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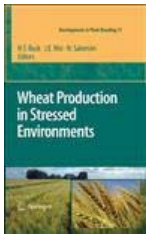

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Wheat Breeding for Soil Acidity and Aluminum Toxicity

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Developments in Plant Breeding

Wheat Production in Stressed Environments
Proceedings of the 7th International Wheat Conference, 27 November–2 December 2005, Mar del Plata, Argentina

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Abstract

The soils of southern and central-southern Chile where the national wheat production is concentrated are of volcanic origin, with low pH and with high exchangeable aluminum. Soils contain large amounts of phosphorous in organic form, however available phosphorous is low. The high content of free Al negatively affects the root growth of wheat varieties depending on their Al-sensitivity or Al-tolerance. The mechanism of tolerance is exclusion of toxic Al as a consequence of root excretion of queelant organic acids; roots of tolerant varieties are also protected by higher root mycorrhizal colonization. Crosses between sensitive and tolerant material and subsequent selection under low pH and high Al have produced high yielding tolerant cultivars. This paper outlines the development of tolerant wheat varieties, describes the germplasm used and discusses the selection process including including the use of growth chambers, greenhouse assays and field experiments

Keywords Al-tolerant varieties - citric acid - rhizosphere - mycorrhizal colonization - segregant material

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Keywords: Al-tolerant varieties, citric acid, rhizosphere, mycorrhizal colonization, segregant material

INTRODUCTION

The soils of southern and central-southern Chile (35 °S to 42 °S), are of volcanic origin and characterized by high acidity (pH range from 4.5 to 6) and high aluminum saturation approaching 30% without lime and 0–18% with applied lime. Nutrient availability including P is low. These constrictive characteristics are known as the soil acidity complex which often creates a chemical barrier reducing root growth and development; these roots become inefficient in absorbing nutrients and water (Reynolds et al. 2001).

Despite this, volcanic soils contain high levels of total P (2,000 to 4,000 mg kg^{-1}) but the availability of this nutrient is low (5–20 ppm) The unavailability of P to

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