Remedial measures technique for increased yield

By Dr Steve Oosthuyse, general manager, HortResearch SA

During the past three years, Dr Steve Oosthuyse of HortResearch SA in Tzaneen, has researched the application of the Remedial Measures (relationship determination) Technique (RMT) on soya bean – this three-year project was funded by the Protein Research Foundation.

Work was carried out on two soya bean stands: one in Rustenburg on the farm of Ferdie Meyer, and the other in Bothaville on the farm of Johan Botma. The primary aim was to identify key relationships between plant performance and soil conditions in order to gather empirical data that can be used to determine fertilisation measures, which in turn will enhance plant performance.

Centre pivot at the Rustenburg stand.

It is all in the relationship

Interactions in soil relating to nutrient uptake are generally complex and difficult to understand. The technique is entirely empirical (it does not rely on assumption) and reveals specific yield limiting and promoting factors of an area of land. Application of the technique is not limited to soya bean and can be applied to any crop grown in soil.

The power of RMT to determine soil conditions having a favourable or unfavourable effect on plant performance, has been demonstrated. In some instances, measures to improve productivity are obvious; in others, the knowledge of the interpreter may be significant in recognising remedial measures. Some cases may not allow for the practical implementation of modifications, or it may require a longer implementation period. Irrespective of the situation, an understanding of favourable and unfavourable factors is gained.

The analysis indicates actual target levels as well as how significant the effect of a factor is in a particular situation. The coefficient of multiple determination (R2) indicates the percentage by which the data variation is accounted for by the variation in the independent variables designated as being significant.

RMT is unique since performance variables are a component of the analysis. The basis of the technique is not complex, and it diverges from other methods in that it reveals the relationships between plant performance and soil variables. Variation always exists between locations in a cultivation block, affording the interpreter the opportunity to determine these relationships. The absence of any relationships indicates that none of them has a bearing on performance.

Table 1: Recommended amounts (kg/ha) of fertiliser (spray at every opportunity, i.e. when applying fungicide, with a TE cocktail).

	21% N	15% Super P	51% K	18,6% Ca
	AS	Granular P	KCl	Gypsum
Quadrant 1	156	52	1 201	33 104
Quadrant 2	158	139	773	65 834
Quadrant 3	164	150	455	58 974
Quadrant 4	163	29	1 183	38 842

Site-specific information

The following was deduced while carrying out the technique at the Rustenburg site during the 2018/19 and 2019/20 growing seasons. The plants at this site are grown under irrigation and the soil is a clay-loam (the area under centre pivot was divided into quadrants).

Removal of samples from the untreated and treated quadrants.

Target soil analysis values:

- Potassium (K) saturation: 3,2 (from an average of 2,5).
- Iron (Fe) concentration: 77,5mg/kg (from an average of 95).
- Sodium (Na) saturation: 0,5% (from an average of 0,6).
- Phosphorus (P) (Bray I) concentration: 20mg/kg (from an average of 14,6).

Fertiliser recommendations

Carry out your agronomist-recommended fertilisation programme, but also consider the following and adjust when necessary:

- Increase K saturation to 3,2% by applying potassium chloride (KCl).
- Discontinue any applications of Fe.
- Consider improving water quality, if possible, by reducing the quantity of especially Na.
- Apply additional phosphate to increase P concentration from 15 to 20mg/kg.

Quantifying performance variables

Just prior to harvest in April this year, ten plant clusters and soil, in which the roots were imbedded, were removed from the treated quadrant, as well as the adjacent untreated quadrant. After collection, plant performance variables were quantified.

Figure 1: Cluster bean yield (g) of each of the samples.

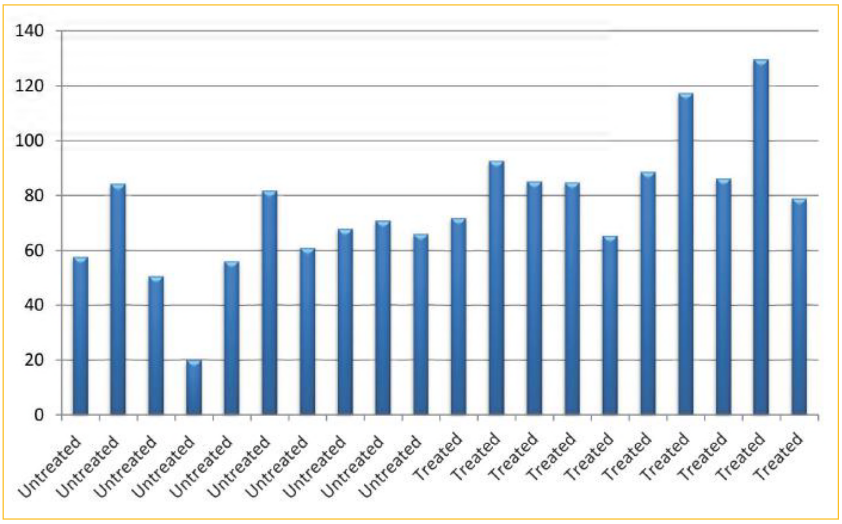
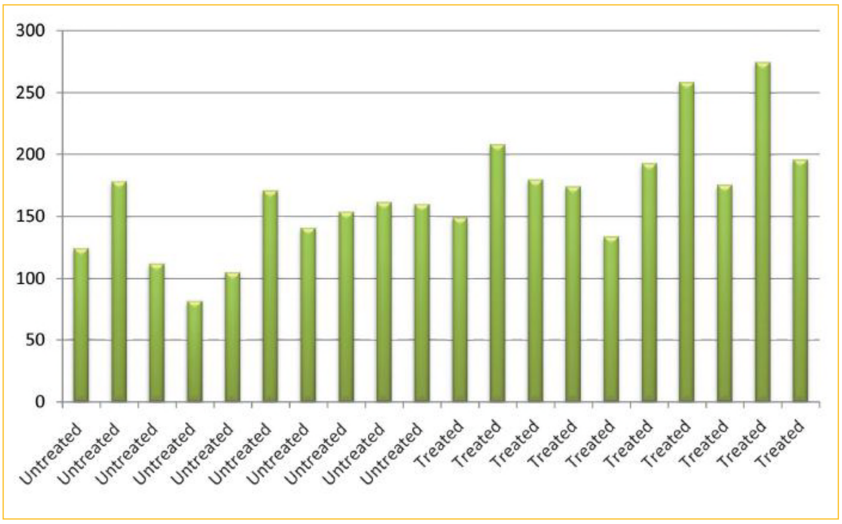


Figure 2: Total dry weight of each of the plant clusters (g) sampled.



The plants from the treated quadrant were 40% heavier (generally larger) and yielded 46% more in terms of bean weight; solitary bean weight was 16% greater. Individual values for bean and plant weight are shown in *Figure 1* and *2*.

Beans and pods of a sampled cluster.

The power of RMT lies in its ability to use uncomplicated techniques to identify yield limiting and promoting factors in a situation that is naturally complex. Dealing with a multi-factorial, natural situation is facilitated, and the indication of remedial measures is straightforward.

Those interested in having the method applied to stands on their farms can email Dr Steve Oosthuyse at hortres@pixie.co.za.