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Multi-Country Analysis of Genotype × Environment Interactions of Lowland Rice to Improve RiceAdvice Prediction

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Abstract

Lowland rice accounts for 75% of the world's rice production. It contributes to food security and poverty alleviation in Africa. However, the gap between potential and actual yield in Africa is still substantially wide. AfricaRice and its partners have developed a free android-based decision-support tool, named 'RiceAdvice' to improve farmers' decision making and to enhance productivity (yield and income) in lowland rice systems in West East Africa at both low and high altitudes. RiceAdvice provides users with personalized advice on rice management practices: cropping calendars, best agricultural practices, and soil fertility management. So far, it has helped to gain 0.6 to 1.8 t/ha of yield, equivalent to an income gain of \$100 to \$200 per ha. RiceAdvice is ready for use in 5 countries and under testing in 9 countries in Africa. This tool is based on detailed physiological field experiments. Knowledge of genotype-specific parameters for rice varieties and daily weather data obtained from 'Rice Garden Trials', can be used in a validated crop simulation model. The later provides estimation of growth duration and timing of specific development stages for each variety, as well as expected yield losses due to cold or heat stress. In addition, matching timing of application, amount, and nature of fertiliser with crop development stages will be acquired from 'Nutrient Omission Trials'. We report here experiments undertaken in Madagascar, Ethiopia and Rwanda at different altitudes, using 4 contrasting rice genotypes (Yunkeng, IR64, Chhomrong, X-Jigna). In Madagascar, 12 planting dates monthly staggered in 2 locations were used in a non-replicated split-plot design. In Ethiopia, the varieties were planted under two different crop establishments (transplanting and direct seeding) in a Spit-plot design. In Rwanda, they were planted in 2 locations, under 2 Nitrogen rates (80 and 160 kg/ha) and either with or without basal application of N, as

well as omission treatments of Nitrogen, Phosphorus and Potassium, in a RCBD. Result on yield stability and genotype \times environment interactions from the wide range of studied environments, will be discussed and presented.

Keywords: Altitude, cold, East Africa, nutrient availability, *Oryza sativa*, yield stability