2nd International Rice Research Congress, 9-13 October 2006, New Delhi, India

Crop establishment, water management, and plant type characteristics: moving toward more productive cultural practices

Estela Pasuquin,[1] Tanguy Lafarge,*[1,2] and Rogelio Magbanua[1]

[1]International Rice Research Institute, DAPO Box 7777, Metro Manila, Philippines
[2]Centre de coopération internationale en recherche agronomique pour le développement, Montpellier, France
*Corresponding author: t.lafarge@cgiar.org

Abstract

Water availability for agriculture is decreasing mainly due to increasing consumption from cities and industries. But a 1% increase in water productivity in agriculture will make available an extra 24 liters a day per person. Flooded rice is taking up about 3,000 liters to produce 1 kilogram of grain and its consumption of irrigation water on earth is about 100 Mm^3 $year^{-1}$. This system, however, offers big opportunities to increase water productivity, defined as kilogram of grain per volume of drop water. To evaluate distinct crop establishment strategies concerned with planting methods and water saving, and genotype adaptability to these strategies, the performance of traditionally transplanted rice (E1) at 100 pl m^{-2} (25 kg seeds ha^{-1}) was compared with that of wet direct-seeded (E2), dry direct-seeded (E3), and aerobic rice, all sown at 80 kg seeds ha^{-1}, for six contrasting genotypes including hybrids and inbreds. Regardless of genotype, continuous flooding in E2 and E3 resulted in grain yield higher than that measured in E1 (22% lower) and E4 (28% lower): a lower panicle density at maturity was reported in E1 whereas a lower percentage of filled grain was reported in E4. During early crop growth, the number of tillers in E2 was significantly higher, about 650 m^{-2} at 14 d after sowing, than that in E3, E4, and E1, about 400, 300, and 100 m^{-2}, respectively. This trend was also observed in leaf area and leaf and panicle dry weight dynamics and could be attributed to the quicker emergence of the pre-germinated seeds in E2, despite a 3-d delay in sowing. The calculation of water use in E4 was difficult in terms of estimating water outflows in surrounding canals from heavy rainfall, which were frequent during the season because of the intended absence of bunds surrounding E4. Moreover, seepage and percolation were not evaluated. In E3, water use during crop growth was high due to the heavy demand from the dry soil right after crop emergence and throughout plant growth. Water productivity in E2 was finally similar to that in E3 but greater than that in E1, mostly because of the difference in grain yield. Higher grain yield was observed in flooded compared with aerobic management for three genotypes (PSBRc 80, IR72 and IR71676-90-2-2) mainly due to the greater percentage of filled grain. In contrast, grain yield was higher with aerobic compared with flooded management for two genotypes (IR77298-14-1-2 and Magat) mainly due to a greater number of productive tillers. Magat had a significantly higher grain yield in E4 than the other genotypes. The high potential of direct seeding was confirmed in the irrigated fields, where dry direct seeding, unlike aerobic rice, did not appear as a promising option for water saving. A pattern of growth adapted to a given crop and water management approach clearly offers great opportunity to increase grain yield and water productivity. The implications of plant assimilate partitioning on crop performance during early growth and during grain filling are discussed in greater detail.