Improving rice production through digital technology: Validating the RiceAdvice decision support tool in Mali

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Abstract

Traditional blanket fertiliser rates and conventional fertiliser management practices among smallholder farmers in Mali have often fallen short of delivering significant yield improvements and economic gains in rice production. However, applying digital technology to provide personalized fertiliser rates and management recommendations holds promise for improving rice yields and economic returns for smallholders. In 2022, 47 non-replicated on-farm trials were carried out in 17 villages in the Sikasso, Soudan-Guinean agroecology of Mali to compare the fertiliser rates and management recommendations of a mobile application, RiceAdvice, with conventional farmer practices in flooded rice cultivation. We find that the use of the RiceAdvice tool led to an average increase in paddy yield by 18% (1.5 t ha^{-1}) and a 17% improvement in nitrogen (N) use-efficiency (10.4 kg paddy N kg^{-1}) compared to conventional farmer practices, without increasing the overall quantity of fertiliser used. However, significant differences were observed in the timing and amount of fertiliser application between RiceAdvice and conventional farmer practices: in RiceAdvice plots, an average of 41 kg N ha^{-1} as NPK 17:17:17 was applied basal, while conventional practices involved applying on average 38 kg N ha^{-1} 15 days after transplantation (DAT) of rice. Furthermore, in the RiceAdvice plots, 47 kg and 56 kg N ha^{-1} were top-dressed as urea at 27 and 43 DAT, respectively, whereas in conventional farmer practice, averages of 91 kg and 22 kg N ha^{-1} as urea were top-dressed 45 and 60 DAT, respectively. The first and second N top dressing in the RiceAdvice treatment plots represented 31% and 37% of total top-dressed N, respectively. In the farmer practice it represented 81% and 19%, respectively. The second urea top dressing occurred by choice only in 23% of the plots in the farmer practice against 100% in RiceAdvice plots by recommendation. The average benefit-cost ratio of the RiceAdvice technology was higher (2.4 USD USD^{-1}) with government fertiliser subsidy than without (1.3 USD USD^{-1}). We conclude that extending the RiceAdvice decision support tool services could improve rice productivity, N use-efficiency, economic profitability, and livelihoods in Mali without increasing the amount of fertiliser used in rice production.

Keywords: Benefit-cost ratio, decision support tool, digital technology, nitrogen use-efficiency, profitability, rice yield, RiceAdvice tool

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