Remedial measures technique shows the way in soya

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The remedial measures technique is an analytical 'numbers' procedure enabling the analyst to determine factors of a multiple nature affecting an outcome. Such an outcome is bean yield – as is evident in the case of the Protein Research Foundation's exercise carried out on soya bean plants grown at two locations in South Africa.

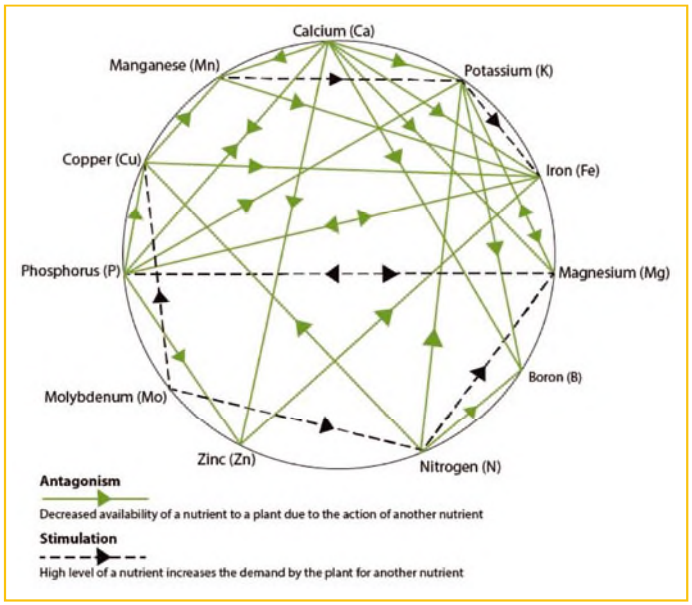
The multiple factors assessed are those relating to soil fertility and favourabilty for growth and productivity. The procedure is entirely empirical, having no reliance on assumption.

The sand in which soya is grown at the Bothaville site.

Complex interactions

Interactions between plant nutrients in the soil affecting root uptake are complex. Mulder tried to indicate these in his chart (*Figure 1*). The implication is that prediction of uptake based on application quantities is an inaccurate science.

Figure 1: Mulder's chart indicating nutrient interactions in the soil as they promote or retard root uptake.



The remedial measures technique, in relating yield metrics to nutrient levels and other soil variables, provides direct information of applications and circumstances that will specifically, if simultaneously altered, affect yield.

The technique is being demonstrated on irrigated soya growing in a clay soil near Rustenburg (Ferdie Meyer) and on dryland soya growing in sand near Bothaville (Jan Botma). At each site 20 plant-clumps (eight to ten plants), well distributed in the trial area, were uplifted with soil attached to the roots.

The soil adhering to the roots of each plant was analysed comprehensively (20 analyses), as well as the plant in terms of bean yield and dry matter content. Soil pH, nutrient content (P, K, Na, Ca, Mg, Fe, Mn, Cu, Zn, and B in mg/kg), cation exchange capacity (cmol (+)/kg), and bulk density (kg/m^3) quantified from each sample were evaluated with regard to component influence on plant performance.

The analytical procedure makes use of a multivariate statistical algorithm identifying factors of significance as determinants of plant performance at each growth site. The results indicate goals to be achieved – those associated with best performance. The plant samples that were taken comprised outstanding, moderate and poor performers.

Increasing bean yield

In Rustenburg, where the soil of the area under consideration naturally exhibit a positive imbalance of magnesium, bean yield bore a highly significant relationship with soil potassium, soil magnesium and cation exchange capacity. The component potassium relationship was positive whereas that of magnesium was negative (*Figure 2 and 3*).

Cation exchange capacity's component effect was positive. Increasing soil K to

200ppm for the following season is an attainable goal, expected to generally increase bean yield. Practically, reducing soil Mg and increasing soil CEC are impractical to achieve in the short term. Mg application should be excluded, and adjustments of the other nutrients (N, P, Ca, Cu, Fe, Mn, Zn, or B) should be made to cater for expected crop removal of these nutrients.

At Bothaville, where the soil is almost 100% sand, bean yield bore a highly significant relationship with cation exchange capacity and Zn concentration. The component Zn relationship was positive as was the cation exchange capacity relationship. Plant performance

Figure 2: Soil K concentration (Y axis) as it related to plant bean yield (g).

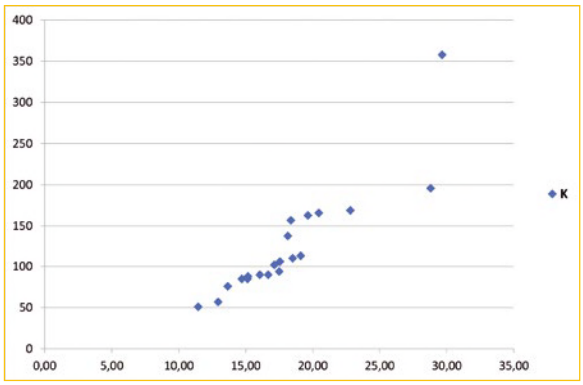
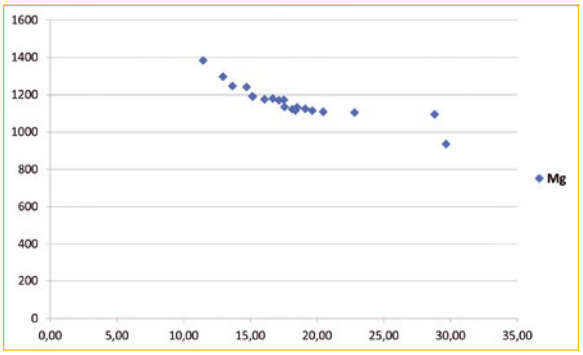


Figure 3: Soil Mg concentration (Y axis) as it related to plant bean yield (g).



was markedly better where nutrient retention was slightly greater.

The analysis also indicated a yield response to Zn. In view of it not being possible to alter cation exchange capacity in a season, it was recommended that fertiliser catering for expected crop removal be applied in a number of applications – as many as four – from the time of planting.

Fortnightly applications may be appropriate, as well as the use of controlled release or reduced-release granular fertiliser. Spray application of zinc nitrate when the plants have leafed-out somewhat was also recommended.

The benefits of these alterations are to be assessed during 2019 a number of weeks prior to harvest. The analysis procedure is to be repeated at each site to determine further adjustments to continue bean yield increases. The results of these endeavours are to be communicated in our next article.

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