PHENOTYPIC RESPONSES OF RICE (*ORYZA SATIVA* L. SUB. INDICA) TO SALT STRESS CONTROLLED BY ENVIRONMENTAL ENGINEERING SYSTEM

SURIYAN CHA-UM 4236951 SCBT/D

Ph.D. (BIOTECHNOLOGY)

THESIS ADVISORS: KANYARATT SUPAIBULWATANA, Ph.D. (PLANT BIOTECHNOLOGY), CHALERMPOL KIRDMANEE, Ph.D (HORTICALTURAL ENGINEERING), THARATHORN TEERAKATHITI, Ph.D. (PLANT PHYSIOLOGY), GOPALAN SELVARAJ, Ph.D. (PLANT BIOTECHNOLOGY)

ABSTRACT

Salinity is one of the major problems that directly damage the plant cells and further inhibit the water use efficiency in plants, resulting in low growth rate and low productivity. Rice plant responses to salt stress is known to involve multifunction mechanisms, which are dramatically regulated by various environmental factors. To reduce the uncontrolled environmental signals, the phenotypic response of rice plants under salt stress were investigated under an *in vitro* environmental engineering system by using rice (*Oryza sativa* L. sub. indica) as a model plant. The phenotypic rice seedlings grown under a photoautotrophic system significantly expressed a response to salt stress more than those grown under a photomixotrophic system. Low relatively humidity (RH) and acidic pH conditions in the system caused severe symptoms of salt stress in the plants. The regulation of glycinebetaine (Glybet), a form of quaternary ammonium compounds that help to stabilize the osmotic potential of plant cells, was studied. The application of exogenous Glybet could promote the uptake of this compound to the cell and result in enhancement of water use efficiency and net photosynthetic rate (NPR) of the seedlings more than those applied with exogenous choline (Cho) and control, respectively. It was found that among the salt-tolerant and salt-sensitive lines of aromatic rice, different amounts of Glybet as well as the activity of BADH (Betaine aldehyde dehydrogenase) enzyme was obviously observed. The salt-tolerant line presented higher Glybet accumulation with high BADH activity more than those of salt-sensitive rice. Identification of salt stress response between them could be clarified by different parameters such as NPR, pigment degradation, respiration rate and stomatal conductance. Under the photoautotrophic environmental engineering system, the effect of each environmental factor such as pH and %RH could be observed without an interfering effect of other signals as presented normally in the field. The realistic expression in both of salt-sensitive and salt-tolerant lines of rice plant to salt stress under the environmental engineering system may represent the exact response and be applied for use in other crop species.

KEY WORDS: ENVIRONMENTAL ENGINEERING SYSTEM / GLYCINEBETAINE / PHOTOSYNTHETIC SYSTEM / PHENOTYPIC EXPRESSION / RICE / SALINITY

122 pp. ISBN 974-04-4932-8