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F1-ATPase relieves the damage caused by a high temperature stress during seed development

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Applied genetics to efficient plant biomass production

All of lives on Earth are depending on the plant biomass. We study on technologies enabling to exploit the plant potentials. We are hoping to contribute to construct a sustainable future. In order to utilize the plant biomass efficiently, we are going to determine key factors on the quality and quantity of crop production, and genes involved in tolerance to environmental stresses such as by a global warming. We also develop a molecular farming system for biomaterials in transgenic plants.

Biography

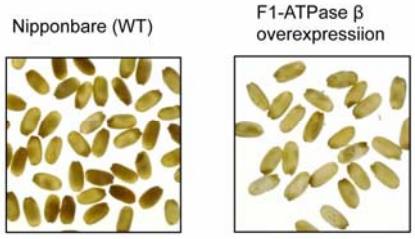
Birth: April 1956 at Osaka, Japan
Education:
1978: Bachelor of Agriculture, Kyoto University,
1980: Master of Agriculture, Kyoto University,
1987-1989: Research student, Nagoya University,
1992: Ph. D., Nagoya University (Science)
Employment:
1980-1996 Researcher, Mitsui Chemicals, Inc.,
1989-1993 Senior researcher, Mitsui Plant Bio Research Institute,
1996-2001 Associate professor, Tokyo University of Science
2001- Professor, Tokyo University of Science,

Selected Publications

1. H. Aoki, et. al. Enhanced translation of the downstream ORF attributed to a long 5' untranslated region in the *OsMac1* gene family members, *OsMac2* and *OsMac3*. *Plant Biotechnol.* (2014) in press
2. K.-C. She, et al. High-temperature stress susceptibility of representative japonica rice cultivars derived from Norin-22: inadequate ATP supply during seed development may lead to severe damage. *Plant Biotechnol.* 29, 465-471 (2012)
3. H. Teramura, et al. A long 5' UTR of the rice *OsMac1* mRNA enabling the sufficient translation of the downstream ORF. *Plant Biotechnol.* 29, 43-49 (2012) .
4. K.-C.. She, et al. A novel factor FLOURY ENDOSPERM 2 is involved in regulation of rice grain size and starch quality. *Plant Cell*. 22, 3280-3294 (2010)
5. K.-C. She, et al.: Reduced rice grain production with ATP shortage during seed development. *Plant Biotechnol*. 27, 67-73 (2010)
6. T. Imamura. et al.: Acquired resistance to the rice blast in transgenic rice accumulating the antimicrobial peptide thanatin. *Transgenic Res.* 19, 415-424 (2010)

Description and image (s) of the research

High-temperature stress during seed development resulted in reduced grain quality with chalky endosperm, which was caused by insufficient storage starch synthesis because of shortage of ATP supply and inadequate energy status in developing seeds. In this case, since expression of genes involved in F1-ATPase was significantly decreased, reduced amount of F1-ATPase largely affected the grain quality. We created the transformants in which an F1-ATPase β gene was overexpressed in immature seeds. They confer the tolerance to the high-temperature stress and produced normal-shaped grains as well as those developed in the normal conditions. This indicated the possibility of acquisition of a tolerance to the high-temperature damage.



Overexpression of F1-ATPase beta gene gives normal-shaped grains
Mature seeds of rice (Nipponbare) seeds (Left), and transformant seeds containing F1-ATPase beta genes (Right) that are developed under high-temperature conditions. They are shown by a transparent light condition. Chalky seeds and normal seeds represent by a dark and clear materials, respectively.

Applications

Molecular breeding of a Rice plant tolerant to high-temperature stress damage.
ATPase activity as a molecular marker for selection of a tolerant plant.

Advantages

Molecular-based breeding of a new cultivar that adapt to an environmental alteration by the global warming.