Tropentag, September 14-16, 2010, Zurich

"World Food System —
A Contribution from Europe"

Exploiting the Diversity of Adaptation Mechanisms for Site-specific Management of Iron Toxicity Stress in Lowland Rice

Mathias Becker[1], Folkard Asch[2]

[1] *University of Bonn, Institute of Crop Science and Resource Conservation (INRES) - Plant Nutrition, Germany*

[2] *University of Hohenheim, Dept. of Plant Production and Agroecology in the Tropics and Subtropics, Germany*

Abstract

Iron toxicity is an abiotic stress affecting lowland rice on an estimated 18 Mio hectares. Crop damage and yield losses imply the occurrence of excessive amounts of Fe(II) in the soil solution, its uptake and acropetal translocation in the xylem and its movement into the leaf symplast. There, Fe(II) catalyzes reactive oxygen species, which can damage cell membranes and structural components. The amount and the time of occurrence of toxic Fe(II) in the soil solution differs between environments and soil types. The intensity of iron stress in the plant varies seasonally and further depends on the phenological stage of rice. The severity of symptom expression and yield loss is additionally determined by genotype characteristics and prevailing stress tolerance mechanisms. Such mechanisms may involve the exclusion of potentially toxic Fe(II) from the root or the leaf symplast, or the detoxification of included Fe(II) in plant tissues.

Consequently, different types of iron toxicity (intensity, duration, time of occurrence) occur depending on environmental factors (climate, season, soil, landscape structure). These Fe toxicities differentially affect rice plants, depending on the level of stress tolerance and the type of adaptation mechanism. There is a need to match iron stress types with effective mechanisms to effectively counteract conditions of iron toxicity. This paper synthesizes the current state of knowledge on the occurrence of Fe toxicity in different environments, presents recent research findings on plant physiological mechanisms of stress adaptation, and proposes ongoing and future research involving molecular marker studies and the environment-specific targeting and extrapolation of promising genotypes.

Keywords: , Fe(II)/Fe(III), *Oryza sativa*, oxidative stress, QTL

Contact Address: Mathias Becker, University of Bonn, Institute of Crop Science and Resource Conservation (INRES) - Plant Nutrition, Karlrobert-Kreiten-Str. 13, 53115 Bonn, Germany, e-mail: mathias.becker@uni-bonn.de