“Drought Stress Memory of the Seed of Rice (*Oryza sativa* L.) in response to Seed Priming Treatment”

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Seed priming may improve germination performance of rice under drought stress. This might indicate the presence of drought stress memory in the primed seeds. To elucidate possible physiological mechanism of drought stress memory in primed seeds, we determined the seeds biochemical changes during priming and post-priming germination under drought. The experiment was conducted using three factorials completely randomized design (CRD) with three replications. Factors involved were rice cultivar as the first factor, seed priming treatment as second factor and drought stress treatment as third factor. Rice cultivars used were IR64 (V1) and MR297 (V2). Seed priming treatments were non-primed seeds as control (T1), hydropriming (T2), osmopriming with 15% PEG6000 at -0.3 mPa (T3), osmopriming with 30% PEG6000 at -1.0 mPa (T4), and osmopriming with 45% PEG6000 at -2.2 mPa (T5). The drought stress treatments were 0 mPa as control (S1), -0.2 mPa (S2), -0.4 mPa (S3), -0.6 mPa (S4), and -0.8 mPa (S5), respectively. In general, results of the present study indicated the involvement of proline in the recruitment of drought stress memory in the primed seeds of rice. Proline accumulation was significantly higher in the primed seeds mainly T3 and T4 immediately after priming, during re-dried process, and during germination process under severe drought at -0.8 mPa. Proline would act and function as an osmolyte in maintaining normal osmotic condition and biochemical processes of the cell under drought stress. The proline was also significantly correlated with the α-amylase activity and starch content of the seeds. Higher α-amylase activity in the primed seeds would accelerate the process of starch hydrolysis into soluble sugar for further embryo growth and development. As result, the primed seeds of T3 recorded significantly higher germination performance while the T4 recorded significantly higher root length and total seedling length under severe drought. In addition, protein profiling analysis revealed small size protein of 35 kDa which was highly accumulated in the T4 as compared to other seed priming treatments. However, detailed classification and identification of the 35 kDa protein could not be confirmed in the present study due to limitation of the 1D-GE analysis. Therefore, further study using two-dimensional gel electrophoresis (2D-GE) approach could be conducted to specifically identify the up-regulated and down-regulated proteins during priming and post-priming germination under drought stress and to classify the type of 35 kDa protein observed in the present study. Clear understanding on the physiological mechanism of drought stress memory in the primed seeds of rice could potentially be translated into further field application of seed priming on confronting climate change challenges especially during prolong drought stress in the early planting season of rice.

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