Unraveling the diversity dynamics and network stability of alkaline phosphomonoesterase producing bacteria in modulating maize yield

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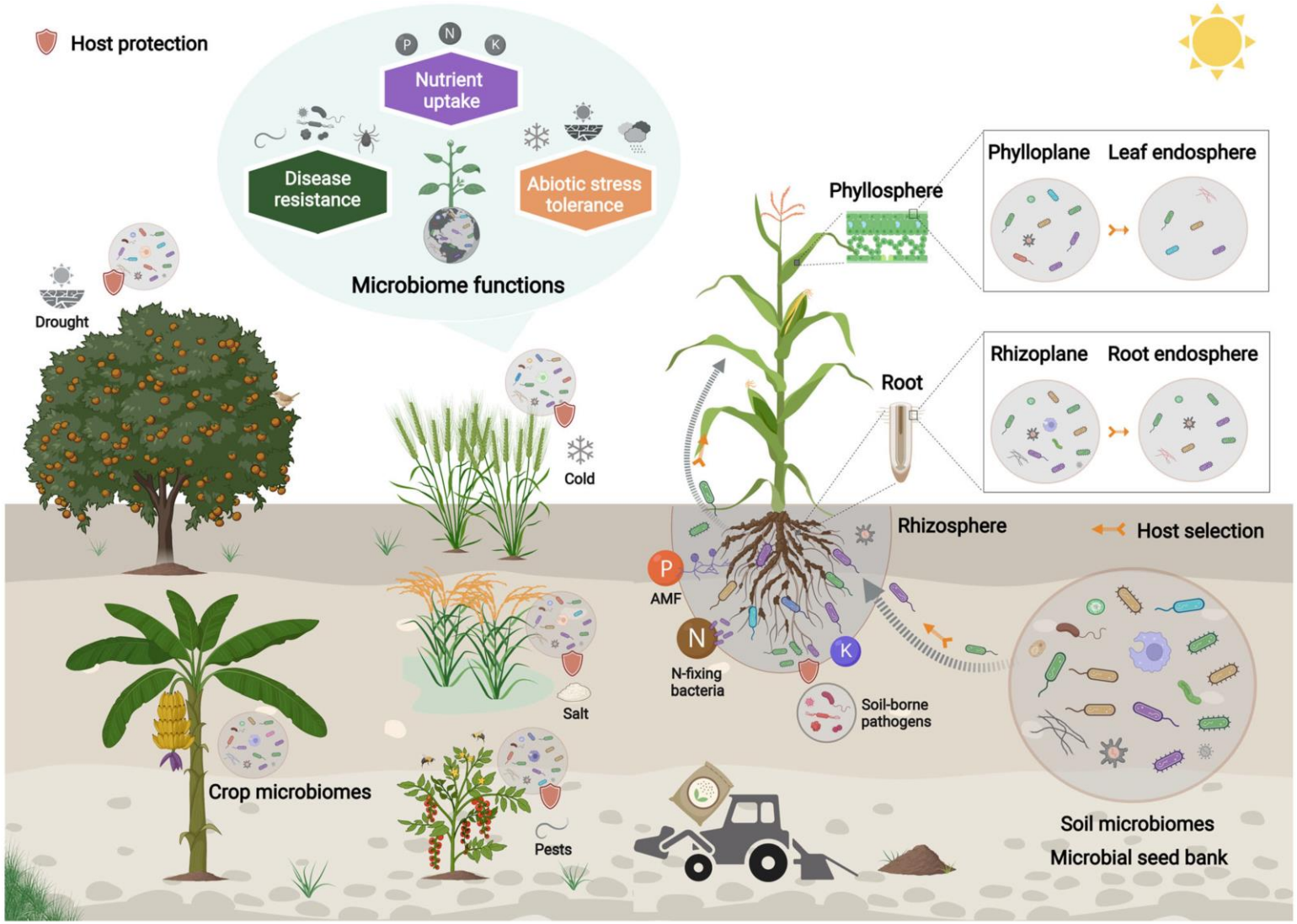
Introduction

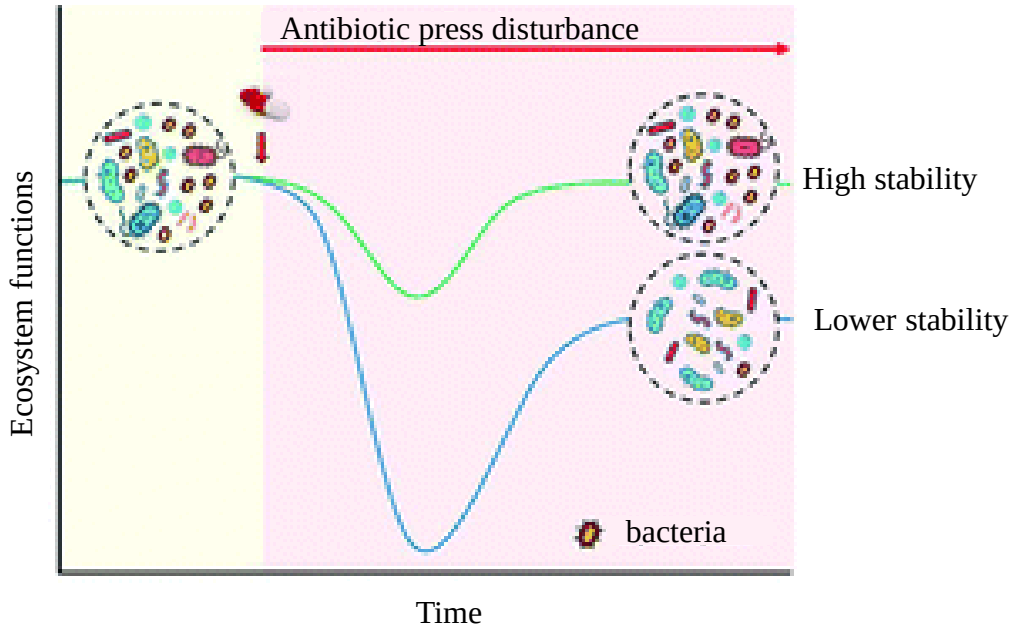


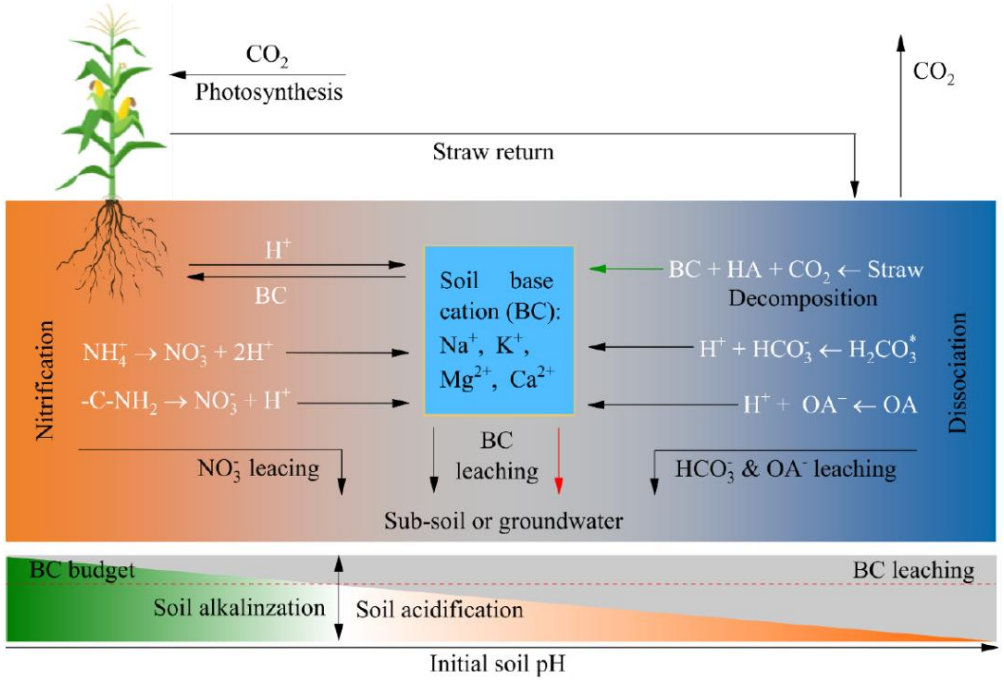
Soil bacterial community dynamically influences the soil-plant system and regulate nutrient efficiency and plant productivity.

Phosphorus (P) availability in soil represents a major challenge to crop productivity, as it limits the capacity of agricultural systems to feed the world's growing population.

Manipulating soil phosphate-degrading microorganisms is an important way to improve soil phosphorus availability and crop yields.

Introduction

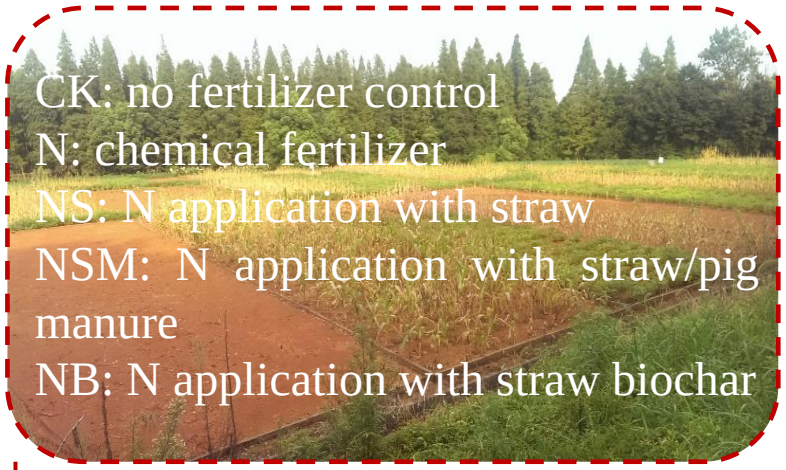




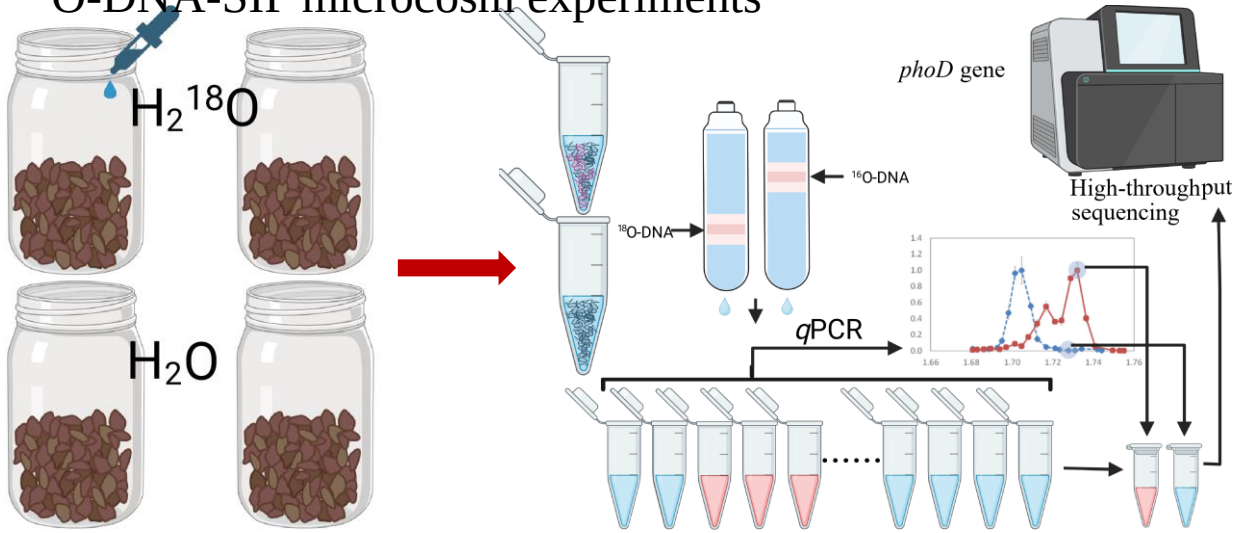
- How changes in the alkaline phosphomonoesterase producing bacterial diversity alter community stability under straw amendments has not been completely evaluated.

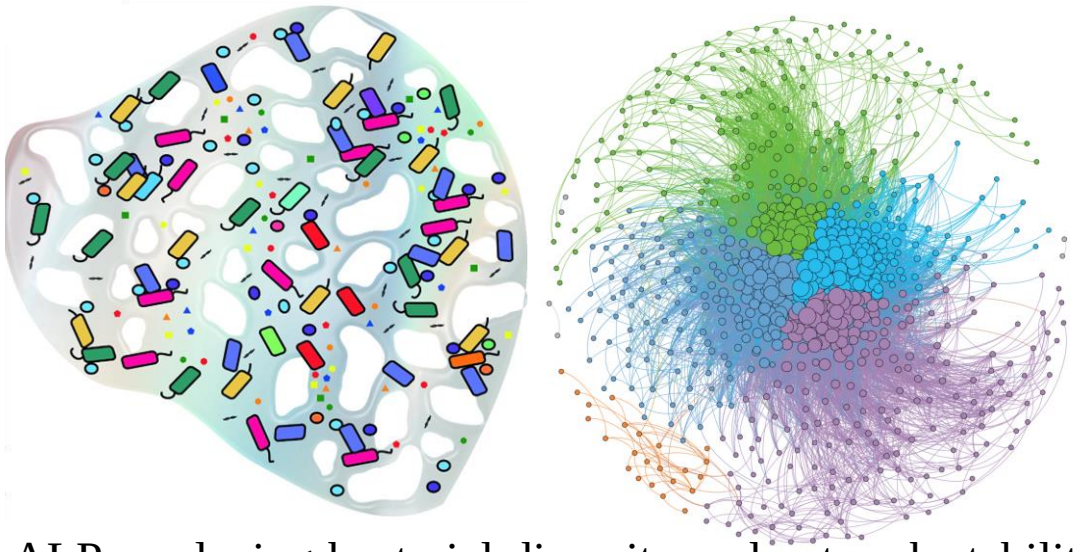
Experiment design

Field experiments beginning 2010



^{18}O-DNA-SIP microcosm experiments





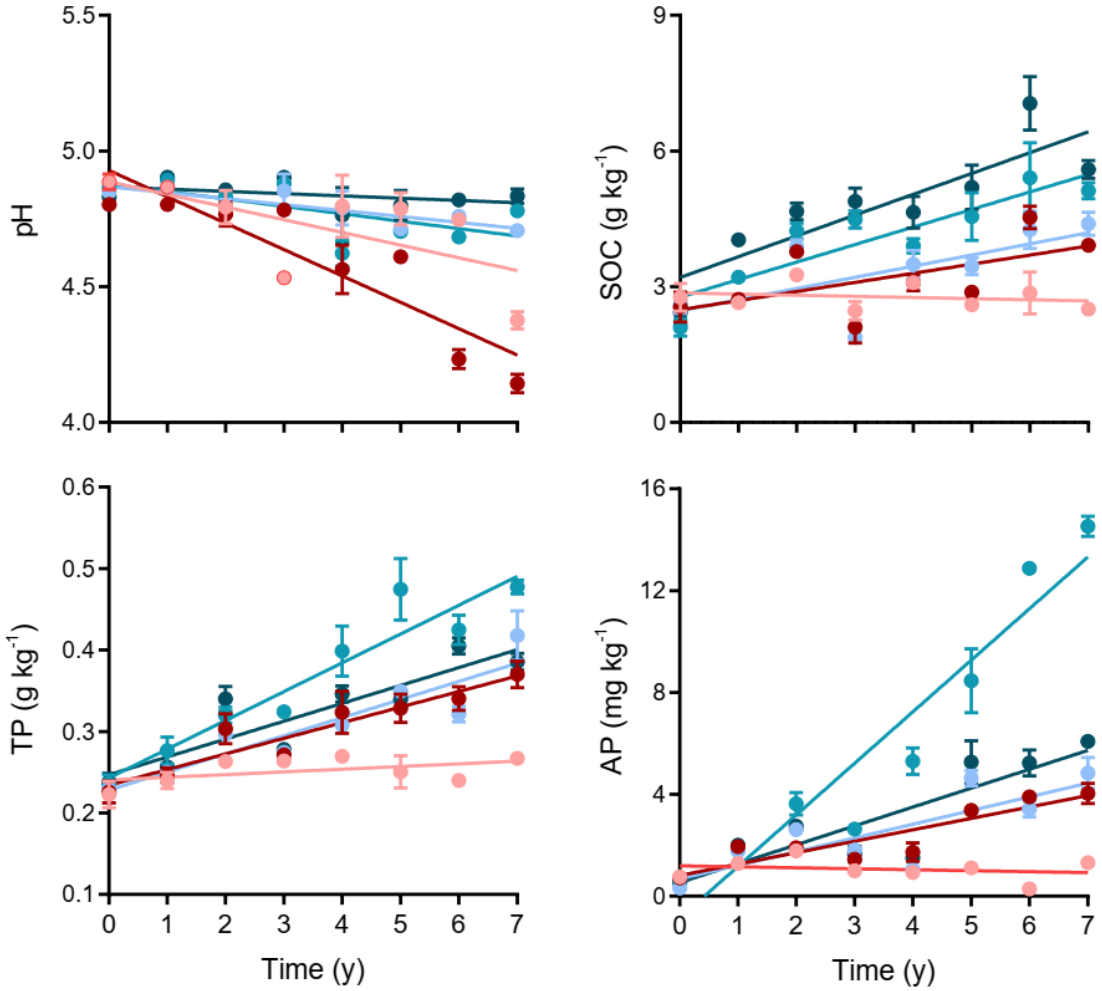
ALP-producing bacterial diversity and network stability impacts on soil function and group productivity.

Scientific questions

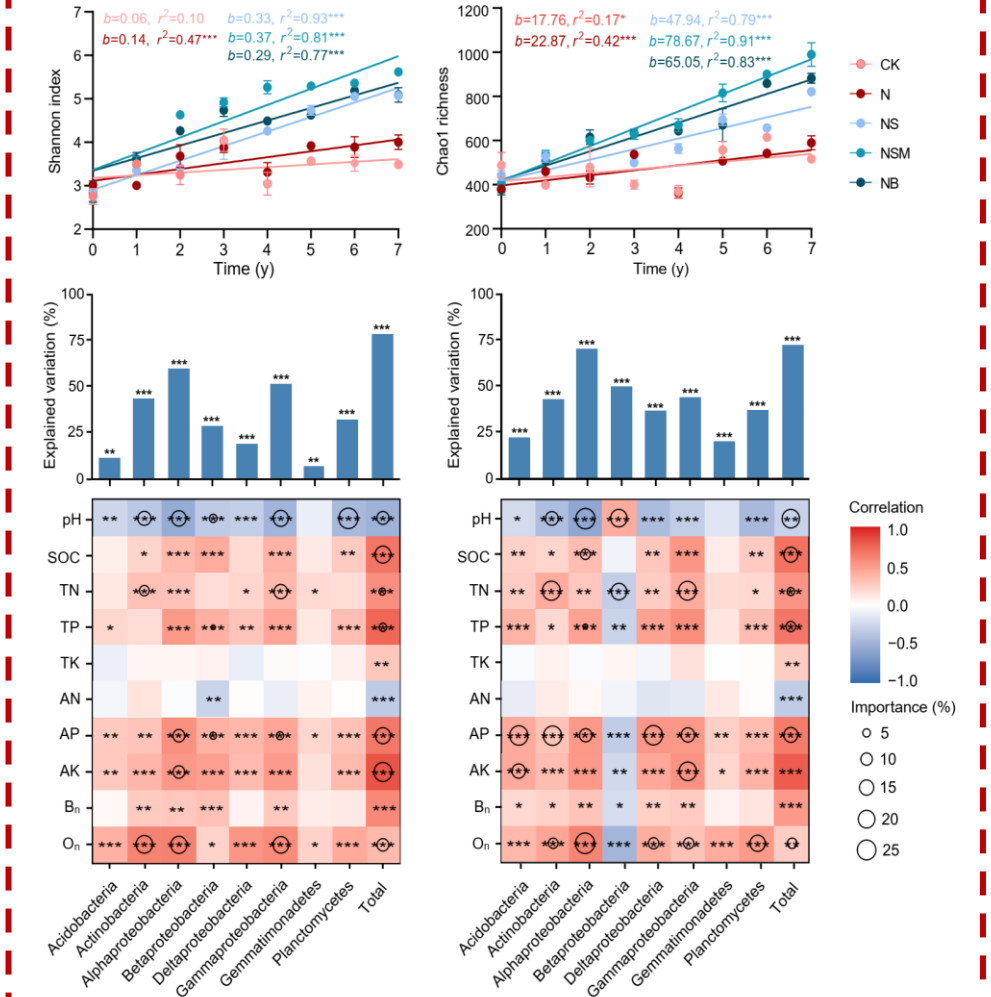
- how and to what extent different straw amendments affect the temporal turnover of ALP-producing bacterial community;
- how the observed patterns in the diversity of ALP-producing bacterial community connect with ecological succession and network stability;
- how the diversity and stability of ALP-producing bacterial community contribute to soil P cycling dynamics and maize yield.

Results

①Straw amendments diminished soil acidification and promoted soil fertility.



② Straw amendments increased soil ALP-producing bacterial diversity.



Results

①ALP-producing bacterial networks

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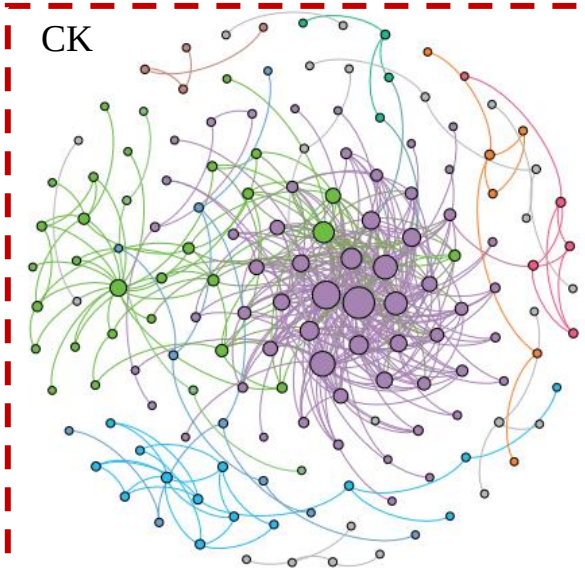
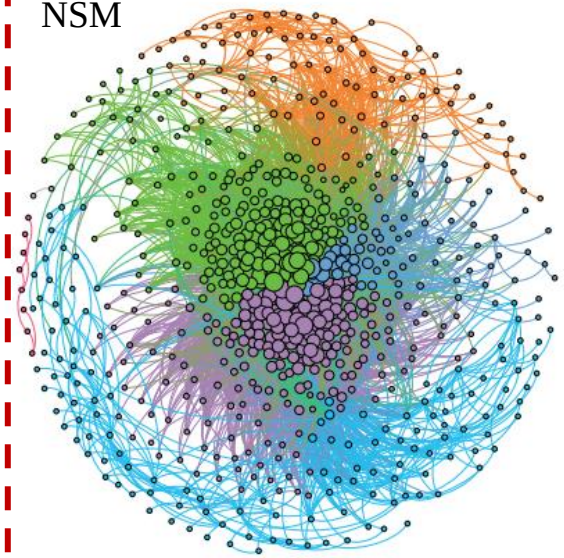
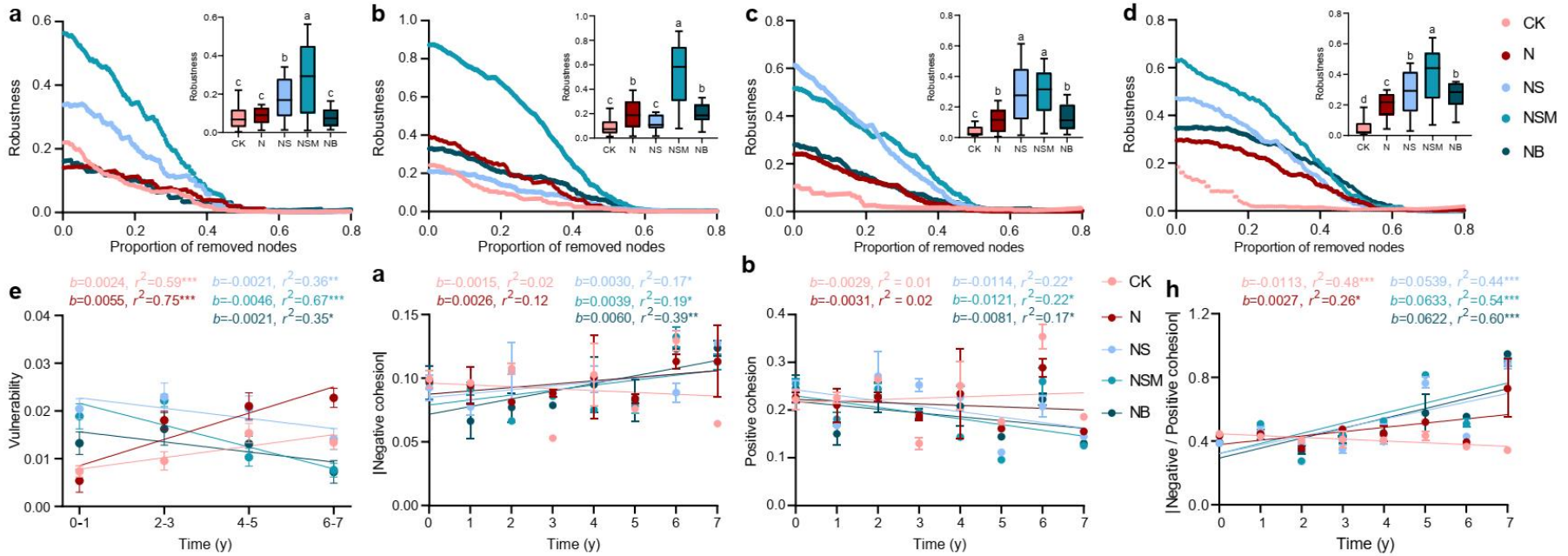


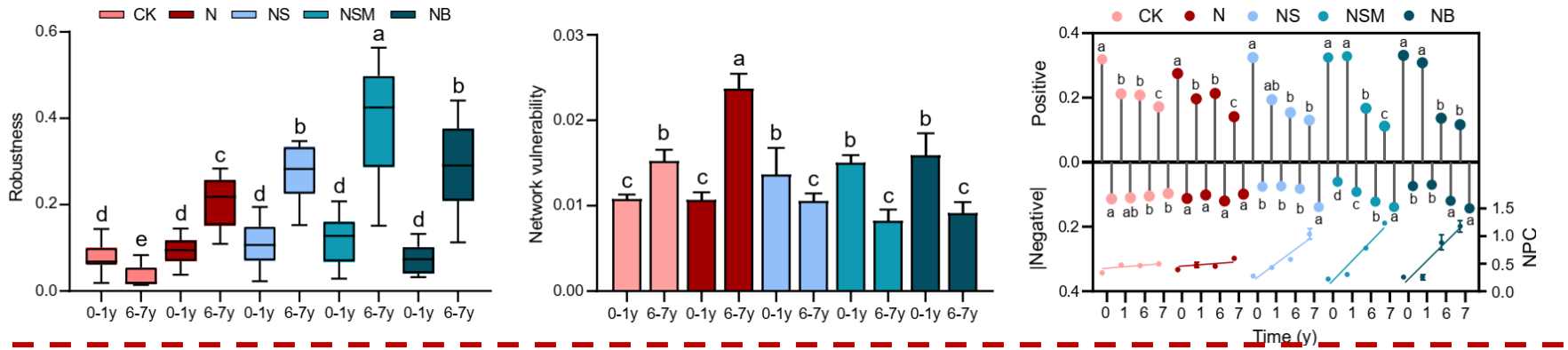
NSM



②Straw amendments elevated soil ALP-producing bacterial network stability and cohesion.



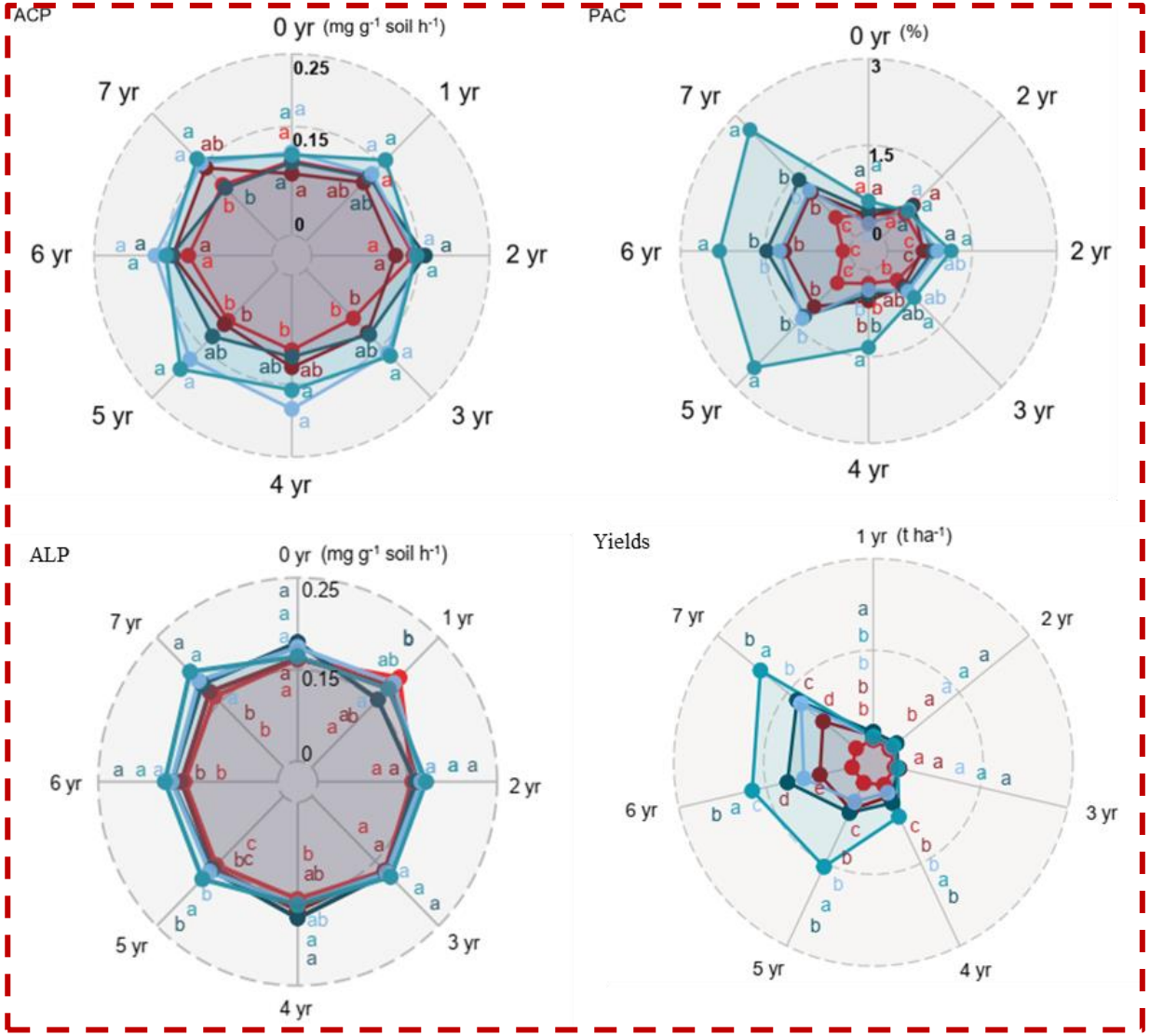
③DNA-SIP microcosm experiments demonstrated these assumptions.

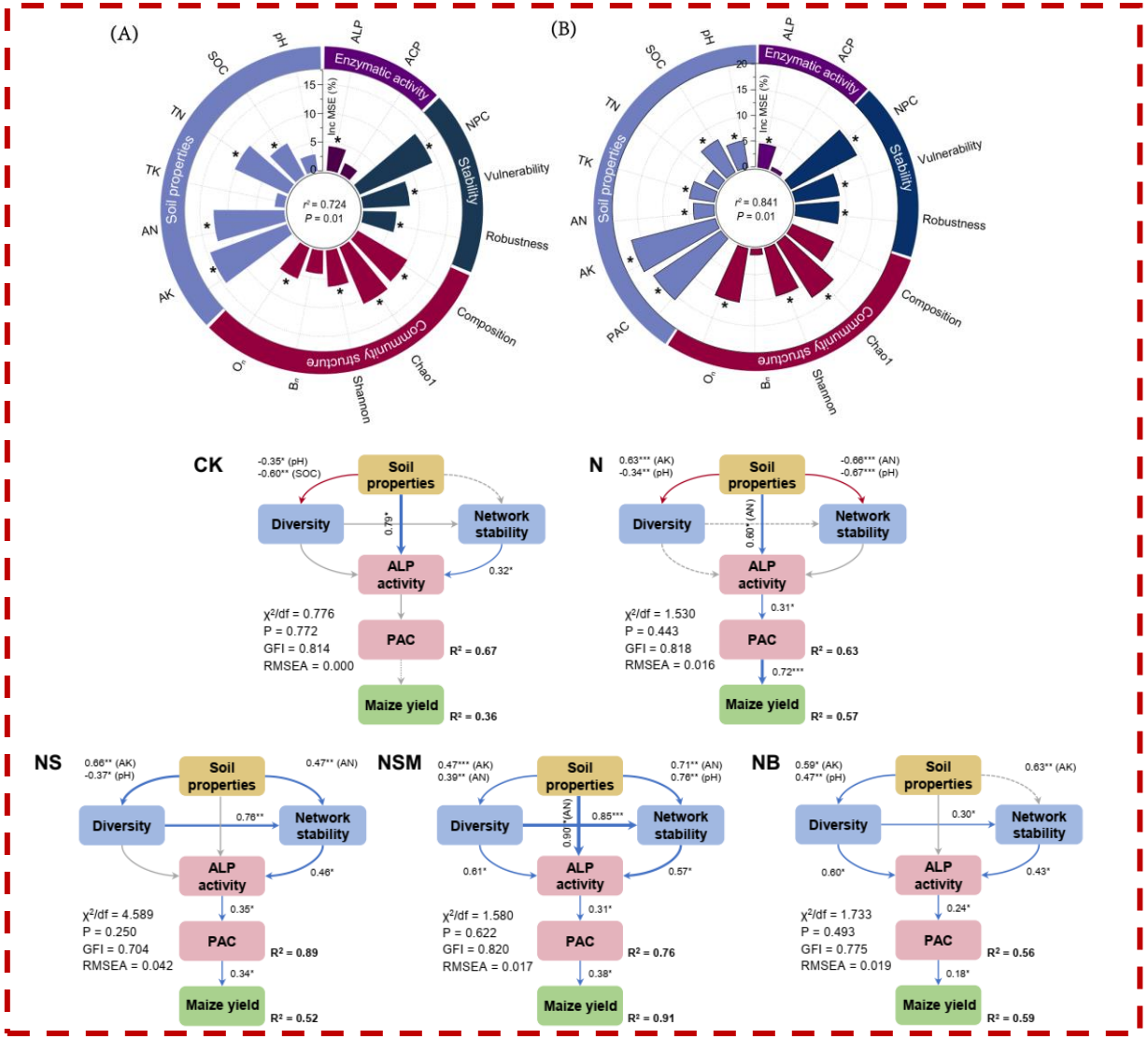


Results

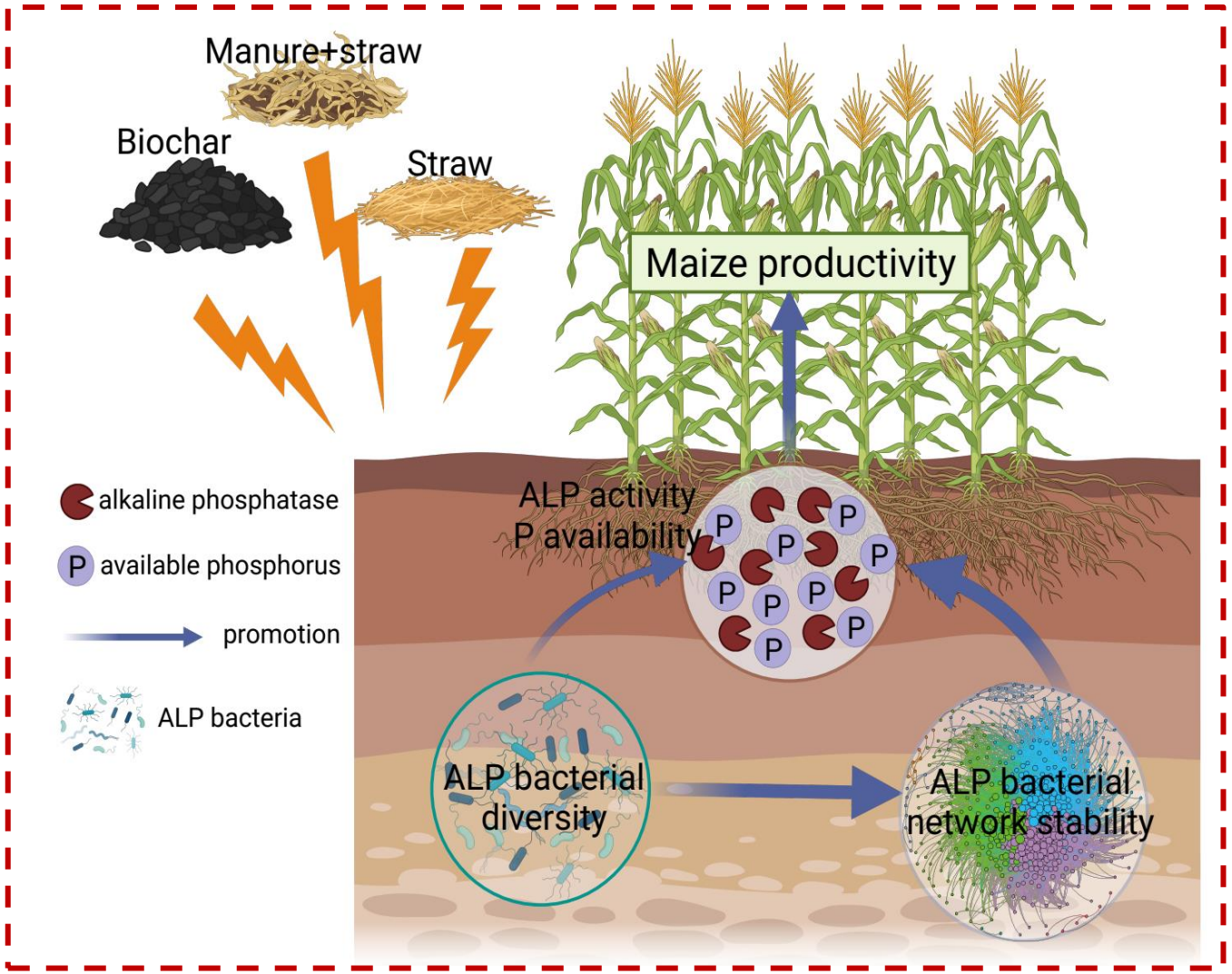
①Straw amendments increased soil PAC and maize productivity

②Random forest model combined with SEM reveal its mechanisms





Summary



- Straw amendments significantly improved the succession patterns of the ALP-producing bacterial diversity;
- Straw amendments significantly increased the network stability of the ALP-producing bacteria over time, as evidenced by higher robustness and NPC, while lower vulnerability;
- High dynamic and stability of ALP-producing bacterial community generated high ALP activity which further increased soil P availability as well as maize productivity.

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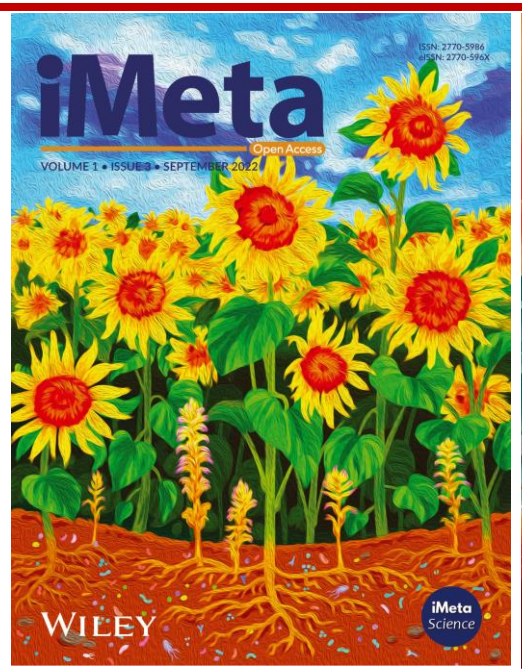

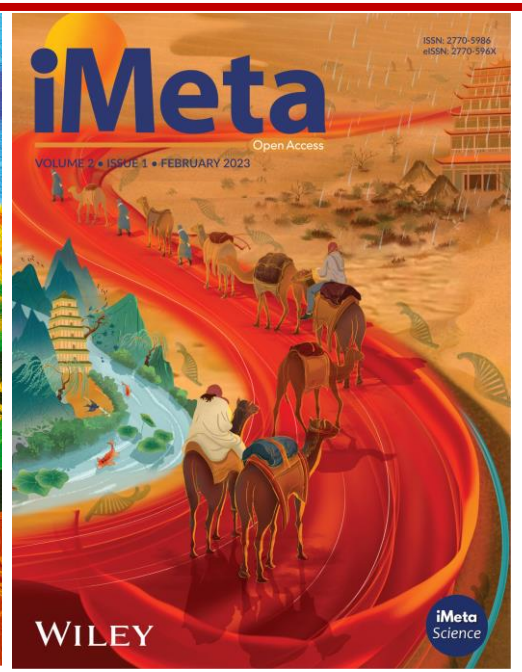

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