Use of a capacitive sensor in the SITIS Phenotyping Platform for the automated determination of the effective area of the root system to uptake water

C.M. Guimarães[1], A.Torre Neto[2], L.F.Stone[1], M.G.Narciso[1], R.C.Pereira[1], S.Lopes Junior[1]

[1]Embrapa Arroz e Feijão, CP 179, CEP 75375-000, Santo Antônio de Goiás, GO. e-mail: cleber.guimaraes@.embrapa.br, luis.stone@embrapa.br, marcelo.narciso@embrapa.br, rubens.castro@embrapa.br, sergio.lopes@embrapa.br
[2]Embrapa Instrumentação Agropecuária, CP 741, CEP 13560-970, São Carlos, SP, andre.torre@embrapa.br.

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The best performance of upland rice in front of the water deficiency may be associated with several parameters [1]. Among them, those associated with the plant's greater ability to uptake water in the deeper soil layers seem to be the most important when the drought is short and there is good availability of water stored in the deeper soil layers. Deeper and more branched root systems contribute to better utilization of soil water. In addition, primary roots with larger diameter have thicker xylem vessels, which offer less resistance to water flow. All these characteristics are associated with the effectiveness of the root system in uptaking water, which is better the bigger it is in the deeper soil layers. In this direction, the total use of water by the root system was determined using capacitive sensors conditioned in soil columns made in PVC pipes 25 cm in diameter and 100 cm in height. The following equation was used to it:

$$\sum_{i=1}^{n} \Delta\,(\theta v_j - \theta v_{j-1}),$$

Where, i = soil layer, j = time and θv = volumetric soil moisture. The percentage of individual water use of 20 cm layers, from the surface to 100 cm depth, is determined by the use of each layer, θvj-θvj-1, in relation to the total use. For the monitoring of soil volumetric moisture, a basic version of the SITIS Platform of Plant Phenotyping for Drought Tolerance at Embrapa Rice and Beans is used, with FDR sensors [2] to measure the soil moisture.

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