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EXTENDED ABSTRACTS

Water stress induced nitrogen redistribution to root improves nitrogen use efficiency at the vegetative stage of rice (Oryza sativa L.)

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ABSTRACT

Water stress occurs when the demand for water exceeds the available amount during a period or when poor quality restricts its use. Water stress causes deterioration of freshwater resources in terms of quantity (aquifer over-exploitation, dry rivers, etc.). The water stress challenges all actors across all sectors. this is often often a naturally a critical environmental issue, with depleting groundwater levels. it's a huge political challenge for the authorities because the municipalities face an ever-increasing water demand from the citizens and thus got to address an increasing supply gap. Water and nutrient availability are two major constraints in most rice-based rainfed shallow lowland systems of Asia. Both stresses interact and contribute to the low productivity and widespread poverty during this environment. the target of this study was to reinforce the understanding of interaction between the two factors and to identify varietal characteristics beneficial for productivity during a water- and nutrient-limited rice environment. For this purpose, we screened 19 rice genotypes adapted to different rice environments under two water and two nutrient treatments during the wet season of 2004 and 2005 in southern Luzon, Philippines. Across all genotypes tested and as compared with the irrigated control, rainfed conditions reduced grain yield of the treatment without N application by 69% in 2004 and by 59% in 2005. The mean nitrogen fertilizer response was highest within the dryer season of 2004 and thus the rainfed treatment, indicating that water stress had no effect on fertilizer response. Nitrogen application reduced the relative yield loss to 49% of the irrigated treatment in 2004 and to 52% of the irrigated treatment in 2005. Internal efficiency of N (IEN) and recovery efficiency of applied N (REN) were significantly different between genotypes but weren't suffering from water availability (REN) or by water and nutrient availability (IEN). In contrast, grain yield and total N uptake were suffering from cultivar, N and water availability. Therefore, germplasm for rainfed environments should be screened under conditions of limited and good nitrogen and water supplies. The four best cultivars, CT6510-24-1-2, IR55423-01, IR72, and IR57514-PMI5-B-1-2, performed well across all treatments and both years. aside from IR72, they were all characterized by medium height, medium duration, high early vigor, and a moderate level of drought tolerance. this mixture of characteristics seems to enable the optimal use of limited water and nutrient resources occurring in many shallow rainfed lowlands. We also concluded that moderate drought stress doesn't necessarily affect the response to moderate N rates, if drought doesn't induce high spikelet sterility which fertilizer N is correctly managed. N are often easily transported from old organs to developing organs for reutilization. N remobilization between organs is critical for top nitrogen use efficiency (NUE) at whole-plant level. Two hybrid rice cultivars japonica ‘Yongyou 538’ and indica ‘Zhongzhou 1’ were hydroponically cultivated at low N (LN, 0.71 mM) and enough N (SN, 2.86 mM). The imposition of water stress, which was induced by 100 g.L-1 PEG 6000, resulted during an increase of NUE in ‘Yongyou 538’, but a discount in ‘Zhongzhou 1’. Water stress reduced nitrate and ammonium uptake and accumulation in ‘Yongyou 538’, whereas nitrate and ammonium uptake in

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‘Zhongzhou 1’ wasn't significantly affected. Contrary to ‘Yongyou 538’, ‘Zhongzhou 1’ accumulated more ammonium in roots under water stress. additionally , water stress caused an increase in catabolism of carbon in roots of ‘Zhongzhou 1’, as indicated by increased root activity, constant pyruvate kinase activity and sucrose concentration and reduced total carbon. The degradation of protein was also augmented in ‘Zhongzhou 1’. In contrast, the consumption of assimilates in ‘Yongyou 538’ was significantly inhibited, allowing more carbon stored in roots. Furthermore, water stress resulted during an enormous increase in N allocation in root at SN. The results indicate that attenuation of root catabolic activity under water stress reduces nitrogen uptake and enhances the buildup of carbon and nitrogen in roots, subsequently improves NUE at whole-plant level.

Keywords: Water stress, nutrient, reutilizationtarted in India