

Estimating soils properties using NIRS to assess amendments in intensive horticultural production

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During the past ten years, Near Infrared Spectroscopy has been successfully applied to the analysis of a great variety of agriculture products. Previous works (Morra et al., 1991; Salgó et al., 1998) have shown the potential of this technology for soil analysis, estimating different parameters just with one single scan. The main advantages of NIR applications in soils are the speed of response, allowing the increase of the number of samples analysed to define a particular soil, and the instantaneous elaboration of recommendations for fertilisation and soil amendment. Another advantage is to avoid the use of chemical reagents at all, being an environmentally safe technique.

In this paper, we have studied a set of 129 soil samples selected from representative glasshouse soils from Southern Spain. The samples were dried, milled, and sieved to pass a 2 mm sieve and then analysed for organic carbon, total nitrogen, inorganic nitrogen (nitrate ammonium), hygroscopic humidity, pH and electrical conductivity in the 1:1 extract. NIR spectra of all samples were obtained in reflectance mode using a Foss NIRSystems 6500

spectrophotometer equipped with a spinning module. Calibration equations were developed for seven analytical parameters (pH, Total Nitrogen, Organic Nitrogen, Organic Carbon, C/N ratio and Electric Conductivity).

Preliminary results show good correlation coefficients and standard errors of cross validation in equations obtained for Organic Carbon, Organic Nitrogen, Total Nitrogen and C/N ratio. Calibrations for nitrates and nitrites, ammonia and electric conductivity were not acceptable. Calibration obtained for pH had an acceptable SECV, but the determination coefficient was found very poor probably due to the reduced range in reference values. Since the estimation of Organic Carbon and C/N ratio are acceptable NIIRS could be used as a fast method to assess the necessity of organic amendments in soils from Mediterranean regions where the low level of organic matter in soils constitutes an important agronomic problem. Furthermore, the possibility of a single and fast estimation of Total Nitrogen (tedious determination by modifications of the Kjeldahl procedure) could provide and interesting data to use in the estimation of nitrogen fertilizer rates by means of nitrogen balances.

Literature References

- Morra M.J., Hall M.H., and Freeborn L.L. 1991. Carbon and Nitrogen analysis of soil fractions using near-infrared reflectance spectroscopy. *Soil Sci. Soc. Am. J.*, 55, 288-291
- Salgó A., Nagy J., and Tarnóy J. 1998. Characterisation of soils by the near infrared technique. *J. Near Infrared Spectrosc.* 6, 199-203