

Effects of a fungal volatile organic compound on microbiomes associated with perennial ryegrass and white clover under drought stress

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Drought can significantly reduce pasture growth in many parts of New Zealand with subsequent negative effects on the economy. Fungal volatile organic compounds (FVOCs) can facilitate plant-microbe interactions including host-microbiome recognition, assembly, and maintenance via chemical signalling. This study investigated the impact of coating seeds with a FVOC on plant biomass and plant associated microbiomes of drought stressed pasture plants (perennial ryegrass, white clover, and a mixture of both) in a glasshouse study. Plant dry matter and soil microbial samples were collected when plants had recovered from three consecutive drought events. The ITS3/ITS4 and 16S V5/V7 regions were sequenced using the DNA nanoball sequencing platform, with sequence denoising using the DADA2 pipelines, and microbiome analyses conducted via MicrobiomeAnalyst. FVOC treatment increased plant dry weight after the three drought events by 9%, 8% and 33% respectively in the absence of drought

and by 15%, 31%, 48% under drought conditions for grass, clover, and the mixture, respectively. Bacterial amplicon sequence variants (ASVs) of Rhizobiaceae, Bacillaceae, and Xanthobacteraceae from FVOC treatments were 11%, 5%, and 22% higher than controls, whereas fungal ASVs of Nectriaceae, Chaetomiaceae, Mortierellaceae, Filobasidiaceae, and Hoehnelymycetaceae were reduced by 9%, 6%, 10%, 3%, and 38%, respectively. Bacterial families that incorporate known mutualistic species were associated with plant growth and stress responses, while fungal families that showed a reduction in ASVs were primarily those that include species capable of causing plant disease. These results suggest that FVOC treatment can enhance plant biomass and modulate microbiomes to improve drought resilience, offering a potential strategy for pasture management under water-limited conditions.