

**UNIVERSIDAD DE LA FRONTERA**

Facultad de Ingeniería y Ciencias

Doctorado en Ciencias de Recursos Naturales



**MECHANISMS INVOLVED IN SILICON UPTAKE AND  
TRANSPORT, AND GENE EXPRESSION OF SILICON  
TRANSPORTERS IN RESPONSE TO ALUMINIUM  
TOXICITY IN RYEGRASS PLANTS**

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

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**SOFÍA VALESKA PONTIGO SEGUEL**

**TEMUCO-CHILE**

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**“Mechanisms involved in silicon uptake and transport, and gene expression of silicon transporters in response to aluminium toxicity in ryegrass plants”**

Esta tesis fue realizada bajo la supervisión de la Dra. PAULA CARTES INDO, perteneciente al Departamento de Ciencias Químicas y Recursos Naturales de la Universidad de La Frontera y es presentada para su revisión por los miembros de la comisión examinadora.

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**Dr. Dr. Andres Quiroz**  
**DIRECTOR DEL PROGRAMA DE**  
**DOCTORADO EN CIENCIAS DE**  
**RECURSOS NATURALES**

.....  
**Dra. Paula Cartes Indo**

.....  
**Dra. Alejandra**  
**Ribera Fonseca**

.....  
**Dra. María de la Luz Mora**

.....  
**Dra. Monica Rubilar**  
**DIRECTOR ACADÉMICO DE**  
**POSTGRADO**  
**UNIVERSIDAD DE LA FRONTERA**

.....  
**Dra. Ana Gutiérrez Moraga**

.....  
**Dra. Liliana Cardemíl**

.....  
**Dr. Luis Corcuera**

## **Thesis summary**

"Silicon (Si) is known to benefit plants, particularly under stress, by accumulating in them. Understanding the mechanisms of Si uptake and transport is crucial for its beneficial effects in agriculture. Si is seen as a sustainable option to combat Al stress, a major issue for Southern Chilean crop production. The study focused on ryegrass, comparing Si uptake and effects under Al toxicity in two cultivars (Al-sensitive, Jumbo; Al-semi-tolerant, Nui). Si uptake was higher in Jumbo, especially short-term, with potential differences in Si transport proteins. Two potential Si transporter genes (LpLsi1 and LpLsi2) were identified and expressed in roots, with their expression reduced by Si supply. Si also counteracted Al effects on ryegrass, reducing Al concentration, improving root growth, and enhancing antioxidant activity, suggesting a possible cultivar-specific Si requirement or regulatory elements. This research sheds light on Si's role in enhancing plant tolerance to Al stress through both physiological and molecular mechanisms."