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“Development on the margin”

Yield Stability and Genotype $\times$ Environment Interactions of Upland Rice in Altitudinal Gradient in Madagascar

SUCHIT PRASAD SHRESTHA¹, FOLKARD ASCH¹, JULIE DUSSERRE², ALAIN RAMANANTSOANIRINA³

¹*University of Hohenheim, Dept. of Plant Production and Agroecology in the Tropics and Subtropics, Germany*

²*CIRAD / URP SCRiD, PERSYST, Madagascar*

³*National Centre for Applied Research and Rural Development (FOFIFA), Research Unit in partnership for Sustainable Farming and Rice Cropping Systems, Madagascar*

Abstract

Upland rice production has world-wide the largest potential for increasing area under production and thus contributing to food security in low-input farming systems. Upland rice is cultivated in tropical and sub-tropical rainfed environments in aerobic soils without impounding water. Production in high altitudes has been limited so far since the vegetation period in most cases does not allow growing rice due to its extended growth cycle. In addition, high altitudes are unfavourable as cold stress can induce pollen or spikelet sterility at anthesis. However, cold tolerant genotypes are capable to cope with this environment and can produce stable grain yield. According to climate change prediction, high-altitude environments will gain importance in upland rice production systems due to the expected positive effects such as rise in temperature and reducing sterility assuming that other climatic factors such as rainfall patterns will not have adverse effects. In order to evaluate the genetic variation in yield response across an altitudinal gradient experiments were conducted at three different altitude/temperature gradient locations with moderately water-limited conditions, ranging from hot-equatorial conditions to the lower limit of the crop's thermal adaptation in Madagascar for two years. 10 different and contrasting upland rice genotypes were sown at two monthly staggered sowing dates and meteorological data and site-specific soil characteristics were recorded. Genotype specific crop duration, tillering capacity, above ground biomass, grain yield and yield components, harvest index and spikelet sterility were monitored to identify specific traits for varietal adaptation. The result of yield stability and genotype-environment interaction will be discussed and presented.

Keywords: Cold tolerance, genotype-environment interaction, genotypic traits, upland rice, yield stability