Plant nitrophily drives plant productivity and plant-microbial interactions

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INRA, UMR1347 Agroécologie, BP 86510, F-21000 Dijon, France

The interest for plant interactions, especially between crop and weed species, in agricultural situations has increased with the pressure to reduce the use of chemical inputs. Thus, a better knowledge is required in plant traits mediating the issue of plant competition and how this competition is impacted by the environment.

Nitrophily is a plant trait referring to plant habitat, ranging from oligotrophic species mostly found in soils with low N content to nitrophilic species better adapted to soils with high N content.

We hypothesize that nitrophily impacts (i) the issue of plant-plant interactions, through competition for N and light and (ii) plant associations-rhizospheric microbial community interactions. We can expect that microbial community from nitrophilic/oligotrophic roots association is (i) different from community associated to the same plants cultivated alone, and (ii) differently impacted according to the association type.

To test these hypotheses, three nitrophilic and two oligotrophic graminaceous species (one crop plant and four weeds) were cultivated in mono- or bi-specific associations in a soil supplemented or not with N. The issue of the plant-plant interactions was assessed by checking their productivity through biomass measures. The impact of the different plant combinations on total bacterial communities was characterized by A-RISA (Automated-Ribosomal Intergenic Spacer Analysis) fingerprinting.

The biomass was significantly higher in nitrophilic than in oligotrophic species when grown in N supplemented soil. Bi-specific associations showed different root biomass compared to monocultures in both N conditions.

Genetic structure of rhizospheric bacterial community differed according to the N level. In higher N availability, bacterial communities structures were very similar, whereas in N limiting conditions, the rhizosphere of bi-specific associations harbored different bacterial communities in comparison to monocultures.

These results suggest that nitrophilic plant trait is a driver of plant productivity via plant-plant competition, and this affects rhizospheric microbial community in N limiting conditions.