Bio

World's first visualization of the switching mechanism of plant tip growth using novel fluorescence imaging without recombinant DNA technique

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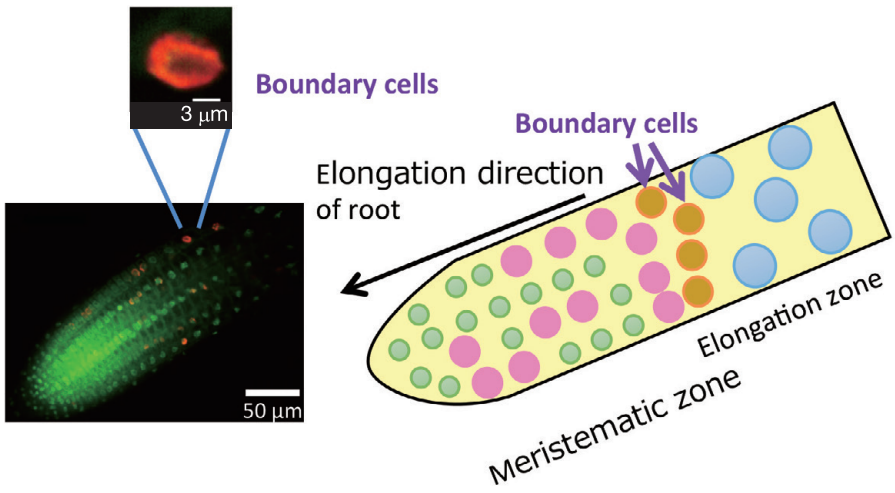
Purpose of Research

This imaging method which simply applies a small-molecule compound and a fluorescent label to plant tissue, visualizes plant growth process in a non-invasive and real-time manner, without recombinant DNA technique. Using this method, we have identified distinctive boundary cells which switch cells from proliferation to elongation in root and other meristems, for the first time in the world. This imaging method will be an effective, easy-to-handle tool in developing novel useful plants. It will also help develop "digital plants" and other plant simulations and provide a tool for minute and efficient soil/fertilizer assessment, breeding, etc.

Summary of Research

Imaging that clearly reveals plant growth processes and structures has great potential to aid in breeding and many other processes in agriculture. Conventional live imaging of cell division and elongation requires recombinant DNA technique. In our method, a tested plant is simply soaked in a solution of the thymidine analog EdU (5-ethynyl-2'-deoxyuridine), which is incorporated into the chromosomal DNA in dividing cells and then detected with a fluorescent azide label. Thus, plant growth processes in a whole plant can be analyzed successively in a non-invasive, real-time manner. In addition, this method can be widely used because it only requires commercial reagents.



Comparison with Conventional or Competitive Technology

Conventional imaging methods are time-consuming (recombinant DNA technique methods) and/or invasive (biochemical methods). Our method has the following advantages:

- No recombinant DNA technique required;
- Non-invasive, real-time observation possible; and
- Fast and easy.

Expected Applications

- Soil/fertilizer assessment.
- Novelbreeding focused on plant growth process.
- Digital (virtual) plant model.

Challenges in Implementation

No particular problem. The method only requires commercial reagents and so has not been patented.

What We Expect from Companies

Development of new applications of this imaging method. We can optimize/customize the method on request.

Points

- **Non-invasive, real-time imaging of plant growth process**
- **No recombinant DNA technique required**
- **Fast and easy**
- **Possible application to digital plant models**

■ Articles:
"Imaging of plant growth process" Nikkei Sangyo Shimbun, October 16, 2013; "Associate Prof. Matsunaga and colleagues of TUS visualize plant growth without recombination and discover boundary cells" Nikkei Biotech ONLINE, October 14, 2013

■ Publication:
"The boundary of the meristematic and elongation zones in roots: endoreduplication precedes rapid cell expansion" Hayashi, K. Hasegawa, J. Matsunaga, S. Scientific Reports 3 2723 (2013)