# ARE VARIABLE RATE INPUTS suited to every situation?

*Caroline Desbourdes: "For nitrogen fertilisation, variable rate application is a technique that can be used in 50% of wheat parcels and 75% of oilseed rape fields."*

**The implementation of different cultural practices within a parcel depending on the crop's potential should improve efficiency, according to Caroline Desbourdes, precision farming specialist at ARVALIS. She nevertheless points out some of the limitations of the techniques currently available.**

***Perspectives Agricoles:*** **How can variable rate inputs be implemented?**

**Caroline Desbourdes:** Variable rate practices is a technique suited to fields that present a significant level of heterogeneity, but in such a way that large enough operational zones can be defined. The minimum width on which to apply varying input rates is usually the width covered by a spreader or sprayer. However, some spreaders are capable of applying variable rates on both sides of the hopper. The choice of the method used to characterise infield variability must be based on the variable input limiting factor. It should therefore focus on the nutritional status of the plants to determine the level of nitrogen inputs required in oilseed rape crops as well as for late applications in wheat. The nature of the soil should be used to determine base fertilisation, second nitrogen applications to wheat, as well as sowing density.

***P. A.:*** **Input rate variation based on the plants' nitrogen status has proved successful, but what about basing it on soil characterisation?**

**B. D.:** One of the possible techniques is called "grid sampling", or systematic sampling. This means that the soil of a parcel is sampled according to a pre-set grid. An ARVALIS study has shown that at least five samples per hectare are necessary in order to characterise the variability of the soil's chemical and physical features. It is a reliable, but relatively expensive method. Other, so-called "indirect" methods have therefore been developed. One of them is based on the soil's resistivity or conductivity properties when it is subjected to an electrical current. That same study also showed that in half of the parcels tested, there was a correlation between the areas that, using that method, were identified as displaying homogeneous behaviour, and varying depths. However, in the parcels tested, no link was established between those homogeneous areas and the distribution of the soil's chemical elements (such as phosphorus and potassium). This distribution depends, among other things, on the cropping practices used in the past. Farm yield maps may also be available. They provide an annual assessment based on a wide array of parameters, and as such are difficult, or even impossible, to use to vary input rates.

***P. A.:*** **Are infrared measurements a possible alternative method?**

**B. D.:** Carrying out soil analysis in the field, using a portable infrared sensor, has many advantages. The measurement is simple, can be taken in less than a minute, and does not require sending a sample to a laboratory. The number of analyses carried out can therefore be high, and still at a much reduced cost. Grid sampling then becomes affordable. ARVALIS is currently working on calibrating the device, in order to link the optical signal with the soil's physical and chemical properties. Preliminary results are encouraging. The aim is to characterise as many of the soil's features as possible, such as its pH, its physical composition and its nutrient status. This technique would have useful applications for base fertilisation, as well as when identifying the areas where sensors should be placed for irrigation management purposes, and even when determining sowing density if a link can be established between this parameter and the nature of the soil.

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