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Growth of Rice (*Oryza sativa* L.) Cultivars under Upland Conditions with Different Levels of Water Supply

3. Root System Development, Soil Moisture Change and Plant Water Status

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Abstract: A deep root system may be a desirable plant characteristic in upland rice because it improves the plant's water extraction capacity. The objective of the present study was to assess the deep root development of rice cultivars in relation to soil moisture change and plant water status under upland conditions with moderate water deficits in the field and in simple lysimeter experiments. We used one upland cultivar ('Yumeno-hatamochi' [YHM]) and two lowland cultivars ('Lemont' [LMT] and 'Nipponbare' [NPB]) in the field experiment, with no supplemental water from 88 to 106 days after sowing (DAS) and 116 to 145 DAS. In the lysimeter experiment, we used YHM and NPB and imposed two water stress periods during the late vegetative stages (71 to 104 DAS and 88 to 104 DAS). In the lysimeter experiment, a higher deep-root length ratio (proportion of the length of deep roots to the total root length) in YHM was associated with a greater deep-root length than in NPB. The difference in deep root development was associated with change in soil water content at the depths of 45 to 70 cm between the two cultivars under the above conditions. The drought in the field experiment was less intense than in the lysimeter experiment, and we observed greater varietal differences in total aboveground biomass than in root system development; this was associated with the change in soil water content during the initial

drought period. LMT, with smaller shoots, tended to save water and maintain higher leaf water potential and lower diffusion resistance as the drought progressed. Our results suggest that deep root development of rice was primarily advantageous for soil water extraction and plant water status under moderate water stress in uplands, but that the advantage of a deep root system was affected by total aboveground biomass, which had strong effects on plant water status under these conditions.

Keywords: [Deep roots](#), [Lysimeter](#), [Minirhizotron](#), [Rice \(*Oryza sativa* L.\)](#), [Soil water depletion](#), [Upland](#)

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