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

1. Nitrogen Content and Dry Matter Production

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Abstract: The total water supply (irrigation plus rainfall) would determine biomass production. This study aimed to elucidate the effects of water supply and cultivar differences on the dry matter production of rice grown under upland conditions. Three rice cultivars ('Yumeno-hatamochi', YHM; 'Lemont', LMT; 'Nipponbare', NPB) were used on an upland site with three water regimes (rain-fed, RU; irrigated, IU; water deficit during the panicle-formation stage, WD) and in a flooded lowland (FL) in Japan from 2001 to 2003. The total amount of aboveground dry matter (TDM) of NPB in RU (1101 g m^{-2}) was 15% lower than that in FL (1302 g m^{-2}) in 2001, when dry spells occurred frequently, but was comparable to FL in 2003 (1313 vs. 1324 g m^{-2}) under favorable soil water conditions with ample rainfall before heading. The nitrogen (N) content of the aboveground part at maturity in RU in 2003 was similar to that in FL, but the growth duration was 9 days longer in RU. The amount of total water supply during the crop growth differed greatly (419 to 1132 mm) among water regimes and years under upland conditions, where TDM and aboveground N content generally increased with increasing water supply. We detected a cultivar – water regime interaction in TDM at maturity in both 2002 and 2003. In FL and under the upland conditions with adequate water supply in 2003, TDM was the largest for NPB, but it was the smallest in this cultivar in 2002 when rainfall was less frequent. The small TDM of NPB

in 2002 resulted from a smaller amount of N uptake associated with shallower root system development. In contrast, YHM had a deeper root system and thus the amount of N uptake was larger and TDM was smaller under upland conditions with limited water supply. Our results indicate that the three cultivars responded differently to the water conditions, and that the total water supply greatly affected TDM in uplands through its effects on the amount of N uptake, which was associated with the depth of root development.

Keywords: Biomass production, Deep rooting, Nitrogen uptake, Water-use efficiency

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