Biological nitrification inhibition maintains wheat yield with reduced nitrogen fertilizer application

Production | Demonstration | Item: Wheat

GHG emission reduction
Chemical fertilizer reduction

Outline

Biological nitrification inhibition (BNI)-enabled wheat, in which BNI capacity was introduced from wild wheat by intergeneric crossing, suppresses soil nitrification, maintains high productivity under reduced nitrogen (N) application, and consequently reduces environmental loads, such as nitrous oxide (N_2O) emissions and aquatic pollution in wheat cultivation.

Background/effect/note

BNI is the mechanism that inhibits soil nitrification and reduces the conversion of ammonium from fertilizer to nitrate by releasing substances from crops. BNI-enabled wheat (Fig. 1) exhibited improved nitrogen use efficiency with enhanced BNI (introduced from wild wheat by intergeneric crossing) capacity. As the productivity under low N conditions is improved, grain yield and quality were not significantly different with a 60% reduction in N fertilizer application (Fig. 2). BNI-enabled wheat can reduce lifecycle GHG emissions (Fig. 3) and aquatic pollution from nitrate, which is easily leached from the soil, due to the decreased N application and the suppression of soil-nitrifying activity. The expression of BNI capacity is dependent on soil conditions (pH etc.).

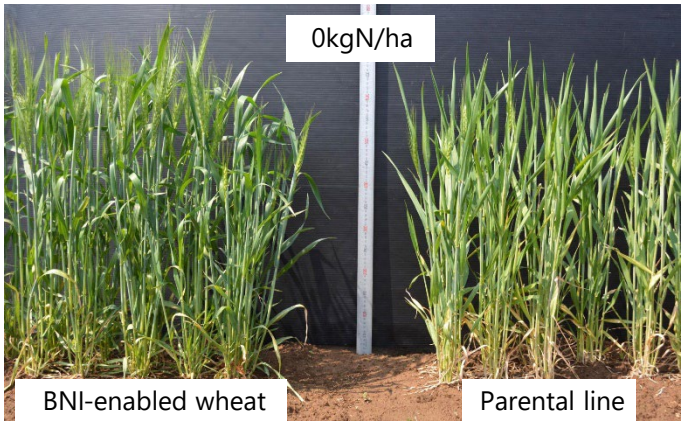

Fig. 1. Biological nitrification inhibition (BNI)-enabled wheat exhibits improved productivity under low nitrogen conditions in the field.

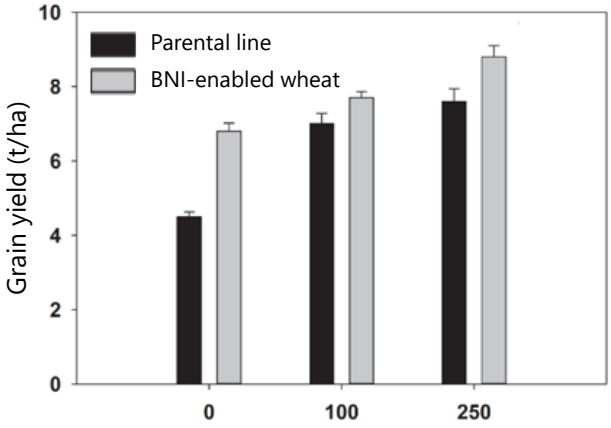

Fig. 2. Grain yield with different nitrogen application amounts

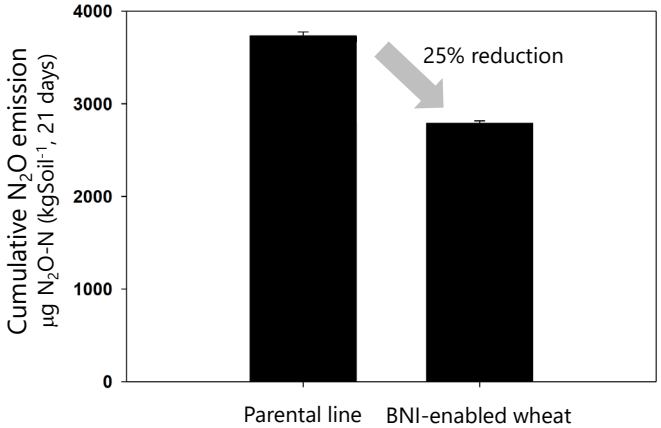

Fig. 3. N_2O emissions from rhizosphere soil

Technical details:

JIRCAS research highlights (FY2021)

https://www.jircas.go.jp/en/publication/research_results/2021_a04

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