Challenges and opportunities for innovative research on legume nutrition and stress adaptation: an ecophysiologist's and phenotyping point of view

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Agroecology needs to reconcile agronomy and ecology, preserving and valorizing plant and microbe biodiversity. Legumes have merits for agroecology considering their ecological services. They constitute a protein source and their production relocation give merits for feed and food. However, they are still under represented due to both biotic and abiotic constraints. Research need to increase their profitability through higher and more stable yield and protein content, and new uses in a fluctuating environment [2].

Mechanisms which control nutrient use efficiency have to be highlighted i) considering nutrient acquisition, storage, remobilization [3] ii) under various conditions of water deficit or depressed nutrient availability, and iii) assessing plant and soil microbe interactions [4] which have important effects on the growth, nutrition and health of plants as well as on biogeochemical cycling.

This rely on using multidisciplinary approaches and different legume species, depending on the characteristics to be improved and available genetic and genomic resources. Some phenotyping platform under controlled conditions can modulate both plant genetics and microbiome. Phenotyping tools and methods involving also some "omic's" [5] can so generate large data sets concerning plant and possibly microbial traits. These are completed by environmental characterization which is part of phenotyping and need also both accurate tools and methods [6].

These data in turn feed models [7] which are crucial for a better understanding of plant physiological functions under various environmental conditions. This is essential to identify plants that are better adapted or resilient to stress and to characterize (beneficial) plant and microbiome interactions.

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