IDT6-015 | Yield stability under reproductive-stage drought stress in Swarna/Moroberekan advanced backcross introgression lines (BILs) of rice

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Drought is one of the major abiotic stresses frequently affecting rice yield in many rainfed environments. Evaluation of breeding lines under both irrigated control and drought stress conditions would be useful in identifying lines that possess stable yield across the two conditions. In the present study, breeding lines were developed from a cross between Moroberekan, a drought-resistant tropical japonica variety with poor yield potential, and Swarna, a popular semi-dwarf indica variety that shows high yield potential. Advanced backcross introgression lines derived from the Swarna x Moroberekan cross and carrying *qDTY3.2* were then evaluated under both non-stress and reproductive-stage drought during the wet and dry seasons from 2012 to 2015 at the IRRI-South Asia Hub, ICRISAT, India. An initial population of 420 BC2F3 lines in 2012 was subsequently reduced to seven in the year 2015 by repeated selections. Drought stress was imposed at the onset of the reproductive phase and maintained until grain filling by withholding irrigation until water table depth reached 100 cm below ground level to cause severe leaf rolling in more than 50% lines including susceptible checks. The control trials were watered on a daily basis till crop maturity. Observations on days to flowering, plant height and grain yield were recorded. Promising lines yielding up to 1.5 to 2.0 t/ha under severe drought stress with yields of more than 5.0 t/ha under irrigated control and stable performance over the years were identified.

IDT6-016 | Characterization of low Ca2+ stress-induced embryo apoptosis response genes and their regulation of embryo development

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Ca2+ deficiency in soil induces early embryo abortion in peanut, producing empty pods, or ill-filled pods, especially under drought condition, which is a general problem. However, the underlying mechanism remains unclear. In this study, embryo abortion was characterized to be caused by apoptosis marked with cell wall degradation. Using a method of SSH cDNA libraries associated with library lift (SSHaLL), 62 differentially expressed genes were isolated from young peanut embryos, which were classified to be stress responses, catabolic process, carbohydrate and lipid metabolism, embryo morphogenesis, and regulation. The cell retardation with cell wall degradation was caused by up-regulated cell wall hydrolases and down-regulated cellular synthases genes. Two *CYP707A4* genes, encoding abscisic acid (ABA) 8′-hydroxylases, key enzymes for ABA catabolism, were up-regulated by 21-fold under Ca2+-deficient conditions, reducing the ABA level in early embryos. Over-expression of *AhCYP707A4* in *Nicotiana benthamiana* showed a phenotype of low ABA content with high numbers of aborted embryos, small pods and less seeds, which confirms that *CYP707A4* is a key player in regulation of Ca2+ deficiency-induced embryo abortion via ABA-mediated apoptosis. The results elucidated the mechanism of low Ca2+-induced embryo abortion. A set of varieties with different sizes of pods were evaluated for their tolerance to calcium stress, and we found that big pod varieties showed less tolerance to low calcium and more easy to produce ill-filled pods or empty pods. Drought will make worse of the phenomenon. Soil supplied with rich calcium will improve the pods filling and greatly reduce number of empty pods. We conclude big-pod varieties easier to produce empty pods are also associated with calcium level in the soil.