

**SCREENING OF RICE GERMPLASM FOR RESPONSE TO
DROUGHT AT REPRODUCTIVE STAGE UNDER
DROUGHT STRESS CONDITIONS ***

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INTRODUCTION

Drought stress is a major constraint of rice production and yield stability in rainfed ecosystems in the world. According to the rice cultivation statistics in 2013 around 40% of rice growing area in Sri Lanka came under rainfed cultivation (Agstat, 2014). Due to global climatic changes most of the rice growing areas will be prone to drought. Punyawardana *et al.* (2013) stated that the dry zone of Sri Lanka begins to experience more dryer periods by the year 2015. Therefore, development of drought tolerant rice varieties would be one of the strategies to stabilize rice production in the country.

The time of drought stress in relation to the stage of crop development and severity of drought mainly influence grain yield. Based on the previous studies flowering is the most sensitive stage for drought and drought at this stage considerable yield loss can be observed. Traditional cultivars are highly adapted to the diverse biotic and abiotic stresses for their survival. Sri Lanka has a rich genetic diversity of rice and most of the traditional germplasm have been conserved at the Plant Genetic Resources Centre (PGRC). However, information on specific adaptations are lacking for these conserved germplasm.

* See "Tropical Agriculturist" Volume 164 for details.

MATERIALS AND METHODS

Present study was conducted to screen selected traditional rice germplasm, which have been conserved at the PGRC, for drought stress at the reproductive stage using primary and secondary traits under induced drought stress conditions and compare with unstressed conditions under plant house and field conditions. Forty six rice accessions including 34 traditional germplasm, 4 improved varieties, 7 drought tolerant exotic varieties and one wild relatives of rice (*Oryza eichingari*) were used as planting materials for this study and they were evaluated for response to drought under induced water stressed condition at the reproductive stage, which is the most critical stage for drought stress. One plant house trial and two field trials were conducted for germplasm screening. The plant house trail was established using one meter long PVC pipes in a Randomized Complete Block Design with two replicates. A water stress was induced at early booting stage while control treatment was maintained under unstressed condition. Drought linked above ground traits and root traits were investigated according to the procedure given by Yue *et al.* (2006). Analysis of Variance, correlation analysis and Broad sense heritability (H) were computed to study the drought responses of these accessions.

RESULTS AND DISCUSSION

Tested rice germplasm significantly varied with respect to drought linked traits. Different adaptation mechanisms were shown by different accessions for their survival under water stress condition. Based on the relative performances among accessions, significant morphological variations, both in above and below ground traits, were observed. Different adaptation mechanisms such as good root system, less reduction in spikelet fertility and harvest index, maintenance of good plant biomass and comparatively more days for leaf rolling were observed with different accessions for their survival under water stress condition.

Wild relative of rice *O eichingari* showed the highest adaptation for the drought condition. Traditional accessions Podi niyanwee, Goda heenati (4049), Alwee (4919), Alwee (4023), Mada al Galle, improved accession Bg300, Ld 12-38 and exotic accessions Kinandang Patong, DSN11 and DSN37 performed well under induced drought conditions. Suwandel, Rathnawalu, Nona Bokra and Rathu

Heenati showed significantly inferior performances under drought conditions. Lafitte *et al.* (2000) stated that supplying of water about a period of 14 days from 10 days before flowering until 4 days after flowering can reduce yield by 20-40% when compared to the fully irrigated control. Even relatively mild stress at this stage has a large impact on grain yield.

Correlation analysis revealed that the spikelet fertility, harvest index, grain weight and spikelet per panicle significantly contributed to yield stability under drought stress conditions. High correlation was observed between spikelet fertility and delayed leaf rolling. No significant correlations were observed between yield and root traits. Selected accessions can be utilized as donor parents for development of high yielding rice varieties for low moisture stress conditions.

Broad scene heritability of yield, spikelet fertility, harvest index, root length and total root volume below 30 cm depth under stressed condition were high and it is comparable with heritability under non stressed conditions. Heritability of total biomass and total root volume were lower under water stressed condition than that of under control condition. This indicated that traits these traits are partly influenced by the environment and the environment influence are comparatively higher under drought conditions. Thus drought tolerance can be improved by selecting for relative yield, spikelet fertility, harvest index and drought induced root volume below 30 cm depth.

CONCLUSIONS

Wild relative of rice *O eichingari* showed the highest adaptation for the drought conditions, whilst traditional accessions Podi niyanwee, Goda heenati (4049), Alwee (4919), Alwee (4023), Mada al Galle, improved accession Bg300, Ld 12-38 and exotic accessions Kinandang Patong, DSN11 and DSN37 performed well under induced drought conditions. These promising accessions can be utilized as donor parents in rice improvement programs for drought tolerance.

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