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The relationship between root colonization by arbuscular mycorrhiza (AM) fungi and phosphorus (P) fertilization remains controversial and soil characteristics are still rarely considered. To assess the contribution of AM to maize P nutrition in contrasted field conditions, a range of hybrids were grown at two contrasting P levels of a long-term P-fertilizer trial in two adjacent soil types: alkaline and neutral. Root colonization was assessed by microscopic observation and qPCR targeting two common AM species, *Funneliformis mosseae* and *Rhizophagus irregularis*. Functionality of AM colonization was assessed by measuring the expression of two P-transporters by qPCR.

Regardless of the soil type, AM root colonization was highest in the non-fertilized treatment compared to high-P fertilization. Looking closer, this drop was driven by the neutral soil and no variation was observed in the alkaline soil with P fertilization. The non-fertilized treatment was particularly harsh for maize development in the neutral soil, triggering the highest expression of the plant P starvation inducible gene (ZmPT1:3), coupled to the lowest plant growth and P content. Under these conditions, the mycorrhizal P uptake pathway was particularly activated with the highest expression of the AM inducible P transporter (ZmPT1;6). On contrary, its expression remained constant among fertilization levels in the alkaline soil.

The observed resilience to P fertilization in the alkaline soil could partially be due to high abundance of *F. mosseae*, which increased under P fertilization. Our results emphasize the importance of considering soil characteristics which differentially impacted AM symbioses and their implication in plant nutrition.

Keywords: phosphorus fertilization, long term-trial, molecular trait indicators, P transporter, qPCR