Alleviation of water stress effects on MR220 rice by application of periodical water stress and potassium fertilization

ABSTRACT

The use of periodical water stress and potassium fertilization may enhance rice tolerance to drought stress and improve the crop's instantaneous water use efficiency without much yield reduction. This study was conducted to assess the effects of different periodical water stress combined with potassium fertilization regimes on growth, yield, leaf gas exchanges and biochemical changes in rice grown in pots and compare them with standard local rice grower practices. Five treatments including (1) standard local grower's practice (control, 80CF = 80 kg K2O/ha + control flooding); (2) 120PW15 = 120 kg K2O/ha + periodical water stress for 15 days; (3) 120DS15V = 120 kg K2O/ha + drought stress for 15 days during the vegetative stage; (4) 120DS25V = 120 kg K2O/ha + drought stress for 25 days and (5) 120DS15R = 120 kg K2O/ha + drought stress for 15 days during the reproductive stage, were evaluated in this experiment. Control and 120PW15 treatments were stopped at 100 DAS, and continuously saturated conditions were applied until harvest. It was found that rice under 120PW15 treatment showed tolerance to drought stress evidenced by increased water use efficiency, peroxidase (POX), catalase (CAT) and proline levels, maximum efficiency of photosystem II (fv/fm) and lower minimal fluorescence (fo), compared to other treatments. Path coefficient analysis revealed that most of parameters contribute directly rather than indirectly to rice yield. In this experiment, there were four factors that are directly involved with rice yield: grain soluble sugar, photosynthesis, water use efficiency and total chlorophyll content. The residual factors affecting rice yield are observed to be quite low in the experiment (0.350), confirming that rice yield was mostly influenced by the parameters measured during the study.

Keyword: Water stress; Rice production; Periodical water stress; Potassium fertilization; Leaf gas exchanges; Biochemical changes; Chlorophyll fluorescence