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Abstract

Placing Soil Information in the Hands of Farmers †

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Abstract: Adequate soil information to adapt fertilizer plans and support farmers' yield ambitions is either hard to obtain or expensive, as it often requires soil sampling and analyses in a lab. AgroCares has developed two services, i.e., the Scanner and the Lab-in-a-box, that place the knowledge of soil analysts and agronomists in the hands of the farmer in a quick, easy and affordable way. The obtained spectral image of the soil provided by the scanner is compared to data in the Global Soil Database; using machine learning regression models, the content of the soil sample is predicted based on its spectrum. The results are returned to the farmer as a soil status report. The Global Soil Database is developed country by country and starts by determining the number and location of the samples required to cover the full spectral range of the specific country using data such as soil type, land use, fertilizer and crop residue management, satellite crop development images, climate and elevation. These samples are then collected following protocols and shipped to the Golden Standard Laboratory in the Netherlands where they are analyzed using regulated, traditional wet chemistry techniques and scanned with the sensors of the Lab-in-a-Box (Mid-Infrared and XRF) and the Scanner (Near-Infrared). The reference values obtained in the GSL and the spectra for each sample obtained from the Scanner and the Lab-in-a-Box form the ground truthing data set required for the machine learning algorithms. Once all the soil data have been extracted from the spectral image, they are sent to the fertilizer module, where the different nutrients are allocated to soil fertility categories. These categories are used to establish the quantities in kg/ha of nutrients needed to reach the desired level of soil fertility. Using local nutrient crop uptake tables, the total nutrient requirements are calculated and converted into fertilizer recommendations that consider factors like nutrient loss after application and available fertilizer. The user then receives a full soil management report that includes the soil analysis results in classes of N, P, K, pH and organic matter with the Scanner, and in values of all macro- and micro- nutrients with the Lab-in-a-box.

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