

STUDY OF THE ABILITY IN EXPLOITING ORGANIC P SOURCES BY THE FODDER CROPS ALFALFA AND MAIZE

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The increasing agricultural practice of applying animal effluent/digestate on crops can result in the accumulation of surplus P in soil and in P losses to water systems. The management of this surplus P would profit from new plant materials more effective in the uptake of the different P organic forms, particularly phytates, present in animal effluent/digestate.

Two fodder crop species are considered in our study: a) alfalfa (*M. sativa*) represented by the Italian landrace “Vogherese” originating from intensive cattle farming region; b) silage maize represented by a commercial hybrid and a traditional Italian population.

The hypothesis at the basis of the study was that the long dating adaptation to environments characterized by intensive cattle husbandry of alfalfa landrace and the selective history after vs before the customary use of mineral fertilizers in maize could have brought to different abilities in exploiting P sources for plant growth.

In a previous study ⁽¹⁾ *MsPHY1* (MSAD_287834 <https://www.alfalfatoolbox.org>) gene, homologous to *MtPHY1* ⁽²⁾ gene of *M. truncatula* encoding a root extracellular phytase, was identified and a pattern of adaptive response was found among two Italian landraces originating from intensive vs extensive cattle farming regions at both the genetic and agronomic levels. A SNP located in a conserved zone required for enzyme function was highlighted, putatively related to the ability in exploiting organic P sources. A second gene, (MSAD_281894 <https://www.alfalfatoolbox.org>) presenting 93% sequence identity with *MsPHY1* showed the same SN polymorphism. The sequence diversity of the two genes is currently

investigated in the “Vogherese” alfalfa landrace to test the consistency of the frequency distribution of the SNP. We are working to obtain synthetic populations starting from S2 plants homozygous/heterozygous for the alternative SNP970 alleles to test the efficiency of the individual plants in the uptake of different P sources.

The ability of maize to grow using organic P and in particular phytate as the principal P source is presently underexplored. The two maize populations were studied *in vitro* to test their ability to use organic P as the only P source for plant growth compared to mineral P, in a 28-day experiment. Maize was able to grow using phytate as the sole P source and a root released phytase activity was detected in plants grown on phytic acid. The two maize populations showed a pattern of differences in growth and in enzymatic activity with respect to the P sources, organic or mineral. These results suggest the presence in maize of root-released phytase/phosphatase enzymes that need to be identified and studied. RNAseq experiments are currently in progress to find candidate genes involved in the organic P exploitation by maize root.

- (1) Carelli, M. *et al.* *Plant Breeding*, 2020, 139:834–844.
- (2) Xiao, K. *et al.* *Planta*, 2005, 222: 27-36.