.

- During the first one, **increase of CPa** might be due to both an **increased light penetration throughout the canopy** and **a reduction of end-product inhibition of leaf photosynthesis** because of the global reduction of C acquisition by trees. This result is confirmed by a study which modelled canopy-level photosynthetic compensation (Anten and Ackerly 2001).
- Then, the production of **new axes** might **contribute to the closure of the canopy in terms of light penetration but also to maintaining the positive effect of pruning on CPmax.**

References

Anten N.P.R., Ackerly D.D. 2001. Functional Ecology: 15, 252-262.
Médiène S., Jordan M.O., Pagès L., Le Bot J., Adamowizc S. 2002. Tree physiology: 22, 1289-1296.
Tschaplinski T.J. and Blake T.J. 1994. Tree physiology: 14, 141-151.