Evaluation on agronomic and eco-physiological indices of lowland rice genotypes under modified agronomical systems

Abstract:

Rising food demand, slowing productivity growth, poor N-use efficiency in rice, and environmental degradation necessitate the development of more productive, environmentally-sound crop and soil management practices. Plant growth and productivity are known to derive from the interaction between genetic potential (G) and environmental factors (E), much of the focus of agricultural improvement efforts in recent decades has been on modifying crops genetic potential more than on improving cropping practices and production systems. Yields have been raised substantially through varietal improvements and the increased use of inputs, including energy, agrochemicals, and delivering more water to crops through irrigation technology. In the past two decades, gains from this strategy have decelerated, with increasing economic and environmental costs of this input-dependent approach. Accordingly, there is reason to consider what can be accomplished by making optimizing changes in crops growing environments and increase in rice productivity and farmer incomes. This experiment was carried out as split plot in randomized complete blocks design with four replications at Neka, Mazandaran, Iran in 2011 and 2012. Cropping systems were chosen as main plots including conventional, improved and SRI and genotypes as sub plots including: Sang Tarom, Hashemi Tarom, Neda and Shiroodi. The result indicated that SRI plants showed significant response in lodging characteristics, eco-physiological indices, quality and technological characters, weeds growth traits, irrigation parameters, energy survey and ratooning parameters. In addition, SRI was found effective in minimizing cost production and water requirement, as shortening the crop cycle, and improving plant stand. SRI methods induced both greater and deeper root growth and improve rice plants morphology, this benefit physiological processes that result in lower plant lodging percentage and higher panicle characteristics, nutrient uptake, grain yield and water productivity. Direct measurements confirmed that SRI increase approximately 5.44 and 12.65% grain yield were noticed compare to improved and conventional systems, respectively. The SRI method registered the highest water use efficiency and water productivity followed by aerobic rice cultivation. Energy use efficiency and energy productivity had increased for SRI regard of reduced all indirect and non-renewable energy consumption for example: cost of labor, fuel, chemical fertilizer, seed and irrigation, therefore GHG and GWP in SRI decreased. The highest protein yield, amylose content and gel consistency were observed in SRI, as the most protein percentage and grain length after cooked were obtained in SRI and improved systems. Ratooning traits as the main crop parameters showed significant increased in SRI compare to improved and conventional systems. The highest ratoon grain yield was produced under SRI, because of increase panicle length, panicle number, and filled spikelet percentage. The most milling degree, grain length, elongation and gel consistency was observed in SRI, but the highest gelatinization temperature was the least in SRI, that all of these results are appropriate and favorable. Therefore, G × E interaction can be made more productive, environmental safety and sustainability of rice-based ecosystems with different management practices: optimally sparse populations, established with very young seedlings carefully transplanted, intermittent flooding of paddies, with active soil aeration and with soil organic matter enhanced as much as possible. Thus, SRI is a production system that involves the adoption of certain changes in management practices for rice cultivation that create a better growing environment for the crop.

Key words: Agro-ecosystem, Energy, Lodging, Productivity, Ratooning, Rice.

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