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Can Yields of Lowland Rice Resume the Increases that They Showed in the 1980s?

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Abstract: The annual rate of rice yield increase in the world declined from 2.7 % in the 1980s to 1.1 % in the1990s. The continued world population increase requires resumption of the previous rate. The objectives of this paper are to review and assess rice production technologies for increased yield in the past and the current challenge on the basis of crop physiology and agronomy, and to discuss the way to increase irrigated rice yield to fulfil the expanding demand. Field experiments conducted in Kyoto, Japan and Yunnan, China showed that the best recent Chinese hybrid has a yield potential about 10 % higher than the best recent inbred cultivar in Japan. This result, and a review on recent challenges in breeding, suggested only moderate increases in the yield potential of rice genotypes in the coming decades. Contrary to the general understanding, the rapid rice yield increase in central Japan from the mid 1950s to mid 1970s was achieved mostly by improved crop and resource management. This, and the fact that farmers' contest-winning yields during 1950s and 1960s nearly doubled the current average in Japan, imply that current crop and resource management is exploiting only part of the large yield potential of rice. Some of the ways to increase yields may include components of the system of rice intensification (SRI). The extremely high yields claimed in SRI are probably not real, but its elements, which have been studied and practiced in Japan for the past 50 years, may lead to yield increases. The practice of transplanting one or two young seedlings per hill has advantages in reducing transplanting injury and increasing tiller and root numbers on lower nodes. Such advantages can be realized under direct-seeding systems, where they are applicable. The practice of

applying a large amount of compost and intermittent irrigation were also adopted by many of the contest-winning farmers in the 1950s and 1960s. These practices increase roots in deeper soil layers, maintain their activities and presumably promote nitrogen (N) uptake at later stages. Remarkable progress has been made in improved N management; agronomic efficiency of N increased from about 15 kg kg^{-1} for a single dose at transplanting to 40 kg kg^{-1} for banded controlled release fertilizer. All of these technological elements will contribute to increased yield when they are rationally integrated into systems that are adaptable to regional environments.

Keywords: Aerobic culture, Controlled release fertilizers, Early transplanting, Hybrids, Plant density, SRI

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