

**UNIVERSIDAD DE LA FRONTERA**

Facultad de Ingeniería y Ciencias

Doctorado en Ciencias de Recursos Naturales



**THE EFFECTS OF COMBINED CITRUS WASTES-CATTLE  
MANURE ADDITION ON PHOSPHORUS AVAILABILITY IN  
SOIL AND ITS POTENTIAL USE AS A BIOFERTILIZER IN  
PASTURES**

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

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**CECILIA DE LOURDES PAREDES**

**NEGRÓN**

**TEMUCO-CHILE**

**2021**

**“The effects of combined citrus wastes-cattle manure addition on phosphorus availability in soil and its potential use as a biofertilizer in pastures”**

Esta tesis fue realizada bajo la supervisión de la directora de tesis, Dra. María Luz de la Mora del Núcleo Científico y Tecnológico en Biorecursos de la Universidad de la Frontera y ha sido aprobada por los miembros de la comisión examinadora.

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### **Thesis summary**

"Phosphorus and acid pH are major limiting factors for grass and crop production in the Andisols of Southern Chile. Agro-industrial waste-derived amendments may be used as substitutes for synthetic fertilizers to improve soil physicochemical and biological properties and crop production. This doctoral thesis investigated the combined effects of two different agro-industrially derived amendments, beef cattle manure (CM) and citrus wastes (CW), on phosphorus availability, soil biological properties, along with, plant nutrition, and antioxidant responses in ryegrass to evaluate their putative use as organic phosphorus fertilizers. The results showed that the combined amendment of CM+CW was more effective than each one used separately. The combined amendment enhanced the soil phosphorus availability and the liming effect on acid soils. Moreover, showed a beneficial effect on phosphorus acquisition and oxidative stress with a concomitant increase in plant productivity, indicating that the combined amendment could be used as an organic fertilizer to improve the soil fertility and sustainability of agricultural production systems"