Effect of in situ light x soil N resource interaction on Quercus petraea seedlings mixed-grown with Molinia caerulea

Antoine Vernay, Philippe Malagoli, M. Fernandez, Thomas Perot, Thierry Ameglio, Philippe Balandier

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VERNAY Antoine[1], MALAGOLI Philippe[1], FERNANDEZ Marine[1], PEROT Thomas[2], AMEGLIO Thierry[1], BALANDIER Philippe[2]

antoine.vernay@inra.fr

[1] PIAF, INRA, Univ. Clermont-Auvergne, 63100 Clermont-Ferrand, France

[2] Irstea, Research Unit on Forest Ecosystems (EFNO), Domaine des Barres, F-45290 Nogent-sur-Vernisson, France

Introduction :

Coexistence of forest species results from habitat filtering and niche stabilizing processes acting concomitantly. Understanding these processes will help to design efficient techniques of seedling establishment in forest restoration. This may bring rethought silvicultural practices

Objectives :

- Determine how early oak / *M. caerulea* responses are affected by nitrogen (N) along light gradient.
- Assess importance and intensity of the interactions.
- Highlight which mechanisms are affected by different resource availabilities along the gradient

Materials & Methods (Fig 1 and 2)

- Light gradient: from under tree canopy (17% PAR) to the middle of a gap (80% PAR) (Fig1)
- Nitrogen (N): no N supply (N_0) or 91 kg.ha^{-1} (N_{91})
- Biotic interaction: sole oak seedling (Qp_S) *vs* mixed oak seedling with *M. caerulea* (Qp_M) (Fig 2)

Fig 2: sole-grown (A) and mixed-grown (B) oaks in the light gradient

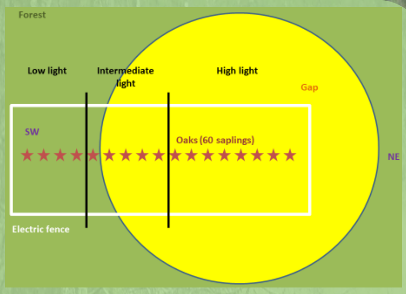

Fig 1: experimental design

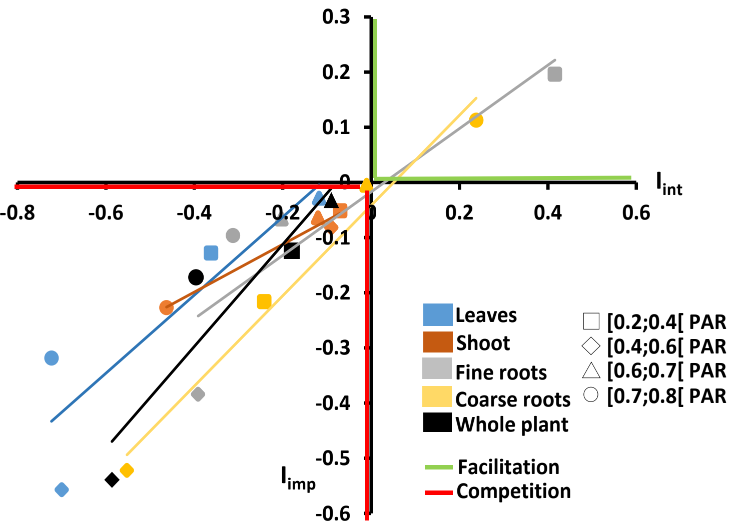

Fig3: Relationship between intensity (I_{int}) and importance (I_{imp}) of interaction by *M. caerulea* on oak for each considered organ, among different light classes

Results:

- Fig 3: Negative indices showed a global competition in terms of intensity and importance of interaction for mixed-grown oak. Facilitation was observed (positive indices) for oak coarse roots and for fine roots under high and low light levels, respectively.
- Fig 4: There was a positive relationship between N content (g per oak) and coarse roots carbon allocation to coarse root, independently of competition treatment (Qp_S, $R^2 = 0.79$ and Qp_M, $R^2 = 0.61$). Foliar N content was higher in Qp_S than Qp_M treatment.
- Fig 5: Shoot/root ratio was positively related to light gradient in Qp_S treatment ($R^2 = 0.25$) whereas it was relatively constant over the gradient for Qp_M ($R^2 = 0.05$).

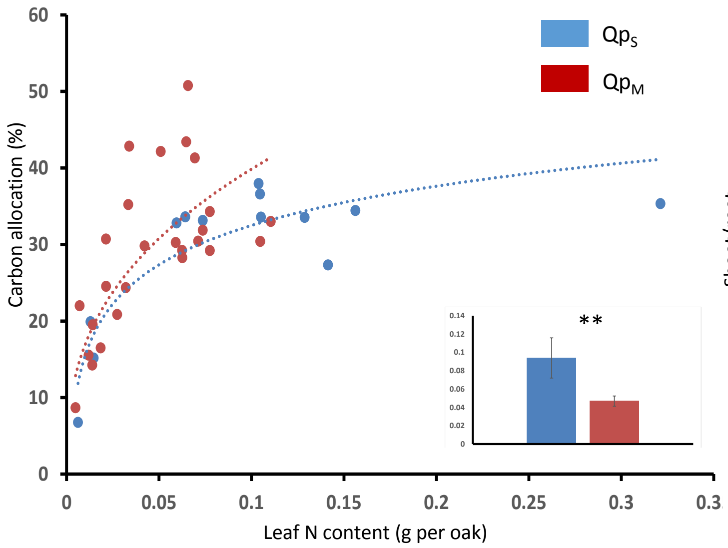

Fig 4: carbon allocation to coarse roots *vs* N content (g per oak) . Small window shows N content of Qp_S *vs* Qp_M

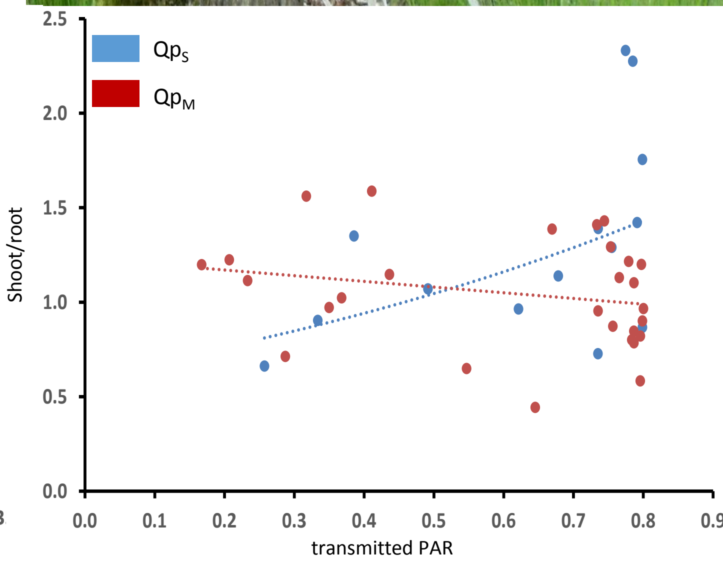

Fig 5: Shoot/root ratio variation along light gradient

Conclusion:

- Facilitation surprisingly occurred for root system along light gradient in mixed grown oak.
- *M. caerulea* favorised oak coarse root biomass under high light, probably because larger leaf N accumulation resulted in larger C gain that in turn favoured C allocation to oak coarse root ➔ resource conservative strategy.
- Conversely in low light fine root biomass is favoured, probably due to a decrease of *M. caerulea* biomass and cover, resulting in better foraging potentialities.

➔ Low light and weak competition would allow oak seedling to develop fine roots to take up soil resources. However, higher competitive root abilities is not sufficient, higher light will be necessary to support growth