Poster

Assessing phosphorus availability to paddy rice: soil testing and plant responses

Martinengo S., Schiavon M., Santoro V., Said-Pullicino D., Celi L., Martin M.
Università degli studi di Torino – Dipartimento di Scienze Agrarie, Forestali e Alimentari

The optimization of P fertilization in paddy rice fields requires an accurate estimate of soil P availability to optimize both soil fertility and rice productivity. While there are several generally accepted methods to evaluate P availability to crops grown in aerobic soils, the P available pool in paddy soils cannot be so easily assessed. Phosphorus cycle in paddy soils is closely linked to Fe redox wheel and hence conditioned by the complex interactions between soil physicochemical characteristics, microbial activity and the mechanisms used by plants to promote P uptake. The aim of this study was the identification of a simple, suitable method for the estimation of P availability for rice plants while taking in account the complex and variable interactions between soil (bio)chemistry and plant responses.
Twelve paddy soils, differing for total P content, pH, texture, and organic C have been analyzed for available P with different methods (Olsen, Mehlich-3, anion exchanging resins, and oxalate). Rice plant were cultivated in the same soils for 60 days. The concentrations of Fe (II), MRP, and total P in the soil solution were analyzed weekly. At the end of the 60 days, the plant biomass produced, the P content in plant tissues and the activity of phytase and phosphatase enzymes in roots were measured.
Soil pore water analysis showed wide differences among soils for the concentration of dissolved phosphate. The concentration in solution increased during the first 3-4 weeks, following the same trend of Fe(II), then it tended to decrease, probably because of plant uptake, with more or less pronounced oscillations. The amount of P released in solution was slightly correlated with total P, but it was best predicted by resin extraction at all times. Oxalate, extracting the P pool bound to poorly ordered Fe oxides, was a good predictor only during the first week, then the correlation weakened as the Fe(II) concentration in solution stopped to increase. Both the production of dry matter and P concentration in the tissues was affected by soil P content. The extraction with resins was still the best predictor for plant productivity and P uptake. Phosphatase enzymes showed a greater activity than phytase in all cases; the former did not significantly differ among soils, while the latter were higher in those soils releasing more P in solution during the growing period.