Enhancing nitrogen use in crops: A translational research approach

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Abstract
Optimization of reactive nitrogen (N) use by crops has assumed great significance in recent years due to increasing fertilizer costs and severe environmental pollution due to N losses from the soil. This is particularly relevant for developing countries where farmers have limited financial resources and are confronted with the need for food security for an increasing population amidst climate change. The study reported in this paper is part of the Cambridge – India Network for Translational Research in Nitrogen (CINTRIN) which aims to translate our recent understanding of developmental N use in model plants such as Arabidopsis and Brachypodium to foxtail millet, wheat, sorghum and pearl millet by screening for nitrogen insensitive (NIS) ideotypes, analysing their relative N utilization, yield potential and subsequently, establish candidate genes regulating N use. Among the four studied crops, foxtail millet (Setaria italica L.) is a C4 model cereal that requires very low growth inputs, and is perfectly adapted to tropical semi-arid climate. The crop has one of the highest nutritional indices for human consumption, making it suitable for arid and semi-arid environments. In the present study, we propose to employ high-throughput phenomics platforms to examine agronomically important traits in 200 genetically and geographically diverse accessions of foxtail millet and use next generation comparative genomics and bioinformatic tools to identify candidate genes/QTLs regulating N use. We also propose to compare and analyse the variation in physiological N uptake/ use and allocation to grains by using high throughput 13N/15N partitioning experiments to identify parallels with nitrogen sensitive (NS) and nitrogen insensitive (NIS) genotypes. The overall objectives of the study are to couple the molecular basis of plant development to the physiology of N uptake and partitioning, thereby defining new NIS ideotypes and generate valuable information on cultivar-specific N fertiliser requirements, which will have direct benefits to farmers.

CINTRIN will provide innovative approaches to tackle crop biological N use

CINTRIN: a truly translational centre

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