



## Takuji OHYAMA, Ph.D.

Professor

Program: Life and Food Sciences

Area: Applied Life and Food Sciences

Undergraduate: Dept. of Agricultural Chemistry

### Professional Expertise

His professional expertise encompasses nitrogen fixation and metabolism of soybean plants, nitrogen and carbon metabolism in tulip, curcuma, cucumber, sugarcane and rice. He and his group use stable isotopes  $^{15}\text{N}$  and  $^{13}\text{C}$ , as well as radioisotopes  $^{11}\text{C}$ ,  $^{13}\text{N}$ , and  $^{14}\text{C}$  etc. They have developed a deep placement of coated urea and lime nitrogen to increase soybean seed yield and quality.

### Research Fields of Interest

1. Nitrogen fixation and metabolism in soybean plants: Soybean is very important crop for foods and feed for animal worldwide. Soybean seeds contain a large amount of protein, therefore, they require a lot of nitrogen for high seed yield. Soybean plants assimilate the nitrogen from three sources, N derived from atmospheric  $\text{N}_2$  by nitrogen fixation, N derived from soil and N derived from fertilizer.  $\text{N}_2$  is fixed to ammonia by root nodule, a symbiotic organ with soil microorganism rhizobia. We investigated the fate of N fixed in nodules and N absorbed in roots using stable isotope  $^{15}\text{N}$ .
2. Inhibition of nodule growth and nitrogen fixation activity by nitrate: Combined N especially nitrate inhibit nodulation, nodule growth and nitrogen fixation activity in soybean plants. We discovered that nitrate inhibits nodule growth and nitrogen fixation activity rapidly and reversibly, when nitrate was supplied in a culture solution.
3. A new technology of deep placement of slow release nitrogen fertilizers for promotion of soybean growth and seed yield: We supplied slow release nitrogen fertilizer (coated urea or lime nitrogen) at the depth of 20cm, just below planting line. This technique Promoted 20-70% of increase in seed yield as well as improve seed quality.
4. Nitrogen and carbon metabolism in tulip and curcuma: We investigated nitrogen assimilation in tulip roots. Tulip roots accumulate nitrogen in the form of glutamine in winter, and it is used during shoot growth. In spring, tulip plants accumulate a large amount of 4-methyleneglutamine in leaves and stems.



Soybean with or without nodules



Soybean nodulated roots



Soybean seeds

## Education

1980: Ph.D. in Agriculture, The University of Tokyo, Japan

1977: M.S. in Agriculture, The University of Tokyo, Japan

1975: B.S. in Agriculture, The University of Tokyo, Japan

## Professional Societies and Activities

1. President of Japanese Society of Soil Science and Plant Nutrition. 2008-2010
2. Vice president of Japanese Society of Soil Science and Plant Nutrition. 2004-2008

## Awards

1. Progress Award (Japanese Society of Soil Science and Plant Nutrition), 1983
2. Award of Japanese Society of Soil Science and Plant Nutrition), 2000
3. Niigata Nippo Bunka Award, 2005

## Major Publications

### Papers

[1] Effect of sigmoidal releasing-type coated urea fertilizer and ridge tillage on nitrogen accumulation and rate of side-wrinkled seeds in soybean cultivated in rotated paddy fields under poor drainage conditions. *Jpn. J. Soil Sci. Plant Nutr.*, 81,4, 360-366, 2010

[2] "Real-time imaging of nitrogen fixation in an intact soybean plant with nodules using <sup>15</sup>N-labeled nitrogen gas", *Soil Sci. Plant Nutr.*, vol.55, no. pp.660-666, 2009

[3] "Carbon and nitrogen transport during grain filling in rice under high-temperature conditions," *J. Agronomy and Crop Science*, 195 pp.368-376, 2009

[4] Assimilation and translocation of nitrogen and carbon in *Curcuma aalismaticifolia* Gagnep., *Plant Biology*, 12, 414-423, 2009

[5] Rapid quantification of cyanamide by ultra-high-pressure liquid chromatography in fertilizer, soil or plant samples. *J. Chromatography A*, 1216 pp.5614-5618, 2009

[6] Nitrogen fixation and translocation in young sugarcane (*Saccharum officinarum* L.) plants associated with endophytic nitrogen-fixing bacteria. *Microbes Environ.* 24, pp.224-230, 2009

[7] Absorption and translocation of nitrogen in cucumber, *Soil Sci. Plant Nutr.*, 54, No.1, pp.108 - 117(2008)

[8] The autoregulation of nodulation mechanism is related to leaf development", *Sayuri Plant and Cell Physiology*, 49, No.1, pp.121 - 125(2008)

[9] Analysis of the nitrogen nutrition of soybean plants with deep placement of coated urea and lime nitrogen.depth of placement of lime nitrogen", *Soil Sci. Plant Nutr.* 53, pp.772 - 781, (2007)

### Books

[1] Ohyama, T., Ohtake, N., Sueyoshi, K., Tewari, K., Takahashi, Y., Ito, S., Nishiwaki, T., Nagumo, Y., Ishii, S., Sato, T. 2009. *Nitrogen Fixation and Metabolism in Soybean Plants*. Nova Science Publishers, Inc. New York.

[2] Tewari, K., Nagumo, Y., Takahashi, Y., Sueyoshi, K., Ohtake, N., Ohyama, T. 2011. *A New Technology of Slow Release Nitrogen Fertilizers for Promotion of soybean growth*

*and Seed Yield*. Nova Science Publishers, New York.

[3] Tanemura, R., and Ohyama, T., 2012. *Nitrogen nutrition and amino acid metabolism in cucumber*, Nova Science Publishers, Inc. New York.

[4] Ohyama, T., Takahashi, Y., Joh, T., Whitaker, A.C., Nishiwaki, T., Saito, K., Watanabe, S., Shimojo, S., 2013. *Traditional and Modern Japanese Soy Foods: Manufacturing, Nutrition and Cuisine of a Variety of Soy Foods for Health and Joy of Taste*. Nova Science Publishers, Inc. New York. Nova Science Publishers, New York.

[5] Ohyama T., ed. *Advances in Biology and Ecology of Nitrogen Fixation*. 2014. InTech, Rijeka, Croatia.

### Book Chapters

[1] Ohyama, T., Minagawa, R., Ishikawa, S., Yamamoto, M., Hung, N.V.P., Ohtake, N., Sueyoshi, K., Sato, T., Nagumo, Y., Takahashi, Y., 2013. "Soybean seed production and nitrogen nutrition," A comprehensive survey of international soybean research –genetics, physiology, agronomy and nitrogen relationships, Board, J.E. ed. InTech, Rijeka, Croatia. pp.115-157

[2] Fujikake, H., Yashima, H., Tanabata, S., Ishikawa, S., Sato, T., Nishiwaki, T., Ohtake, N., Sueyoshi, K., Ishii, S., Fujimaki, S., Ohyama, T., 2011. "Effect of nitrate on nodulation and nitrogen fixation of soybean," *Soybean Physiology and Biochemistry*, El-Shemy ed. InTech, Rijeka, Croatia. pp.333-363

[3] Ohyama, T., 2010. "Nitrogen as a Major Essential Element of Plants," *Nitrogen Assimilation in Plants*. Research Singpost. pp.1-17

[4] Ohyama, T. 2010. "Nitrogen Absorption and transport in Soybean Plants," *Nitrogen Assimilation in Plants*. Research Singpost. pp.95-109

[5] Ohyama, T., Ito, S., Nagumo, Y., Ohtake, N., Sueyoshi, K., Takahashi, Y., Sato, T., 2010. "Symbiotic Nitrogen Fixation and its assimilation in Soybean," *Nitrogen Assimilation in Plants*. Research Singpost. pp.175-203

[6] Ito, S., Fujimaki, S., Kato, T., Ohtake, N., Sueyoshi, K., Ohyama, T., 2010. "Regulation of Root Nodule Formation in Leguminous Plants," *Nitrogen Assimilation in Plants*. Research Singpost. pp.205-214