Comparing machine learning metamodels of different scale for pasture nitrogen response rate prediction

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In this work we compare the performance of machine learning metamodels of different scale for the prediction of pasture grass nitrogen response rate using a case study across different locations in New Zealand. We first used a range of soil, plant and management parameters known to affect grass growth and/or nitrogen response. These generated a complete factorial that enabled us to run virtual nitrogen response rate experiments, using the APSIM simulation model, in eight locations around the country. We included 40 years of weather data to capture the effect of weather variability on response rate. This created a large database with which to train machine learning models. We created local, regional, and nation-wide models using Random Forest and tested them on known and unknown locations. To evaluate the models, we first calculated the RMSE, MAE and R^2 and then determined if the distributions of the predictions were statistically different using the Mann-Whitney U test. Finally, we explore the generalizability of the models using the error metrics and the results of the statistical test.