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ONLINE ISSN : 1349-1008

PRINT ISSN : 1343-943X

Plant Production Science

Vol. 12 (2009) , No. 4 514-525

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Growth and Yield of Six Rice Cultivars under Three Water-saving Cultivations

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(Received: June 5, 2008)

Abstract: We evaluated the genotypic differences in growth, grain yield, and water productivity of six rice (*Oryza sativa* L.) cultivars from different agricultural ecotypes under four cultivation conditions: continuously flooded paddy (CF), alternate wetting and drying system (AWD) in paddy field, and aerobic rice systems in which irrigation water was applied when soil moisture tension at 15 cm depth reached -15 kPa (A15) and -30 kPa (A30). In three of the six cultivars, we also measured bleeding rate and predawn leaf water potential (LWP) to determine root activity and plant water status. Soil water potential (SWP) in the root zone averaged -1.3 kPa at 15 cm in AWD, -5.5 and -6.6 kPa at 15 and 35 cm, respectively, in A15, and -9.1 and -7.6 kPa at 15 and 35 cm, respectively, in A30. The improved lowland cultivar, Nipponbare gave the highest yield in CF and AWD. The improved upland cultivar, UPLRi-7, and the traditional upland cultivar, Sensho gave the highest yield in A15 and A30, respectively. The yields of traditional upland cultivars, Sensho and Beodien in A30 were not lower than the yields in CF. However, the yields of the improved lowland cultivars, Koshihikari and Nipponbare, were markedly lower in A15 and A30. Total water input was 2145 mm in CF, 1706 mm in AWD, 804 mm in A15, and 627 mm in A30. The water productivity of upland rice cultivars in aerobic plots was 2.2 to 3.6 times higher than that in CF, while those of lowland cultivars in aerobic plots were lower than those in CF. The bleeding rate of Koshihikari was lower in A15 and A30 than in CF and AWD, and its LWP was significantly lower in A15 and A30 than in CF and AWD, but Sensho and Beodien showed no differences among the four cultivation conditions. We conclude that aerobic rice systems are promising technologies for farmers who lack access to enough water to grow flooded lowland rice. However, lowland cultivars showed severe

growth and yield reductions under aerobic soil conditions. This might result from poor root systems and poor root function, which limits water absorption and thus decreases LWP. More research on the morphological and physiological traits under aerobic rice systems is needed.

Keywords: [Grain yield](#), [Lowland rice](#), [Upland rice](#), [Water productivity](#), [Water-saving cultivation](#)

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To cite this article:

Naoki Matsuo and Toshihiro Mochizuki: "Growth and Yield of Six Rice Cultivars under Three Water-saving Cultivations". Plant Production Science, Vol. **12**, pp.514-525 (2009) .

doi:10.1626/pps.12.514

JOI JST.JSTAGE/pps/12.514

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