FarmLime

Sustainable rural livelihoods: from mills to maize

by Clive Mitchell, *Keyworth*

Small-scale farming is probably the most important occupation in southern Africa and provides livelihoods and food security for a large proportion of the rural population. Despite many rural initiatives and agricultural programmes over the years, most small-scale farmers barely produce enough food for their own families and are seemingly locked into poverty. Small-scale farmers in southern Africa use traditional shifting cultivation systems to help maintain the condition of their soil. However, as populations have risen, so has the pressure to produce more food. In many places, the traditional methods have been abandoned in favour of more modern systems employing fertlisers to increase the amount of food produced. This has created the problem of soil acidity (low pH), especially in the high rainfall areas, such as those of northern Zambia and as a result crop yields have actually declined.

The solution is to use agricultural lime, essentially ground dolomite or limestone, which is added to the soil to neutralise acidity and provide vital plant nutrients. Most small-scale farmers do not use agricultural lime, as it is either unavailable or too expensive. If agricultural lime could be made locally available at an affordable price it would give such farmers an opportunity to improve their crop yields. The research project 'FarmLime: Low cost lime for small-scale farming' was carried out in Zambia to devise and test a small-scale process for producing inexpensive agricultural lime, using locally occurring dolomite. The project was funded by the UK Department for International Development (DfID) as part of their Knowledge and Research (KaR) programme.

Maize grown with agricultural lime measuring approximately 2.5 metres, Mkushi, Central Province, Zambia.

The author with small-scale farmer inspecting maize crop grown with agricultural lime, Mkushi, Central Province, Zambia.

Before work on lime production could start, it was important to explore why small-scale farmers do not use agricultural lime and how they could be encouraged to use it. A survey carried out in Solwezi, North-Western Province and Mkushi, Central Province confirmed that they do not use agricultural lime because it is expensive and difficult to obtain. Encouragingly, they already knew about the benefits of using lime. Other constraints were found to be the absence of soil testing to determine the amount of lime required and a lack of cash in the rural economy to pay for it.

The next step was to identify suitable carbonate rocks in the farming districts where lime is required. Dolomite that is suitable for the production of agricultural lime should have a minimum neutralising value (NV) of 80 per cent calcium carbonate equivalent (CCE) and a minimum magnesium oxide (MgO) content of six per cent. A field sampling and laboratory evaluation programme carried out in the Solwezi and Mkushi farming districts found dolomite with an

Mineral resources

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The author with project team inspecting groundnuts grown with agricultural lime, Mkushi, Central Province, Zambia.

NV of 103 to 104 per cent and an MgO content of 19 to 21 per cent. Suitable dolomite was found to occur in seven of the nine Zambian provinces.

The third stage was to identify a low-cost means of producing agricultural lime in those farming districts where it was required. A research programme was carried out to investigate current lime production methods, determine the best means of extracting the dolomite, and put an existing hammer mill to the test. Large-scale commercial lime production is carried out by drilling and blasting dolomite out of the ground, breaking the rock using a crusher, and then milling to the required fineness. The research aimed to replicate this on a small scale using manual extraction, manual rock crushing, and hammer milling. A hammer mill, originally designed for grinding maize, was modified for milling dolomite and successfully employed in trials. As part of the field trials, inmates from open prisons in Mkushi and Solwezi were employed to break the dolomite rock into a suitable feed size for the hammer mill. The costs of producing agricultural lime from the Mkushi dolomite were estimated to be between US$20 to US$33 per tonne. One of the highlights of this research is the spontaneous uptake of agricultural lime production by local entrepreneurs in Solwezi following the field trials of the modified hammer mill.

In an attempt to show small-scale farmers the benefits of using agricultural lime, crop trials (maize and groundnuts) were set up in Mkushi farming district. The sites chosen had highly acidic soils (pH 4.6 to 5) and minimal crop yields (for example 1.5 tonnes of maize per hectare). The results of the trials have been dramatic with maize growing up to 2.5 metres tall and yields of over six tonnes of maize per hectare in the limed plots — three to four times the current crop yields. This provided such an effective demonstration that neighbouring farmers have started to use locally produced lime. The economic case for the use of agricultural lime is seemingly strong: the costs of using lime are far outweighed by the value of the extra crops grown. However, even with such readily demonstrable benefits, the uptake of agricultural lime will depend on the farmers having the ready cash to buy it.

Application of the findings of this project could improve the life of many of the poorest people in southern Africa through a three- or fourfold increase in the amount of food produced. Farmers could sell the extra food, which would enable them to improve their homes, buy better clothes, pay for healthcare, and send their children to school.

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Inmates of Munsakamba open prison crushing dolomite in preparation for milling trials, Mkushi, Central Province, Zambia.