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02e. Improved varieties for intensive production systems

ANALYSIS OF THE DEVELOPMENTAL PLASTICITY OF THE RICE PANICLE AND ITS CONTROL BY PLANT SUGAR STATUS, IN NEAR-ISOGENIC LINES DIFFERING AT QTL TSN 4 AND 12.

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Purpose:
Panicle architectural traits in rice (branching, rachis length and spikelet number), fixed during the reproductive phase, are strongly variable among genotypes and prone to GxE interaction, i.e. they are highly plastic. While numerous papers have analyzed the plant phenotypic plasticity at the vegetative and grain filling stages, morphogenesis of the panicle, and its plasticity in response to environmental constraints, were poorly addressed. This study aims at understanding and modeling the response of rice panicle morphogenesis to whole plant and local (stem, leaf) non-structural carbohydrate (NSC) availability and source to sink balance. This involved analyzing growth and development processes, and photosynthetic activity, along panicle development, i.e. from its initiation to flowering.

Approach and methods used:
In this purpose, original genetic material consisting in near isogenic lines (NILs) differing with their parents by their organ size (panicle and flag leaf) were grown under full light and shading in the greenhouse (Montpellier, France) and under two plant densities in the field (IRRI, Philippines).

Key results:
The effect of the QTL introgression on panicle architecture (rachis length, branch and total spikelet number) was confirmed. Light limitation at the individual plant level, either by shading or high planting density, impacted the processes of panicle development during its early stage (5 to 14 days after panicle initiation), i.e. during branching. This stage is near the transition time from vegetative to reproductive phase when panicle is probably not vigorous enough to buffer nutritional crisis. Greater plasticity under assimilate restriction was expressed with the NILs in terms of branch number (tertiary axes) and spikelet number compared to the recipient lines.

Synthesis and Applications:
This work confirmed that the QTL introgressed on chromosome 4 in the recipient lines is involved in panicle size and branching initiation. Anatomical observations of the peduncle cross-section and of leaf and stem sugars content will be confronted to panicle components in order to further understand the way panicle size and plasticity are governed by NSC availability and plant carbon source to sink relations. These results will be used to improve, calibrate and validate the model Ecomeristem and to conduct ideotype exploration via different combinations of plant parameters.