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"Global food security and food safety:
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Comparison of Multi-Locational Phenological Responses of Rice Cultivars to Altitudinal Gradients in Temperature

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Abstract

The increasing demand for land suitable to secure human food security in the future has already impelled agricultural production into marginal lands. In these, environmental conditions have a much more pronounced impact on agricultural productivity. In addition to that, climate change is expected to increase the unreliability of weather conditions for farmers considerably, thus endangering food security in developing countries in particular. Rice, as an example, is a staple crop and main source of carbohydrate for large parts of humanity, has been adapted to a wide range of environmental conditions, and offers a great possibility to fill in future gaps in food security. Nevertheless, in many regions, such as the Highland of East Africa, the choice of varieties adapted to these specific environmental conditions is limited, often not tested yet.

In order to test the impact of temperature due to altitudinal gradients on the phenological development of rice varieties in East Africa, field trials have been set up. One field site is located in northern Ethiopia, two sites in southern and western Rwanda and two sited in central Madagascar. The sites were selected to represent altitudinal gradients, with overlapping elevations to enable cross-country comparisons. Planting dates where distributed throughout three calendar years, with continuous iterative planting dates taking place in Madagascar, in- and off-season planting dates in Rwanda with different fertiliser regimes, and one planting date during each rainy season in Ethiopia testing different management options. Out of a wider selection of varieties, we have selected 4 rice varieties (Chhomrong, IR64, X-Jigna, Yun-Keng) grown under a total of 9 different thermal environments to compare and evaluate the phenological performance such as days to emergence, days to panicle initiation, days to heading/booting, days to flowering, days to maturity.

These results will help to identify a) potentially suitable varieties for further adaptation to East African Highland environments, b) help to improve phenology-dependent fertiliser recommendation and c) offer the potential to adapt existing or devise new cropping calendars, suitable for the security of future food production systems.

Keywords: Altitude, East Africa, phenology, rice, temperature

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