Bacterial Processes Associated with Soil C and N Following Application of Compost and Manure to Dairy Pasture at the Beginning and End of the Growing Season

LYNETTE ABBOTT[1,2] BEDE MICKAN[1,2,3], ZAKARIA SOLAIMAN[1,2], ANJANI WEERASEKARA[1], SANJA SCHWAB[1], IAN WAITE[1,2], SASHA JENKINS[1,2]

[1]UWA School of Agriculture and Environment (M087), The University of Western Australia, 35 Stirling Highway, Crawley WA 6009, Australia
[2]The UWA Institute of Agriculture (M082), The University of Western Australia, Perth WA 6009, Australia
[3] Richgro Garden Products, 203 Acourt Rd, Jandakot Western Australia 6164, Australia

This study investigated the impact of dairy manure and compost on bacterial community composition and functional diversity in a dairy pasture in south-western Australia. Bacterial activities are involved in both the retention and loss of soil C and N, during the degradation of organic matter. Bacterial communities respond to addition of manure and compost, and play a key role in the incorporation of these C resources into the soil matrix. In this study, bacterial communities in dairy soil amended with manure or compost in a field experiment were characterized in soil collected at the beginning of the growing season in 'winter' and at the end in 'summer' using community profiling of 16S rRNA genes. Soil had been amended in the field with inorganic fertilizer in combination with 2t/ha dairy manure, or compost applied at 3t/ha or 6t/ha. The dominant bacterial phyla were Proteobacteria, Actinobacteria, Acidobacteria, Bacteriodetes and Firmicutes and their relative abundances were influenced by the organic amendment type and application rate as well as the time of sampling. The occurrence of C degrading functional genes and N functional genes were predicted using PICRUSt. Predicted gene counts associated with breakdown of hemicellulose, cellulose and chitin were highest in the winter samples with the application of manure. Predicted C genes and N gene abundance of amoA associated with nitrification was lowest for soils treated with 6 t/ha compost in winter samples. This study illustrates the complexity of soil bacterial community responses to manure and compost applied to dairy pasture. One feature of this dynamic was reduced potential for degradation of soil C and mineralization of N and therefore higher C and N retention in soils when 6t/ha compost was applied compared to application of 3t/ha compost and non-composted manure. Management practices that enhance C sequestration and N retention in agricultural soils may enhance crop productivity whilst will limiting C and N losses via greenhouse gas emissions and leaching.