Distribution of silicified microstructures, regulation of cinnamyl alcohol dehydrogenase and lodging resistance in silicon and paclobutrazol mediated Oryza sativa

ABSTRACT

Lodging is a phenomenon that affects most of the cereal crops including rice, *Oryza sativa*. This is due to the fragile nature of herbaceous plants whose stems are non-woody, thus affecting its ability to grow upright. Silicon (Si), a beneficial nutrient is often used to toughen and protect plants from biotic and abiotic stresses. Deposition of Si in plant tissues enhances the rigidity and stiffness of the plant as a whole. Silicified cells provide the much needed strength to the culm to resist breaking. Lignin plays important roles in cell wall structural integrity, stem strength, transport, mechanical support, and plant pathogen defense. The aim of this study is to resolve effects of Si on formation of microstructure and regulation of cinnamyl alcohol dehydrogenase (CAD), a key gene responsible for lignin biosynthesis. Besides evaluating silicon, paclobutrazol (PBZ) a plant growth retartdant that reduces internode elongation is also incorporated in this study. Hardness, brittleness and stiffness were improved in presence of silicon thus reducing lodging. Scanning electron micrographs with the aid of energy dispersive x-ray (EDX) was used to map silicon distribution. Presence of trichomes, silica cells, and silica bodies were detected in silicon treated plants. Transcripts of CAD gene was also upregulated in these plants. Besides, phloroglucinol staining showed presence of lignified vascular bundles and sclerenchyma band. In conclusion, silicon treated rice plants showed an increase in lignin content, silicon content, and formation of silicified microstructures.

Keyword: CAD; SEM-EDX; Lignin; Lodging; Rice; Silicon