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学　位　論　文　要　旨
SUMMARY OF DOCTORAL THESIS

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題目　Title:

アーバスキュラー菌根形成と植物成長の促進に対する草炭の影響に関する研究

Studies on the effect of peat on the arbuscular mycorrhizal symbiosis establishment and host plant growth

Peat is often the major component of potting mixes, and its specific characteristics exert a significant influence on arbuscular mycorrhizal fungi (AMF). The interactions of the fungal isolates, peat types and levels of peat application to the medium could be specific. In the studies related to the effect of peat on AM formation, Canadian peat has been the substrate most frequently used. The effect of peat from China on AM formation is poorly documented. In this study, the effect of Chinese peat on mycorrhizal formation, mycorrhizal effectiveness and host plant growth was investigated and compared with that of Canadian peat.

In Chapter 2, the effects of peat extract solutions on spore germination and hyphal growth of the arbuscular mycorrhizal fungus, *Gigaspora margarita* Becker & Hall were investigated. Spores were incubated in the extract solutions of peat from China and peat moss from Canada, which were prepared at a weight ratio of 1:10, 1:20, 1:30, 1:50 and 1:100 for each substrate according to the weight ratio of water. Compared with peat and peat moss solutions, solutions of KH_2PO_4 and $(NH_4)_2SO_4$ at various concentrations were used as media to investigate the effect of P and N. Spores in the peat solutions showed the highest values for the germination percentage, hyphal length and number of auxiliary cells, which were significantly higher than those in any other treatments. On the other hand, in the peat moss extract solutions, with a lower content of N and higher content of P than those in the peat solutions, germination and hyphal growth of spores decreased. With the increasing concentration of the N solutions, spore growth was promoted. However, the P solutions exerted an inhibitory effect on spore germination and hyphal growth. Peat solutions showed a high content of N and low content of P,

which might be related to the promotion of spore growth.

In Chapter 3, the influence of Chinese peat addition on arbuscular mycorrhizal formation and host plant growth was investigated in a pot experiment. Peat was mixed with Masa soil at different levels (0, 25, 50, 100, 150, 200 g kg^{-1}) into which an arbuscular mycorrhizal fungus (AMF) *G. margarita* was inoculated, and the seedlings of *Miscanthus sinensis* Anderess were planted. There was a significant increase in plant growth with increasing peat addition. Root colonization and the number of spores proliferating increased with the increase of the level of added peat. By decreasing the bulk density, increasing the maximum water-holding capacity and the content of total nitrogen, peat addition improved considerably the physical and chemical properties of soil, which might result in the promotion of plant growth and AM activity.

In Chapter 4, the influence of Chinese peat and Canadian peat moss addition on arbuscular mycorrhizal formation, mycorrhizal effectiveness and host plant growth was investigated in a pot experiment. Peat and peat moss was mixed with Masa soil at different levels (0, 25, 50, 100, 150, 200 g kg^{-1}) into which an arbuscular mycorrhizal fungus (AMF) *G. margarita* was inoculated, and the seedlings of *M. sinensis* were planted. There was a significant increase in plant growth with increasing peat addition. The growth promotive effect of the AMF on the host was enhanced by peat addition. Root colonization and the number of spores proliferating increased with the increase of the level of added peat. Although plant growth and root colonization in peat moss amendment increased slightly, peat moss had a negative effect on mycorrhizal effectiveness. Different from peat moss, Chinese peat addition improved considerably the physical and chemical properties of soil, which might result in the promotion of AM formation and mycorrhizal effectiveness.

In conclusion, the present study indicated that the application of Chinese peat to soil may enable to promote plant growth by stimulating mycorrhizal formation and enhancing the mycorrhizal effectiveness, which is different from the effect of Canadian peat. Further studies should be carried out to identify the key factors of the promotive effect, which may shed light on how to select suitable peat for the AM fungus-host plant system in actual uses. In addition, the combined use of the suitable peat and AM fungus could become a useful revegetation technique for successful reforestation programs of degraded soil in the future.