



## agriculture & environmental affairs

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Department:  
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**PROVINCE OF KWAZULU-NATAL**

### **SOIL ACIDITY AND NITROGEN STUDIES UNDER NO-TILL MAIZE IN KWAZULU-NATAL**

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#### **Introduction**

While extensive research has been conducted on soil acidity and liming, and on nitrogen fertilization for maize under conventional tillage in KwaZulu-Natal, there is a lack of similar information under no-till. The efficacy of surface-applied lime for correcting soil acidity or at least preventing soil acidification in no-till systems is contentious. Similarly, various studies have shown that more N fertilizer is typically needed for no-till, especially in the short term (e.g. < 10 yrs), but there is no consensus on the extra quantity required relative to conventional tillage. Differences in the efficacy of various N sources (e.g. urea and LAN) tend to be more pronounced under no-till, especially where regular surface liming is practiced. With the increasing adoption of no-till cropping by farmers, this research needs to be conducted so that appropriate advice can be given to no-till farmers.

#### **Materials and Methods**

An experiment comprising three annual rates of unincorporated, surface-applied lime (0, 0.75, 1.5 Mg ha<sup>-1</sup>), and two sources of nitrogen fertilizer (LAN, urea), applied as a topdressing to maize at the rates of 0, 60, 120 and 180 kg ha<sup>-1</sup>, was initiated on an existing no-till field in the Karkloof in the 2001/2002 season. A second experiment comprising three tillage regimes, namely no-till (NT), annual conventional tillage (CT),

and periodic tillage involving conventional tillage followed by four seasons of no-till (CTNT<sub>4</sub>CT), two sources of nitrogen (urea, LAN), and five rates of application (0, 40, 80, 120, 160 kg ha<sup>-1</sup>), was initiated on an existing no-till field in the Loskop area, in the 2003/2004 season.

## **Results and Discussion**

Highly significant positive responses to both N rate and source and to lime were recorded in the Karkloof. The average yield response to lime and N was approximately 2 and 5 Mg ha<sup>-1</sup>, respectively. Yields were influenced by a significant positive interaction between N and lime rate. In the absence of lime, maize response to N amounted to 4.18 Mg ha<sup>-1</sup> compared to 5.66 Mg ha<sup>-1</sup> at the highest rate of lime. Irrespective of the lime rate, maize yield response to N was not statistically significant above an application rate of 120 kg ha<sup>-1</sup>. Yield differences between LAN and urea were not evident at 60 kg N ha<sup>-1</sup>. However, at 120 and 180 kg ha<sup>-1</sup>, LAN was superior to urea by an average of 0.7 Mg ha<sup>-1</sup>. In the absence of applied lime, the surface soil (0-5 cm) has acidified dramatically over the past 12 years. Annual surface application of lime has proved highly effective in preventing soil acidification, even at the highest rate of N used. At the lower rates of N, acid saturation levels have been reduced to less than those found at the start of the experiment. Owing to hard soil surface conditions under NT compared to CT at Loskop, seed placement in NT was shallow, resulting in poor germination and a significantly reduced plant population. Maize yields under NT were significantly lower than those under CT at all rates of N applied, due to the very low plant population. Maize yields were not influenced by a significant tillage x N rate interaction. Neither was yield influenced by either a tillage x N source or N rate x N source interaction, as noted in the exceptionally wet 2010/2011 season.

## **Conclusions**

Surface applied lime was beneficial in terms of increasing maize yield under no-till. This can be attributed to the fact that the lime has prevented acidification of the soil profile down to a depth of 0.6 m and, in some cases, has reduced acid saturation levels to below those found at the start of the experiment. It is, however, important that farmers correct soil acidity problems before converting to no-till, to ensure optimum rooting depth and maximum recovery of applied N. Attempting to plant into No-Till under very dry soil surface conditions led to a significant reduction in plant population, which impacted negatively on maize yield. Results to date show that similar maize yields are achievable with NT compared to CT, provided extra N fertilizer (40-60 kg N ha<sup>-1</sup>) is used for NT.