Difference of concentration of elements depending on age of the leaves of plants —Measurement of elements in plants by in-air PIXE—

S. Kawai[1], S. Moizumi[1], S. Goto[2] and K. Sera[3]

[1]Faculty of Agriculture, Iwate University
3-18-8 Ueda, Morioka, Iwate 020-8550, Japan

[2]Takizawa Laboratory, Japan Radioisotope Association
348-1 Tomegamori, Takizawa, Iwate 020-0603, Japan

[3]Cyclotron Research Center, Iwate Medical University
348-58 Tomegamori, Takizawa, Iwate 020-0603, Japan

Abstract

Soybean (*Glycine max* cv. Nanbushirome) and Broccoli (*Brassica oleracea* cv. Haitsu) were hydroponically grown under Mn supplied (+Mn) or Mn depleted (-Mn) condition in the green house of Iwate University. Relationships among the effect of Mn deficiency, leave's age, concentration of elements, and activity of photosynthesis were investigated. The plant were transferred to Takizawa Laboratory, Japan Radioisotope Association and concentrations of the elements of the intact leaves of the plants were analyzed by in-air PIXE (Proton Induced X-Ray Emission). In the separate experiment, value of Fv/Fm, one of the index of activity of photosynthesis, of the leaves of Broccoli was measured by two dimensional IMAGING-PAM Chlorophyll Fluorometer (FluorCam 800MF) in Cryobiofrontier Research Center of Iwate University. Our aim was to verify the effect of Mn and age of leaves on photosynthesis in the plants.

The results showed that Mn and Cl concentrations of soybean or Broccoli were low in new leaves, especially, in Cl concentration. The result of Cl was different from those of P and S which are also translocated in the anionic forms in plants. Difference of the concentration of elements in leaves between presence and absence of Mn supply was small. Analysis by chlorophyll fluorescence imaging showed that activity of photosynthesis in the interveinal areas of the leaves of the Mn depleted plant was low, especially in 3rd and 4th leaves. The activity of photosynthesis shown by the data of Fv/Fm was not affected by the difference of Mn supply. In these experiments, the relationship between element concentrations and photosynthesis activity was not apparent.

It was noticeable that photosynthesis activity is not affected in spite of very low concentration of Cl in the new leaves. It was suggested that the relationship between photosynthesis activity and Cl concentration in plants, and that functions of Cl in photosystem II needed to be reinvestigated.