Understanding the determinants of maize-bean intercropping

Practices, plant-soil interactions, phenotype & nutrition

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INVESTIR L'AVENIR

Questions

Traditional crop system in the Americas

Photographies of three sister pods (squash, maize and bean)
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OVERYIELDING ?
Synergy processes
Facilitation & complementarity mechanisms
Stimulation of bean symbiotic fixation
Higher disease resistance
OR
COMPETITION ?

Maize-Bean intercropping in French Tarbais

- What are the **main differences between intercropping (IC) and sole-cropping** (SC) in terms of agricultural practices and plant nutrition and yield?
- Can we detect **negative or positive interactions** between plant species in intercropping fields?
- Do **soil characteristics, irrigation and nitrogen fertilization** quantitatively **affect** individual species yield and nutrition, as well as their interaction?
- Do we find an effect of intercropping on **bacterial assemblages in the rhizobiome**?

Results

Farmers interviews

Maize-bean intercropping : a traditional crop system in the Pyrenees. Limited to peasant gardens in the beginning of the 20th century. Farmers have agricultural heritage, and cultivate 5are to 9ha of maize-bean intercropping. Why? Less work and Less diseases (anthracnose, datura & seedling fly).

Varieties: one variety for beans, several for maize rarely traditional, chosen for their solid stem and late flowering. **Varieties have not coevolved and were not selected for intercropping.**

Soil analyzes, and modeling of mineralization

High soil fertility for an organic farm (the only organic farm in our sample).

No confusion between soil and crop effects (=no difference in soil characteristics between crops).

Differences between IC and SC (after accounting for agricultural practices=farm)

- In maize

Higher vegetative biomass in IC than SC.

- In beans

Bigger grains but **lower yield in IC** than SC.

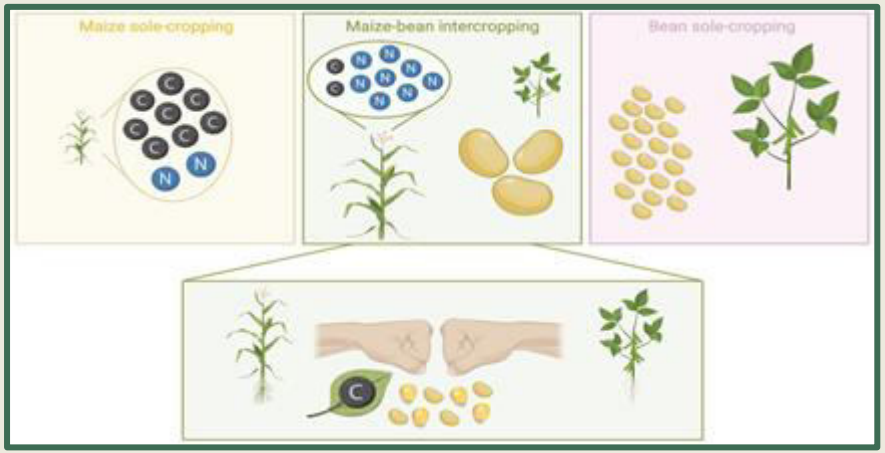
Competition for grain production and carbon nutrition between crops (negative correlations).

Bacterial assemblages (OTUs=Operational Taxonomic Units))

Significant soil effects on OTUs composition.

Neither farm nor IC/SC effect on quantitative measures of bacterial diversity, but both effects (and their interaction) **are significant on OTU composition.**

Conclusions



More competition than synergy in tarbais bean intercropping :

Maize-bean intercropping not optimized (varieties not selected for intercropping, high inputs…).

What are the conditions allowing to leverage synergy processes ?

Test the success of **different variety associations** (co-evolved varieties).

Lower inputs.

Standardize experimental design.

H2020 INCREASE PROJECT STARTED IN MAY 2020: THANKS!!!