

Abstract

Measurement of soil vineyard parameters by near infrared spectroscopy

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Introduction

Modern technological developments in positioning, sensing, and control systems have opened a new era in which many traditional agricultural practices are being left behind. Replacing them, are the so-called 'precision farming' techniques in viticulture that manage variability within a field by applying agronomic inputs in the right place, at the right time, and in the right quantity, to reduce the environmental impact of crop production. Visible and near-infrared (vis-NIR) spectroscopy has emerged as one of these techniques, enabling the rapid and non-destructive analytical correlation of diffusely reflected vis and NIR radiation with chemical and physical properties of soil and plant components. Recent environmental developments have created increased demand for in-field measurement of soil constituents. For example, soil carbon pool measurements are needed to study carbon sequestration, and measurements of soil nitrogen could be used to manage and minimise the leaching of nitrates into the ground water.

Materials and methods

Core soil samples were taken from different treatments (e.g. fertilisation, irrigation) and analysed in the vineyard using an ASD portable vis-NIR instrument (500–1800 nm) in reflectance. Partial least squares (PLS) calibrations between reference and NIR data were developed using cross validation.

Table 1. Cross validation statistics for soil parameters measured using visible and NIR reflectance spectroscopy.

	Mean	<i>SD</i>	R^2	<i>SECV</i>
OC (%)	0.42	0.26	0.88	0.16
TN (%)	0.70	0.03	0.75	0.02
K (mg Kg ⁻¹)	169.3	66.2	0.97	47.9
S (mg Kg ⁻¹)	51.9	38.5	0.92	29.1

OC: organic carbon, TN: total nitrogen, K: potassium, S: sulphur, *SD*: standard deviation;

R^2 : coefficient of determination, *SECV*: standard error of cross validation.

Results and discussion

Preliminary results have shown the potential of NIR spectroscopy to accurately measure soil chemical parameters in the vineyard (see Table 1). Further work is necessary before NIR becomes able to be used by growers and viticulturists to define the amount of fertilisers to use with confidence, as well as reduce the environmental impact through the reduction of fertiliser applied to the vineyard.