# Department of Agrobiological Resources

## Laboratory of Crop Science

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| TEACHING | Food Crop Science I・II.<br>Biological Chemistry II<br>Advanced Crop Production Science<br>Advanced Crop Physiology | Crop Production Science<br>Resource Crop Science |

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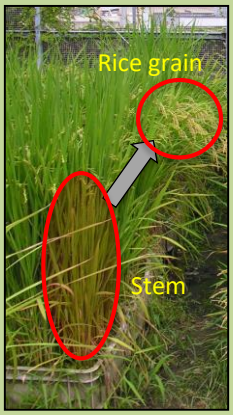
## Elucidation of the characteristics associated with high grain yield in rice

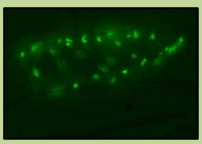
### Analysis of the function of genes implicated in carbohydrate supply for grain filling




Rice plants **temporarily accumulate starch** in the stems before heading.

After heading, sucrose produced by **degradation of starch** is translocated into the filling grains.

We are analyzing the function of genes that regulate starch remobilization in the rice stems after heading.



Subcellular localization of β-amylase protein, OsBAM2. OsBAM2-GFP fusion protein is localized to the plastids.

**The overexpression or knockdown lines of several starch-metabolizing genes** have been generated to understand the mechanisms of starch remobilization in the stems after heading.

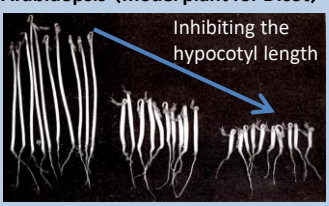
We aim to generate a new rice variety that has the enhanced potential to supply carbohydrate to filling rice grains

Comparison of the growth between the rice plants of *OsBAM3* overexpression (left) and wild type plants (right).

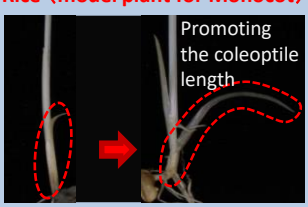
## Effects of plant hormones and complete submergence on rice at seedling stage

### Researches for Ethylene responses in rice seedling

**Arabidopsis（model plant for Dicot）**



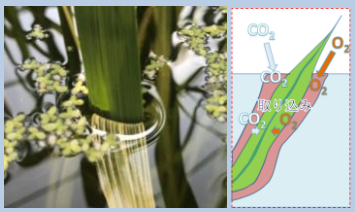

**Rice（model plant for Monocot）**




Ethylene treatment **inhibits** the length of hypocotyl in Arabidopsis but **promotes** the length of coleoptile in rice (indicating **opposite responses!**).

We are investigating the various ethylene responses in rice seedling.

### Gas Film (air layer) contributes to flood tolerance in rice




Air layer shining as silver in water is called "Gas Film"

Air layer forming around the rice leaves in water is called "**Gas film**", which help rice to take essential gases for survival (such as **$CO_2$/$O_2$**) although rice leaves are in underwater condition.

Rice mutant called "*dripping wet leaf* (*drp*)" **which lost gas film** in water **can't survive in the paddy field** (water-rich environment).

We are investigating the water resistance in rice by focusing on "gas film"

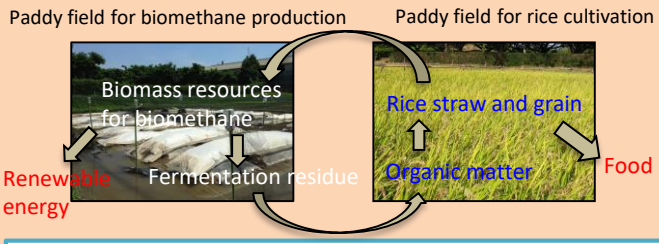


※ Arrows (white) indicate the water surface

## Establishment of cultivation technique for sustainable development of agriculture and rural region

### Establishment of rice cultivation technique in the paddy field after biomethane production by GET system

**"GET system"** is the production technology of biomethane as renewable energy from rice straw in paddy field.




We aim to establish the game-changing double cropping system of food (rice) and renewable energy (biomethane).

### The effect of cultivation environment on yield components and seed oil quality in the breeding lines of egoma.

The seed oil of egoma (*Perilla frutescens* Britt. var *frutescens*) contain lots of **α-linolenic acid**, one of essential fatty acids. In addition, the seeds and leaves have **high antioxidant activity**.

Egoma (*Perilla frutescens* Britt. var. *frutescens*) grown in Exp. Farm of Meijo Univ.

Egoma attract attention as **functional food**. But its production at lowland results in low grain yield and quality because of high temperature during seed-filling stage.

We aim to breed a new variety and develop a proper technique of cultivation in cooperation with Aichi Agric. Res. Ctr.


1) Chen, S., Murano, H., Hirano, T., Hayashi, Y. and Tamura, H. (2020) Establishment of a novel technology permitting self sufficient, renewable energy from rice straw in paddy fields. J Cleaner Prod. 272: 122721.
2) Kurokawa, Y. *et al.* (2018) Rice leaf hydrophobicity and gas films are conferred by a wax synthesis gene (*LGF1*) and contribute to flood tolerance. New Phytol. 18: 1558–1569.
3) Hirano, T., Higuchi, T., Hirano, M., Sugimura, Y. and Michiyama, H. (2016) Two ß-amylase genes, *OsBAM2* and *OsBAM3*, are involved in starch remobilization in rice leaf sheaths. Plant Prod. Sci. 19: 291-299.