ON-THE-GO PH SENSOR: AN EVALUATION IN A KENTUCKY FIELD

M. S. Rodrigues and E. M. Gianello

Soil Science Department
São Paulo State University
Jaboticabal, São Paulo, Brazil

B. Mijatović, E. A. Rienzi and T. G. Mueller

Plant and Soil Science Department
University of Kentucky
Lexington, Kentucky

A. Castrignanò

Agricultural Research Council Research
Unit for Cropping Systems in Dry Environments
Bari, Italia

INTRODUCTION

A commercially available on-the-go soil pH sensor measures and maps subsurface soil pH at high spatial intensities across managed landscapes. The overall purpose of this project was to evaluate the potential for this sensor to be used in agricultural fields.

The specific goals were to determine and evaluate 1) the accuracy with which this instrument can be calibrated, 2) the geospatial structure of soil pH measurements, and 3) interpolation quality.

MATERIAL AND METHODS

The study was conducted at a research farm in central Kentucky. Soil pH sensor measurements were collected and georeferenced. Prediction datasets were created from sensor measurements collected along parallel passes separated by 12-m (n = 309). The mean pH values for the electrode pairs and the separate electrode values were used for data analyses. Validation measurements were collected along passes separated by 43-m (n = 69) which were approximately perpendicular to direction of the prediction dataset measurements (Figure 1a).

Calibration measurements were collected along irregularly spaced passes (n = 20; Figure 1b) using the pH sensor. Additionally, six soil sub-samples were collected within a 1-m square around each point (10-cm depth) and were analyzed for water, KCl, and buffer pH (Figure 1c). Semivariograms were calculated with SAS and modeled visually.

RESULTS AND DISCUSSION

Simple relationships were strong between sensor and laboratory measurements including soil water pH (r^2= 0.87), salt pH (r^2= 0.85), and SMP buffer pH (r^2= 0.84) (Figure 2). The data were well structured spatially (i.e., relative structural variability = 78.7%; range of spatial structure = 31-m). Kriging experimental errors with the validation dataset were larger than desired (i.e., rmse = 0.418; r^2 for the relationship between predicted and measured values = 0.52); these errors reflect the limitations of kriging not the sensor itself. The data suggest that the on-the-go pH sensor has potential to be a useful tool for Kentucky agriculture.

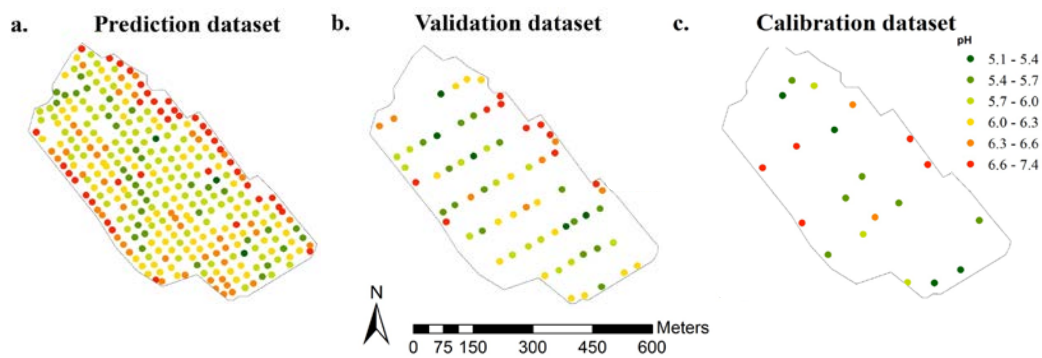

Fig. 1. Sampling design for the prediction (a), validation (b), and calibration (c) datasets.

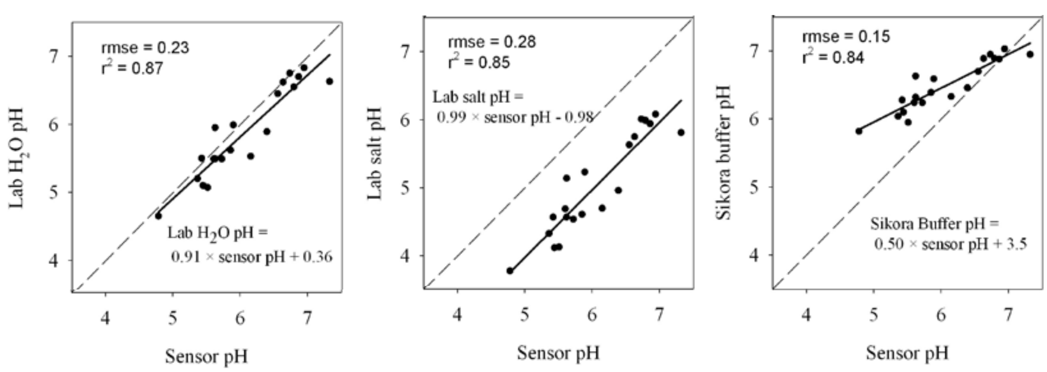

Fig. 2. Sensor measurements of pH were highly correlated with laboratory measures.