

SITE-SPECIFIC FERTILIZATION MANAGEMENT: INFLUENCE OF THE PAST HISTORY OF THE ADDITION OF FERTILIZERS ON THE INTRA FIELD VARIABILITY OF THE RATE OF P AND K IN THE SOIL.

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ABSTRACT

Site specific crop management adapts the fertilizer amount applied in relation to the intra field crop needs. In this context, trials were carried out under field conditions to develop technico-economic baseline data and methodology of soil sampling for precision agriculture in Upper-Normandy.

RESULTS

The intra field variability concerning rates of phosphorus and potassium rates is essentially due to the past history of the field (regrouping of plots) and the past addition of fertilizer. The cropping history since 1947, create in our experimental plot, the three different PK soil rates zones.

The trials were carried out in one field in which a grid sampling of soil was taken in order to establish maps showing rates of P_2O_5 and K_2O . For each rate we calculated the quantities of fertilizer required using the COMIFER method (Llorens, 2001). Techniques of electric conductivity were used to establish the intra field heterogeneous characteristics in soil depth. Yield maps were made for each field

The first step was to characterize the rates of P_2O_5 and K_2O with relation to the past history of the fields plots. Then for this field we calculated, using geostatistic technics, the minimal number of soil analyses required par hectare to correctly describe the heterogeneity of the rates.

For the models produced from the one sample per hectare data we cannot calculate the maximum value reached by the semi-variance and therefore we cannot obtain the sill and the range: there is no spatial dependence. This result is more characteristic for K than P soil rates which are more heterogeneous and it will be possible to obtain a spatial dependence.

For the models produced from the four samples per hectare data, the spatial variability of P and K soil rates is very correctly described: The K range was about 300m and the P range was about 400m. This is consistent with the result shown in literature (Bruchou and Mary, 2007). But this sample frequency is too expensive for the farmers.

For the models produced from the 2pha data, the spatial variability of P and K soil rates is satisfactorily described: P soil rates are better fitted than K soil rates. From the models of variograms obtained, we created the interpolated maps which we used to calculate the fertiliser recommendation that will be applied by SSCM.

Finally we evaluated the economic consequences of the use of site-specific applications applied to commercial farms in terms of the reduction of the use of fertilizers.

The direct margin simulations calculated using an economic simulator "Olympe", vary from 32 to 47 euros per ha (Bourgain et Llorens, 2009). We can see that an increase of farm surface area and soil heterogeneity raises the profitability of site-specific farming compared to uniform farming.

From an environmental point of view, SCCM allows a significant reduction in sprayed amounts for all heterogeneity levels. This difference increases according to the crop system surface area (CSSA).

CONCLUSION

The geostatistic analysis allows us to evaluate the heterogeneity of the P₂O₅ and K₂O rates and to define the minimal number of analyses per hectare necessary at two samples per hectare in our experimental conditions. We were able to assess the potential reduction of P and K fertilizer. These results had demonstrated economic and environmental gains from these techniques in our pedoclimatic conditions.

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