DETERMINATION OF LIME REQUIREMENT OF ACID SOILS

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There are many methods for determining the lime requirement of soils. These methods include the Cedara method developed in Kwa Zulu Natal, the Eksteen method developed in the Western Cape and the pH % Clay tables given in the Fertasa Fertilizer Handbook. It is generally found that the incubation method is the most accurate method especially if the lime to be applied is used in the incubation; this method is however relatively time consuming to carry out (Fertilizer Handbook 2016). It is important that the method used for determining lime requirements should give reliable and reproducible values applicable to a specific soil depth.

Many studies, including grid sampling for precision farming, have indicated that these methods haven't been entirely successful in achieving the intended target soil acidity level at the first attempt.

It is important to determine the reasons for this.

1. The reason could simply be that the correct amount of lime was not applied. Care should be taken to ensure that the application equipment is correctly calibrated and that a consistent application pattern is adhered to, ensuring that the specified amount of lime is applied.
2. The correct amount of lime was applied but the specified depth of incorporation in the soil was exceeded. The lime would therefore have been "diluted" with a greater volume of soil than intended.
3. The amount of lime was incorrectly calculated because of an incorrect assumption regarding the bulk density of the lime and/or the soil.
4. The lime requirement was determined on soil samples that were not representative of the targeted soil profile.
5. The lime used had a lower neutralisation value than was indicated by the supplier.

Regardless of the reason, the result is that the soil acidity level was not adjusted correctly, which could lead to crop yield losses due to under-liming. Over-liming could potentially also cause problems.

It is clear that under-liming took place over a long period on the sandy soils of the Free State and Northwest provinces (van Zyl and Bornman,2019). The specific reasons for this could be a combination of the above-mentioned factors.

Actions to prevent this situation could include the following:

1. Effective soil sampling as discussed in the article by Kobus van Zyl (2020). This should be followed up with further inspection of the land as follows:
2. Profile pits should be inspected to establish whether root development has been negatively affected or restricted. The entire profile should be inspected, sampled and analysed (See figure 1).

Figure 1: Soil profile inspection to determine root development (Photo supplied by Kobus van Zyl, 2020).

Figure 2: Steel plate to take soil samples. (Photo supplied by Jan du Toit Agricultural adviser: Omnia).

3. Some researchers use a steel plate of approximately 60cm with 6 square cups of 10 x 10 x 10cm. The steel plate with the cups is driven into the face of the profile pit using a hammer or hydraulic press. In this way 6 samples can be taken at a time (see Figures 2 and 3).

Figure 3: Grid pattern of soil samples taken. (Photo supplied by Jan du Toit, Agricultural adviser: Omnia)

4. The analysis of these samples gives an insight into the distribution of soil acidity as shown in Figure 4 below.

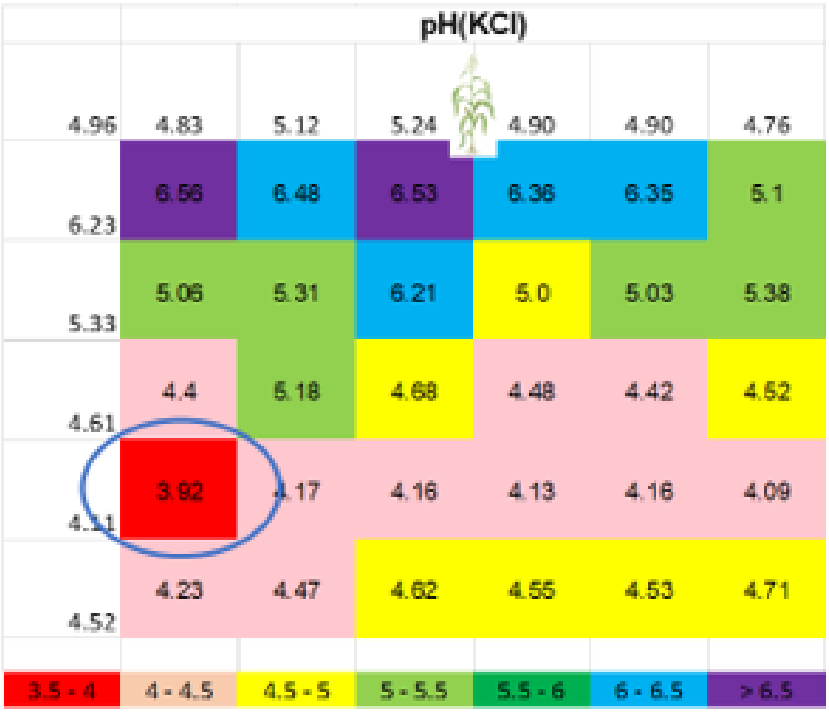

Figure 4: pH (KCl) of soil samples taken in a grid pattern.

(Illustration supplied by Jan du Toit, Agricultural adviser: Omnia)

The acidified zone encircled is the result of pre plant nitrogen fertilizer and is situated at a problematic depth of 40 cm. Although this method gives a clear picture of the distribution of soil acidity, it is only possible to establish after the soil samples have been analysed. It is not visually clear in the field.

5. Probably the most visually impressive method to demonstrate the pH level in different zones on the farm is used by the Australians viz. by spraying universal pH indicator directly onto the soil (Figure 5).

Figure 5: Soil colour which indicates pH after treatment with Universal Indicator (photo supplied by Chris Gazey, 2014)

The topsoil has a greenish colour indicating a favourable pH.

The relatively thick layer of soil directly below is yellow / orange in colour indicating a pH that is unfavourable for root development. This would not have been detected by just sampling and analysing the topsoil.

The soil below the yellow / orange layer has a greenish colour indicating a favourable pH for root development.

The link below gives access to a guide for using Universal indicator on soils.

https://www.youtube.com/watch?v=RPFymigbCAs

The actual soil pH would, however, have to be determined by analysis.

This useful practical method can also be used for evaluating the efficiency of deep incorporation of lime. (Figures 6 and 7).

Figure 6: Effectivity of deep incorporation of lime. (Photo provided by Chris Gazey 2014). The purple colour indicates a high pH and lime that has not fully reacted with the soil and zones where lime has been incorporated deeply after application on the surface.

Figure 7: Purple colouring indicating lime that has been incorporated deeply. (Photo provided by Chris Gazey, 2014). This indicates uneven mixing of lime with acid soil which would be restrictive to root development.

This method would, however, not be as effective on dark coloured soils.

Conclusions:

Effective liming of soils is only possible with thorough inspection of the soil profile and analysis of specific layers in the soil.

The inspection methods described in this article will certainly contribute towards enabling farmers to identify and take control of soil acidity and liming on the farm.

The management of soil acidity can only be effective if all zones of excessive acidity are identified and eliminated. Soil acidity can now be seen!

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