Can on-line visible and near infrared spectroscopy assist in site specific phosphorus management?

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Abstract

This paper aims at utilising high resolution P data generated with an on-line visible and near infrared (vis-NIR) spectroscopy sensor for site specific management of P_2O_5 fertiliser. On-line measurement was carried out for three successive years of 2011, 2012 and 2013 after crop harvest in a 21 ha field in Duck end farm, Bedfordshire, the UK. Variable rate (VR) P was only applied in year 2 after crop harvest, where the field was divided into 4 P-index zones. Indexes 0 and 1 received 140 kg/ha and 70 kg/ha P_2O_5, respectively, whereas indexes 2 and 3 received no P_2O_5 fertiliser. The purpose of this VR P application was to attempt unifying the entire field to index 2, which is considered the optimal P level for cereal crops.

Results showed that the on-line measurement accuracy of P was acceptable with coefficient of determination (R^2), root mean square error of prediction (RMSEP) and residual prediction deviation (RPD) of 0.60, 0.60 mg 100 g^{-1} and 1.5, respectively. The VR application of P_2O_5 after crop harvest in year 2 improved the uniformity of the spatial distribution of P, measured in year 3 with the on-line soil sensor. The number of zones of P-index was decreased from 4 indexes before P_2O_5 VR application to a uniform P index e.g. index 2. The coefficient of variation (CV) of P in the field was reduced from 26% in 2011, and 25% in 2012, to 16% in 2013. It was concluded that the on-line vis-NIR soil sensor is an effective tool to manage and minimise within field variation in P in arable crops. However, a further study is needed that

should include more fields with different soil types in order to generalise the results achieved in the current work.