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

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\section*{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.

\section*{Objectives:}
\begin{itemize}
  \item Determine how early oak / \textit{M. caerulea} responses are affected by nitrogen (N) along light gradient.
  \item Assess importance and intensity of the interactions.
  \item Highlight which mechanisms are affected by different resource availabilities along the gradient
\end{itemize}

\section*{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\textsubscript{0}) or 91 kg ha\textsuperscript{-1} (N\textsubscript{1})
- Biotic interaction: sole oak seedling (Qp\textsubscript{S}) vs mixed oak seedling with \textit{M. caerulea} (Qp\textsubscript{M}) (Fig 2)

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fig1.png}
\caption{Experimental design}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fig2.png}
\caption{Sole-grown (A) and mixed-grown (B) oaks in the light gradient}
\end{figure}

\section*{Results:}
\begin{itemize}
  \item 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.
  \item 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\textsubscript{S}, R\textsuperscript{2} = 0.79 and Qp\textsubscript{M}, R\textsuperscript{2} = 0.61). Foliar N content was higher in Qp\textsubscript{S} than Qp\textsubscript{M} treatment.
  \item Fig 5: Shoot/root ratio was positively related to light gradient in Qp\textsubscript{S} treatment (R\textsuperscript{2}= 0.25) whereas it was relatively constant over the gradient for Qp\textsubscript{M} (R\textsuperscript{2}= 0.05).
\end{itemize}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fig3.png}
\caption{Relationship between intensity (I\textsubscript{int}) and importance (I\textsubscript{imp}) of interaction by \textit{M. caerulea} on oak for each considered organ, among different light classes}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fig4.png}
\caption{Carbon allocation to coarse roots vs N content (g per oak). Small window Shows N content of Qp\textsubscript{S} vs Qp\textsubscript{M}}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fig5.png}
\caption{Shoot/root ratio variation along light gradient}
\end{figure}

\section*{Conclusion:}
\begin{itemize}
  \item Facilitation surprisingly occurred for root system along light gradient in mixed grown oak.
  \item \textit{M. caerulea} favored 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  \textsuperscript{→} resource conservative strategy.
  \item Conversely in low light fine root biomass is favoured, probably due to a decrease of \textit{M. caerulea} biomass and cover, resulting in better foraging potentials.
  \item 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
\end{itemize}