UNIVERSIDAD DE LA FRONTERA

Facultad de Ingeniería y Ciencias

Doctorado en Ciencias de Recursos Naturales

“ASSESSMENT OF THE PHOSPHORUS ACQUISITION RELATED ROOT TRAITS OF TWO WHEAT CULTIVARS DIFFERING ON EFFICIENCY: TOWARDS PHOSPHORUS SUSTAINABILITY”

DOCTORAL THESIS IN FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE DOCTOR OF SCIENCES IN NATURAL RESOURCES

PEDRO MONTESANO DE SOUZA CAMPOS

TEMUCO-CHILE

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“ASSESSMENT OF THE PHOSPHORUS ACQUISITION RELATED ROOT TRAITS OF TWO WHEAT CULTIVARS DIFFERING ON EFFICIENCY: TOWARDS PHOSPHORUS SUSTAINABILITY”

Esta tesis fue realizada bajo la supervisión del Dr. Fernando Ricardo Borie Borie perteneciente al Departamento de Ciencias Químicas y Recursos Naturales de la Universidad de La Frontera y ha sido aprobada por los miembros de la comisión examinadora.

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Thesis summary

"This Doctoral Thesis investigated wheat's phosphate acquisition efficiency (PAE) under limited phosphorus conditions. It studied root morphology, organic acid release, phosphatase exudation, phosphate transporter expression, and root mycorrhizal colonization as key mechanisms. The influence of strigolactones (SL) was also examined. Chapter I introduced objectives and hypotheses. Chapter II reviewed P-acquisition traits, emphasizing arbuscular mycorrhizal (AM) effects. Despite limited AM benefits in wheat, functional diversity, and trait interactions were highlighted. Chapter III assessed indigenous AM fungi effects on Chilean wheat genotypes with varying P-acquisition efficiency. The more efficient genotype showed lower mycorrhizal dependency and varied nutrient accumulation. Chapter IV (objective 2) identified root morphology as pivotal for P accumulation, alongside AM symbiosis and oxalate exudation. Chapter V (objective 3) explored strigolactone’s impact on P-starvation responses and acquisition. The efficient genotype exhibited higher Pi transporter expression and rapid IPS1–miR399–PHO2 modulation, likely due to elevated SL levels. These findings contribute insights for enhancing plant performance under P stress. Chapter VI provided a comprehensive discussion of the results."