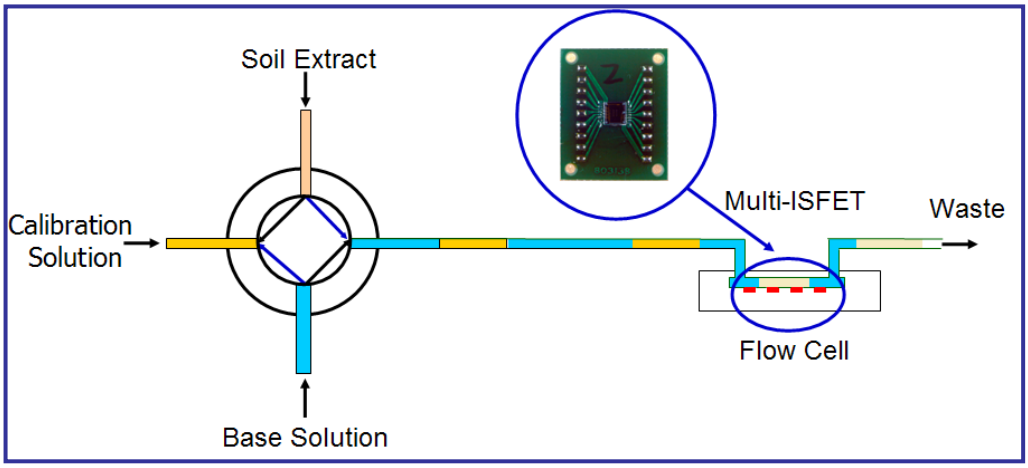
Simultaneous Analysis of Soil N, P, and K: Progress toward On-the-go Soil Nutrient Sensing



The conventional practice of soil sample collection and analysis is costly and time consuming when applied at the intensity needed in variable-rate fertilizer management systems. A more efficient approach would be to sense soil macronutrient (nitrogen, potassium, and phosphorus) status in real time as a machine moves across a field. This approach requires a system that can extract nutrients from the soil, coupled with sensors that can rapidly measure nutrient levels in the soil extracts. The sensing elements must be compatible with the extracting solution, and adoption would be enhanced if a single extracting solution could be used for all soil macronutrients. In previous work, we identified soil nitrate, phosphate, and potassium ion-selective electrode (ISE) sensors that, when used with the Kelowna multiple-element extracting solution, accurately quantified nutrient levels in laboratory solutions. The goal of this research was to evaluate the accuracy of the sensors for measuring nitrate, phosphate, and potassium in soils. We used thirty-seven soils from Missouri and Illinois as our test samples and compared the nutrient levels with our sensors to those obtained with standard laboratory methods. ISE-measured nitrate concentrations were very similar to those from standard methods. ISE-measured phosphate and potassium concentrations were lower than those from standard methods, but the difference could be easily corrected with a calibration equation. *The results show that the ISE sensors could measure nitrate, phosphate, and potassium concentrations at levels typical in agricultural soils.* An ISE nutrient sensing system might be used to target fertilizer to sub-field areas where it would be beneficial, and to reduce fertilizer application in sub-field areas where nutrient concentrations are already sufficient. Such a system could provide lower production costs and reduce environmental impacts, benefiting both producers and consumers.

Kim, H.J., Hummel, J., Sudduth, K.A., and Motavalli, P.P. Simultaneous analysis of soil macronutrients using ion-selective electrodes. Soil Science Society of America Journal 71:1867-1877. 2007.
http://www.ars.usda.gov/sp2UserFiles/Place/36221500/cswq-0324-406667.pdf

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