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Antoine Vernay, Philippe Malagoli, Marine Fernandez, Thomas Perot, Thierry Ameglio, et al.. Effect of in situ light x soil N resource interaction on *Quercus petraea* seedlings mixed-grown with *Molina caerulea*. 3rd Restoring Forests: Regeneration and Ecosystem Function for the Future - IUFRO Conference, Sep 2017, Lund, Sweden. IUFRO, 1 p., 2017, 3rd Restoring Forests: Regeneration and Ecosystem Function for the Future. hal-02734599

**HAL Id: hal-02734599**

**<https://hal.inrae.fr/hal-02734599>**

Submitted on 2 Jun 2020

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

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## 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<sup>-1</sup> ( $N_{91}$ )
- 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

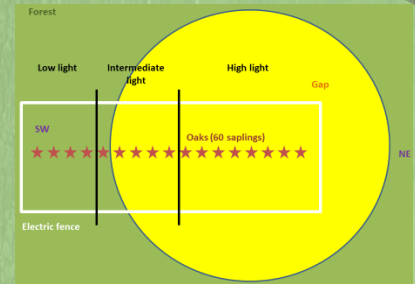


Fig 1: experimental design

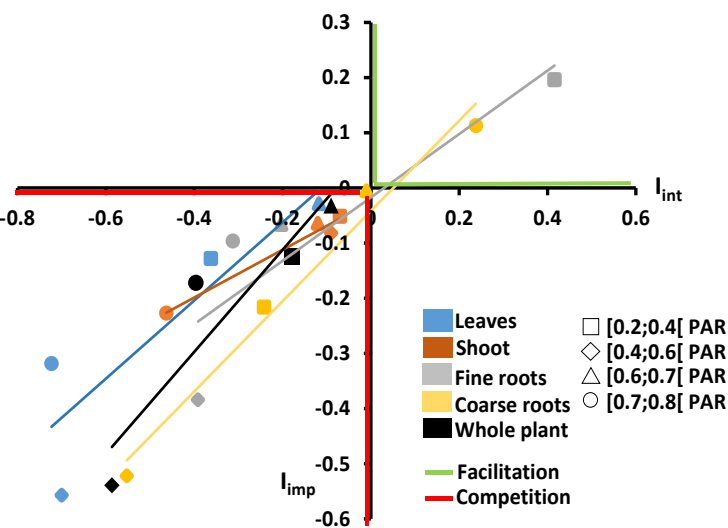


Fig 3: Relationship between intensity ( $I_{int}$ ) and importance ( $I_{imp}$ ) of interaction by *M. caerulea* on oak for each considered organ, among different light classes

## 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  $Qp_M$  ( $R^2 = 0.05$ ).

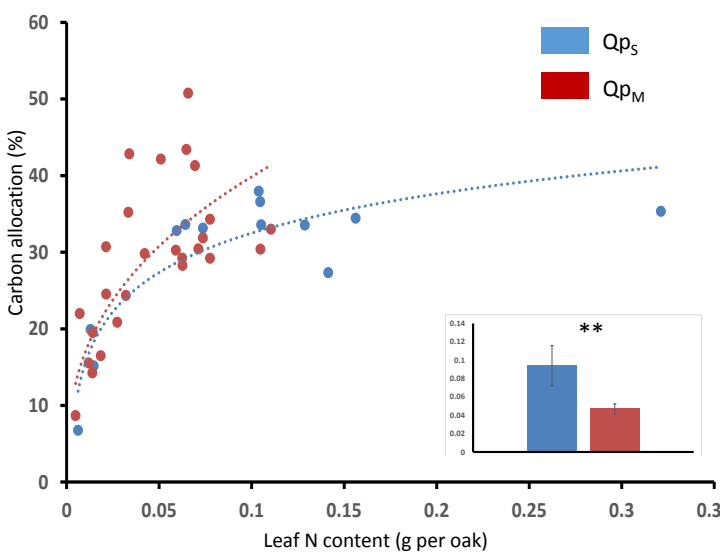


Fig 4: carbon allocation to coarse roots vs N content (g per oak) . Small window shows N content of  $Qp_S$  vs  $Qp_M$

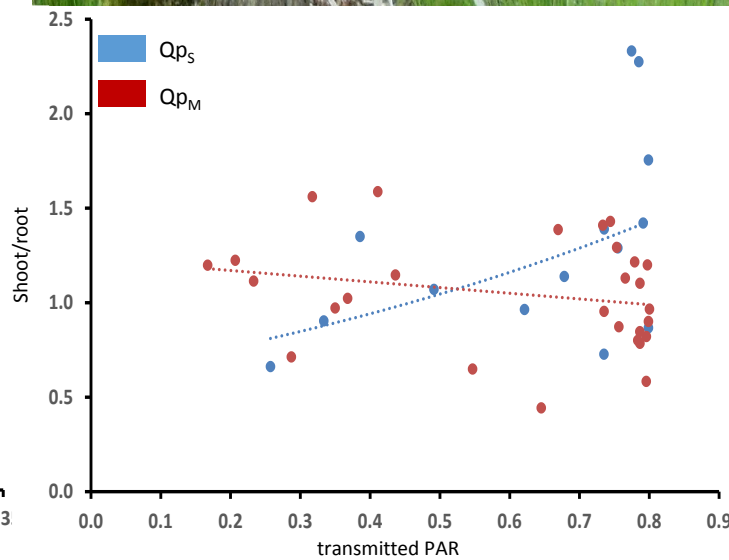


Fig 5: Shoot/root ratio variation along light gradient

## Conclusion:

- Facilitation surprisingly occurred for root system along light gradient in mixed grown oak.
  - *M. caerulea* favoured 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