Feeding the world: Uncovering a key regulator of flower head development in rice

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Rice is a staple food for more than 3.5 billion people worldwide. Meeting the demand for high-yielding rice is an urgent task for breeders. Superior, high-yielding hybrid plants are often produced by crossing two diverse parental lines. This task is quite complicated in rice, a self-pollinating plant. One approach to solving this problem originated in the 1970s, when Chinese scientists figured out how to produce male sterile (MS) rice lines.

The use of MS lines allows breeders to perform controlled pollination, leading to successful hybrid rice production. Unfortunately, in these MS lines, the panicle (flower head) often remains enclosed in the surrounding leaf sheath because the region of the stem that supports it (the uppermost internode) is short, leading to blocked pollination and reduced seed production. To allow panicles to elongate and emerge from the leaf sheath, breeders use rice plants with a mutation in the gene ELONGATED UPPERMOST INTERNODE1 (EUI1), which encodes an enzyme that deactivates the plant hormone gibberellin (GA). This deactivation allows GA to stimulate uppermost internode extension, leading to panicle extension, as well as increased plant height. Understanding what regulates the enzyme EUI1 in normal (wild type) plants is crucial, as according to Dr. Chengcai Chu of the Chinese Academy of Sciences, "A further understanding of the molecular mechanism through which EUI1 activity is regulated during development will provide a more flexible way to fine-tune panicle extension, which may greatly help breeders improve hybrid rice seed production".

By isolating and exhaustively analyzing a dwarf mutant with impaired panicle extension, Dr. Chu and colleagues uncovered a critical regulator of EUI1 gene expression in rice, as discussed in this week's issue of *The Plant Cell*. This regulator, HOX12, binds directly to regulatory elements of the EUI1 gene, functioning as a transcription factor, or central regulator. The scientists propose that HOX12 helps regulate plant growth in response to environmental cues through its effect on EUI1, which acts as a switch to regulate the migration of floral-derived GA from the panicle to the stem. The next step will be to determine the upstream initiators of the HOX12-EUI1 regulatory cascade and the physiological conditions under which these modulations occur.

More information: Shaopei Gao et al. Rice HOX12 Regulates Panicle Exsertion by Directly Modulating the Expression of ELONGATED UPPERMOST INTERNODE1, *The Plant Cell* (2016). DOI: 10.1105/tpc.15.01021

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