Repeated-measure analysis of the temporal nitrous oxide emissions from the multi-species mixtures

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Repeated measures analysis was applied to analyse the nitrous oxide (N$_2$O) emission observed from an experiment that consisted of controlled agricultural plots with evenly distributed mixtures of species from three different functional groups: two grasses (L. perenne and P. pratense), two legumes (T. repens and T. pratense) and two herbs (C. intybus and P. lanceolata). Observations were preprocessed to create repeated measures data, based on seasons and the time of fertiliser application. The concepts of mixed models and diversity-interaction (DI) models were combined to develop statistical models to predict the seasonal variations in the diversity effects in the multi-species mixtures. The combined statistical models were extended to include the effect of multiple levels of fertiliser application as well. Effect of reduced fertiliser application is found to be a dominant factor for seasonal variations in the N$_2$O emission. Model which considered diversity effects and the effect of reduced fertiliser application was able account for 86.2% variation in the seasonal N$_2$O emission. Multiple DI models were fit on on the N$_2$O emissions observed immediately after fertiliser application. Comparison of multiple DI models shows that significant identity effects were observed consistently after each fertiliser application, whereas a significant diversity interaction effect was observed only once between legumes and herbs.