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Enhancing rice farmers adaptation to climate change through combined use of drought-tolerant rice varieties and water-saving technologies in Mali

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Abstract

Rice is a major staple food for over half of the population in Mali. However, climate change poses significant challenges to rice cultivation in the country due to increasing water scarcity and heat stress and add to the constraints of soil fertility depletion and labour scarcity faced by farmers. Adaptation strategies are urgently needed to reverse the trend in increasing food insecurity. The objective of this study was to identify appropriate management strategies to increase rice yield, labour and water productivities and nutrient use efficiency. On-farm experiments were conducted at two sites (Selingue and Mbewani) during two consecutive seasons (2023 and 2024) and included three water management practices (continuous flooding: CF; alternate wetting and drying: AWD; and farmers' practices: FP) and four rice varieties (ARICA3, GAMBIACA, KAFACI 1 and Sutura) in a split plot design.

Water management and variety had significant effects on rice yield, labour and water productivities and nutrient use efficiency. Compared to FP and CF, AWD resulted in the highest labour productivity (99.9 kg day^{-1}) and water productivity (1 kg m^{-3}), nitrogen use efficiency (88 kg kg^{-1}). AWD increased farmers' yields by 16 % and the net benefits by 26.2 % compared to FP (yields of 9.6 t ha^{-1} and 8.3 t ha^{-1} and net benefits of 1758.5 and 1393.9 USD ha^{-1} respectively). Sutura increased the yields by 62 % and the net benefits by 144 % (1497.4–1716.3 USD ha^{-1}) compared to Gambiaka (yields of 9.4 and 5.8 t.ha^{-1} and the net benefits of 1716.3 and 704.3 USD ha^{-1}). The interactions between water management and varieties were significant with the highest yield and net benefit recorded under AWD combined with Sutura and FP. AWD and Sutura rice could be recommended to the smallholder farmers to increase water and labour productivities, nitrogen use efficiency, rice yield and farmers' income in irrigated systems in Mali.

Keywords: Benefit, income, nutrient, water scarcity, yield

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