



Phosphorus fractionation and distribution in Nitisols of the central Ethiopian highlands affects soil nutrient management strategies in barley (*Hordeum vulgare*L.) production

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Abstract

Optimizing nutrient management is essential for sustaining crop productivity on fertilizer-unresponsive acidic soils, particularly through a comprehensive understanding of soil phosphorus (P) dynamics. Phosphorus availability is often limited by soil physicochemical properties, necessitating site-specific amendment strategies. This study evaluated the status of inorganic P fractions and their response to various nutrient and soil amendment treatments in acidic Nitisols from Welmera and Ejere districts in the central Ethiopian highlands, with a focus on barley (*Hordeum vulgare*), a crop that is sensitive to low soil pH. Field and laboratory investigations revealed that strongly acidic soils responded positively to lime application combined with optimal P fertilization, resulting in significant yield improvements. In contrast, moderately to slightly acidic soils exhibited limited response to liming but showed enhanced productivity following organic amendments such as compost. Soil management strategies including the application of inorganic phosphorus fertilizers, increased barley yield to 3479 kg ha⁻¹. Additionally, soil amendments such as agricultural lime improved barley productivity by enhancing the availability of plant-accessible phosphorus. Sequential phosphorus fractionation revealed that iron-bound and occluded P fractions dominated the inorganic P pool, accounting for approximately 45% and 35% of total inorganic P, respectively. Higher level of aluminum-bound P was also observed in strongly acidic soils. Higher water-soluble P represented only about 3% of total inorganic P, highlighting the limited readily available P fraction. These findings emphasize the critical role of detailed P fractionation analysis in informing targeted nutrient management strategies to improve P availability, thereby supporting sustainable soil fertility and crop production, particularly barley under acidic soil conditions.

Biography

Matiyas Dejene has completed his MSc at the age of 30 years from University of Hawassa, Ethiopia in Soil Science specialization. He is the National coordinator of new fertilizer testing research program at Ethiopian Institute of Agricultural Research (EIAR). He has published more than 5 papers in reputed journals.

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