P252

Evaluation of lines of NERICA 1 introgressed with *Gn1a* and *WFP* for yield and yield components as affected by nitrogen fertilization in Kenya

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Abstract

In many sub-Saharan African countries, boosting rice production is a pressing food security issue. To contribute to the increase in rice production, we have developed lines of NERICA 1 introgressed with the gene for spikelet number, *Gn1a*, and the gene for primary rachis-branch number, *WFP* by cross breeding. The performance of rice lines introgressed with the genes for yield related traits can be affected by cultivation environment and management. Thus, in this study, we aimed to evaluate the lines of NERICA 1 introgressed with *Gn1a* or/and *WFP* for yield and yield components under different nitrogen fertilization conditions in Kenya. A field trial was conducted at a paddy field in Kenya Agricultural and Livestock Research Organization-Mwea, Kirinyaga County (0°39′S, 37°20′E) from August 2016 to January 2017. Eight lines of NERICA 1 introgressed with *Gn1a* and/or *WFP*, and their parents, NERICA 1 and ST12, were grown under 0 (NF) and 75 (SF) kg N ha^{-1}. At maturity, five hills per plot were harvested to determine the yield and yield components. The number of primary and secondary rachis-branches per panicle was measured on the longest panicle in each hill. Under SF, the introgression of *WFP* to NERICA 1 increased the number of primary and secondary rachis-branches by 27 and 25%, respectively. On the other hand, *Gn1a* did not increase the number of primary rachis-branches, whereas the number of secondary rachis-branches was increased by 38% on average. The number of primary and secondary rachis-branches of the lines introgressed with both genes increased by 25 and 56%, respectively. Although grain number per panicle increased 33% by *Gn1a*, 34% by *WFP*, and 43% by *Gn1a+WFP*, the yield increase by *Gn1a*, *WFP*, and *Gn1a+WFP* was only 14, 7, and 14%, respectively. The suppression of the yield increase was mainly attributed to the decline in the filled grain ratio. Under NF, *WFP* increased the number of primary and secondary rachis-branches by 20 and 19%, respectively. The introgression of both genes increased the former and the later by 19 and 35%, respectively. However, *Gn1a* did not change them under NF. Thus, even under NF, grain yield increased 11% by *WFP* and 24% by *Gn1a+WFP* due to the increased grain number although filled grain ratio declined. Our findings suggest that the introgression of *Gn1a* and *WFP* could contribute to the rice productivity improvement in sub-Saharan Africa even under low fertility conditions. Improving filled grain ratio of the lines introgressed with these genes by further breeding and fertilization management will be the focus of subsequent work.

Keywords: *Gn1a*, Kenya, nitrogen fertilization, rice, *WFP*, yield components

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