Introducing a quantitative trait locus, *MP3*, improves rice panicle numbers in nutrient-poor soils

The majority of paddy fields in sub-Saharan Africa (SSA) are characterized by nutrient-poor soils. In such fields, tillering in rice plants is severely restricted, which results in a reduced number of panicles and thus a decrease in grain yield. Therefore, genetic improvement to increase rice tillering may ensure sufficient panicles in nutrient-poor soils and thus lead to increase in rice productivity. Because we previously detected a quantitative locus, *MP3* (*MORE PANICLES 3*), to be effective at increasing the number of panicles in nutrient-rich fields, we expected that *MP3* will also be effective in enhancing rice productivity in nutrient-poor soils.

In this study, we used a high-yielding *indica* cultivar, Takanari, and its near-isogenic line bearing the *MP3* allele derived from a *japonica* cultivar, Koshihikari (NIL-*MP3*). They were first grown in pots that contain nutrient-poor soils from Madagascar at various P application rates. The pot experiment demonstrated vigorous tillering in NIL-*MP3* compared to Takanari from the early vegetative stage even under low P levels (Fig. 1). We next conducted multiple field trials in Madagascar with a total of 12 experimental conditions using the two varieties. The experiments produced grain yields ranging from 1.3 to 4.1 t ha^{-1} and panicle numbers ranging from 107 to 270 m^{-2}. The results revealed that NIL-*MP3* produced a greater number of panicles and spikelets m^{-2} (19% and 12%, respectively) than Takanari, with grain yields ranging from 2.0 to 4.1 t ha^{-1}, but not in extremely low yield environments (< 1.3 t ha^{-1}) (Fig. 2).

The results of this study indicate that *MP3* is effective at increasing the number of panicles in nutrient-poor soils in SSA. However, utilization of *MP3* in conjunction with fertilizer management may be necessary in extremely low yield environments (< 1.3 t ha^{-1}). We are currently introducing *MP3* into a local Madagascar cultivar, X265, which is adapted to the environments in SSA, to verify the effect of *MP3* on grain yield in such environments.

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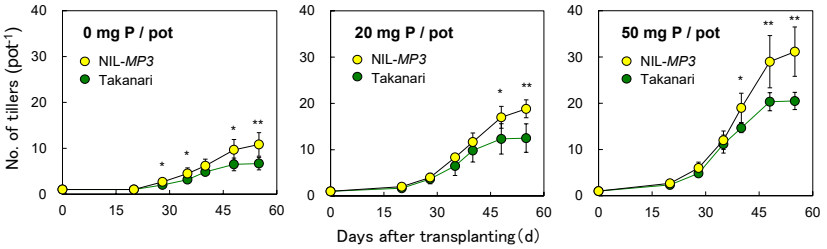

Fig. 1. Changes in the number of tillers between Takanari and NIL-*MP3* grown in pots that contain nutrient-poor soils in Madagascar at various P application rates.
** and * show significance at 1% and 5% levels, respectively.

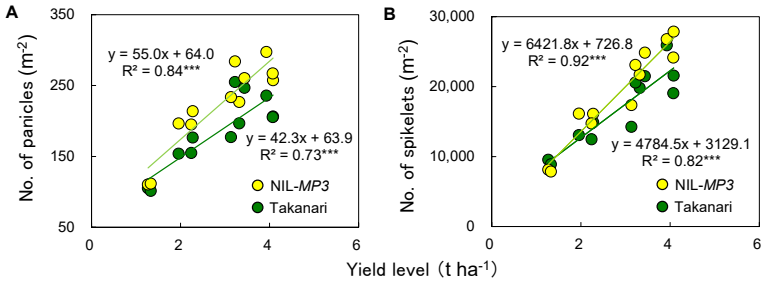

Fig. 2. Comparison of the number of panicles (A) and spikelets (B) between Takanari and NIL-*MP3* across 12 field experiments in Madagascar
Yield level shows mean yield between Takanari and NIL-*SPIKE* in each experiment.
*** shows significance at 0.1% level.

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