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Efficiency of a VISNIR real-time phosphorus fertiliser applicator

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Variable rate (VR) phosphorus (P) fertilisation aims at improving fertiliser use efficiency and environmental impacts by varying fertiliser rates according to the needs of each zone within a field. This study evaluates the profitability of a real-time VR fertilisation of phosphate (P_2O_5) in grain corn yield using visible (VIS) and near-infrared (NIR) soil sensor-based VR applicator. This evaluation was considered in two different soil phosphorus levels (high and very high with minimum and no fertilisation, respectively), which are the common phosphorus levels in Belgian agricultural fields. A previously developed VIS-NIR model was used to predict the available P (Pal). An experimental field divided into two zones according to soil P levels, namely, Zone 1 (high Pal level of 55 mg $100g^{-1}$) with 2 plots and Zone 2 (very high level of Pal of 63 mg $100g^{-1}$) with 3 plots. In these five plots VR of phosphate (P_2O_5) was adapted using the VR applicator. For each plot, the amount of uniform rate (UR) P_2O_5 need was also obtained using the standard soil test phosphorus (STP). The overall P_2O_5application in each plot using the VR approach was compared with the corresponding UR. Results showed that the amount of P_2O_5 applied with VR fertilisation depended upon the initial level of Pal. Compared with the STP recommendation for UR application, in Zone 1 with high level of P, VR provided a positive fertiliser return whereas, in Zone 2 with very high level of P, VR led to a negative fertiliser return.

The corn respond to P revealed that there is a need of fertilisation even in field spots with high level of P which is recommended not to apply any fertilisation.

The results also revealed that the recommendation of P_2O_5 based on STP for UR could only meet the actual fertility requirements of 7-22% of the field area. These results showed that the VR fertilisation of P based on a VIS-NIR sensor is profitable in fields with high level of phosphorus. However, the profitability of this system should also be investigated in fields with medium, low and very low levels of P levels which are not the case in most of the fields in Belgium.