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Engineering nitrogen use efficiency in wheat with improved seedling root growth and post-anthesis nitrogen uptake

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Developing wheat varieties with improved nitrogen use efficiency is very desirable, and may offer a sustainable solution to improve crop yields with less fertilizer application. Roots are the main site for nutrient uptake; their size and distribution in soil profiles, and uptake activity largely determine nutrient uptake efficiency. However, low temperature at seedling stage inhibits root development of winter wheat and nutrient bioavailability; and root senescence during grain filling is becoming a limiting factor for achieving high yield in modern wheat varieties. By screening genes in response to low nitrogen stress and nitrate treatment, we identified a low nitrogen induced transcription factor *TaNFYA-6B* and a nitrate inducible transcription factor *TaNAC2-5A*. Overexpression of these genes in wheat increased root growth and nitrate influx rate of wheat seedlings and improved grain yield under both low and high nitrogen conditions. Glutamine synthetase (GS) plays an essential role in the metabolism of nitrogen. By analyzing the mini-core collection (MCC) of the Chinese wheat germplasm, we identified a favorable allele of *GS2*, *TaGS2-A1b*. Expressing *proTaGS2-A1b::TaGS2-A1b* in wheat significantly increased nitrogen uptake during grain-filling period, and grain yield under both low and high nitrogen conditions. Our results suggest that improving the root ability in efficiently acquiring nitrogen at seedling stage and after flowering is crucial in engineering nitrogen use efficiency in wheat.

Biography

Yiping Tong has completed his PhD from Institute of Genetics and Developmental Biology, Chinese Academy of Sciences. He has published more than 30 papers in reputed journals.

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