

Relative effects of biological amendments and crop rotations on soil microbial communities and soilborne diseases of potato[☆]

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Abstract

Various biological amendments, including commercial biocontrol agents, microbial inoculants, mycorrhizae, and an aerobic compost tea (ACT), were evaluated, alone and in conjunction with different crop rotations, for their efficacy in introducing beneficial microorganisms, affecting soil microbial community characteristics (SMCC), and reducing soilborne diseases of potato in greenhouse and field trials in Maine. Most amendments successfully delivered microorganisms into the soil, altering microbial populations and activity in accordance with the particular organisms added, and significantly altering SMCC (as determined by FAME analysis) to various degrees from 2 to 24 weeks. Amendment effects were greatest early on (2 weeks after amendment), but effects associated with crop treatment became more dominant at subsequent assessments (10 and 24 weeks after amendment). In field trials, effects on microbial characteristics, soilborne diseases and tuber yield were variable, with some microbial inoculants and a biostimulant producing no significant effects, whereas arbuscular mycorrhizae, reduced stem canker and black scurf by 17–28%. When used in three different 2 yr crop rotations (barley/ryegrass, barley/clover, and potato, all followed by potato), biological amendments reduced soilborne disease and improved yield in some rotations, but not others. Soil-applied ACT and the combination of ACT with a mixture of beneficial microorganisms (Mix) reduced stem canker, black scurf, and common scab on tubers by 18–33% and increased yield 20–23% in the barley/ryegrass rotation, but not in the other rotations. Mix also reduced disease (20–32%) in the barley/clover rotation only. None of the amendments significantly reduced disease in continuous potato plots. Both crop rotation and amendment treatments significantly affected SMCC, but rotation effects were more dominant. These results indicate that certain rotations were better able to support the added beneficial organisms from amendments and enable more effective biological control, and also that favorable crop rotations may be more effective than amendments in manipulating or altering SMCC. Establishment and persistence of amendment effects may depend on many factors, but an effective and supportive crop rotation is apparently important.

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