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Assessing Seed Germination and Seedling Vigour in Rice under Different Thermal Regimes

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Abstract

Rice production environments are quite diverse and often cropping calendar options are limited by either water availability or low temperature. Sustainable intensification of rice production systems requires flexibility in the choice of cultivar, sowing date, and management options. In transplanted systems, nurseries provide options to exploit early genotype × environment to the advantage of later development stages. In order to target nursery management to specific systems changes, it is important to know germination and early seedling vigour capacity of genotypes potentially subjected to new growing environments. Therefore, germination capacity, mobilisation efficiency of grain reserves, days to onset of photo-autotrophy and partitioning of early dry matter gains to the different organs was investigated under temperature regimes typical for tropical low altitude (28/20°C day/night) and tropical high altitude systems (20/12°C day/night) for four contrasting irrigated lowland rice genotypes. Rice was grown in wet loamy sand in a climate chamber and was destructively sampled for plant organs and remaining kernel weight for 14 days after seedling emergence in two day intervals.

Germination and early seedling vigour differed significantly among the genotypes and the temperature regimes. Results indicate that low temperatures extend the period of initial water uptake during germination. Once hydrated, seeds metabolic activities followed the same patterns as under optimal temperature. In cold tolerant varieties mobilisation of grain reserves during early growth of the seedling resulted in smaller respiration losses than in cold sensitive genotypes and thus a higher mobilisation efficiency. In contrast, cold sensitive genotypes reached photo-autotrophy earlier but took longer to compensate respirational losses during germination, resulting in a reduced early seedling vigour. The implication for nursery planning and varietal selection for flexibility in cropping calendars will be discussed for rice growing areas at high altitudes in East Africa.

Keywords: Cold stress, germination efficiency, *Oryza sativa*, management option, reserve mobilisation efficiency

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