ABSTRACTS (MASTER THESIS)

Analysis of root contents, secretion and degradation dynamics of isoflavonoids in soybean

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Isoflavonoids secreted from soybean roots function as an essential signal molecule for the symbiosis with rhizobia. Isoflavonoids have been also shown to be involved in the interactions with arbuscular-mycorrhizal fungi and pathogens in the rhizosphere [1]. Because most functions of isoflavonoid were examined using plants grown in hydroponic cultures or under controlled environments containing solely a single microbe of interest, the actual functions of isoflavonoids in rhizosphere, especially in field condition still remain to be elucidated.

In this study, we have focused on the roles of isoflavonoids in soybean rhizosphere, and analyzed isoflavonoid contents in each plant tissues and secretion from roots, as well as the degradation dynamics of isoflavonoids in soil. We also analyzed the expression of *ICHG* (Isoflavone Conjugate-Hydrolyzing β-Glucosidase) in soybeans grown in hydroponic culture and also in the field. In hydroponic culture condition, HPLC analysis showed that the contents and composition of isoflavonoids in leaves and roots were not dynamically altered during development, while those in root exudates clearly differed, depending on the developmental stages. Daidzein was the predominant form of isoflavonoids in the root exudates of soybeans, especially at vegetative stages. The amount of malonyldaidzin was increasing at reproductive stages. Moreover, analysis of *ICHG* expression by real-time PCR showed that *ICHG* expression was higher at vegetative phases during soybean development, but was reduced during reproductive stages. This was in line with the data on the isoflavonoid secretion [2]. As for field studies, we planted soybeans (Glycine max cv. Shin-Tambaguro) in the field at Kyoto Gakuen University, and sampled the leaves and roots at 2, 5, 8, 11, 15, 20 weeks after germination. In the field condition, the contents and composition of isoflavonoids in leaves and roots were not dynamically altered during development, which is same as in hydroponic culture condition. *ICHG* expression was higher at vegetative stages and was reduced during reproductive stages, suggesting that the *ICHG*-mediated pathway for the isoflavonoid secretion has an important role at vegetative stages also in filed. The extraction of isoflavonoids from rhizosphere and bulk soil showed that daidzein was dominant form of isoflavonoids in soil, with more than 100-fold abundance in the rhizosphere. In the degradation analysis, daidzein was shown to be degraded within 3 weeks in both rhizosphere and bulk soils.

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References

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