

DEVELOPING A MOBILE LABORATORY METHOD FOR SOIL NUTRIENT ANALYSIS SERVICES TO LOW INCOME FARMERS

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Abstract. We seek to develop a low-cost methodology for helping underprivileged farmers to analyse soil nutrients and select crops and soil enrichments relevant to their own field, by combining case-based reasoning (CBR) with dedicated image processing (IP) acquiring data from an antique but robust separation method, circular paper chromatography (CPC).

In flows whose components tend to move at different speeds, particles sometimes aggregate into local streams of shared velocity; one example is the convection cells seen on the solar surface. This is especially apparent in radial flows, where increasing circumference permits migration patterns with more intricate lateral detail to evolve. We have defined a CPC procedure in which this will occur consistently. Each soil sample is dried, sieved through 2mm mesh, and orbitally agitated in 1% NaOH. The suspension is separated with conventional CPC by wick-feeding to a filter paper prepared with AgNO₃ as indicator.

In CBR, the number of input values must exceed the desired number of output values. From each optically scanned CPC, the IP extracts 153 area, shape and hue parameters which the CBR compares with our database of 30000 samples previously analysed in conventional soil laboratories. The farmer receives a print-out showing eighteen soil parameters and recommendations for suitable crops and soil enrichments.

The entire operation can be housed in a small bus and operated in rural areas by two relatively low-educated staff after appropriate training, producing about fifty analyses per working day.

Characteristically, CBR neither requires nor generates theoretical explanations; it only delivers results. Our current research involves pilot field expeditions and improving correlations with conventional analyses by optimising the weighting coefficients in the IP-CBR interface. Current soil parameter values are within $\pm 10\%$ of conventional values, except for organic carbon $\pm 30\%$, sulphur $\pm 28\%$ and zinc $\pm 20\%$.

We would welcome tests of our methodology in non-Indian environments.

Key words: Soil nutrient analysis, Crop recommendations, Circular paper chromatography, Image processing analysis, CPC evaluation.