

Effect of the different cover crop incorporation on glomalin-related soil protein and soybean and maize growth

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Abstract

The glycoprotein known as glomalin-related soil protein (GRSP) is abundantly produced on the hyphae and spores of arbuscular mycorrhizal fungi (AMF) in soil and roots. GRSP play a decisive role in the soil aggregation, but GRSP was also sensitive to agricultural managements. Thus, our objectives were to assess the effect of different cover crop incorporation on the GRSP content in soil and growth of subsequent soybean and maize. Pot experiments with the incorporation of four cover crops were set up. The same amount (666g) of aboveground plant parts of wheat (AMF host), hairy vetch (AMF host), mustard (non-host) and rapeseed (non-host) was separately incorporated into soils. The aboveground plant parts and roots of soybean and maize were grown in each incorporated pots and sampled at 6 and 9 weeks after sowing. Our results showed that the different cover crops incorporation affected soil biological and chemical properties such as EC, NO₃-N content, β -glucosidase activity, alkaline phosphatase (ALP) activity and GRSP content. The soil EC and NO₃-N content in the hairy vetch, mustard and rapeseed was higher compared to the wheat. The β -glucosidase activity in the wheat and hairy vetch was significantly higher than that in the mustard and rapeseed, and the ALP activity in the wheat was significantly higher than that in the hairy vetch, mustard, and rapeseed. The GRSP content in the mustard and rapeseed was significantly lower than that of the hairy vetch and wheat. Moreover, The top dry weight and leaf area of soybean and maize in the hairy vetch at 6 weeks were significantly higher compared to the other treatments. Our results indicated that the incorporation of mustard and rapeseed may cause indirectly the decrease of GRSP content and soil enzyme activity in soil. One possible explanation for the decrease of GRSP in non-AMF host crop treatments may be the decrease of AMF density in the soil. AMF are not able to form a symbiotic relationship with *Brassicaceae* roots due to the release of anti-fungal compounds. This means the AMF may not be able to produce GRSP in the soil. However, the differences in the benefit of cover crop incorporation were shown only by a pot experiment. Comparative investigations of crop residue managements would be applied to both pot experiment and field study to clarify a better selection of cover crops in rotation to encourage GRSP production.

Keywords: Arbuscular mycorrhizal fungi, Cover crops, Glomalin-related soil protein, Incorporation

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