

What is soil acidity?

Acidity refers to the concentration of hydrogen ions in the soil. An acidic substance is one whose pH is below 7.0 pH units. For crop production, a soil is acidic if its pH is below 5.0 pH units.

How acid are Zimbabwean soils?

The Soil Productivity Research Laboratory (SPRL) conducted Soil Acidity Surveys in communal areas of Zimbabwe to cover almost all agro-ecological zones. Results presented in Table 1 indicate that soil acidity is one of the main limitations to crop production in communal agriculture. The surveys indicated that almost all locations have acidic fields with 80% of the sampled fields having a soil pH (in 0.01M CaCl₂) less than 4.9 units. Soil acidity was less acute in Gokwe, Zvishavane and Zhombe.

Liming materials

In Zimbabwe lime is usually in the form of calcium magnesium carbonate, CaMg(CO₃)₂, commonly called Dolomitic lime, or just as calcium carbonate, CaCO₃. Cattle manure has some liming effects. In communal areas, cattle manure is of variable quality and the quantities are too small for any significant liming effect on acid soils.

Merits of liming acid soils

Correction of soil acidity improves fertilizer use efficiency by crops. Liming reduces problems of aluminium toxicity in acid soils, increasing the effective rooting depth. A bigger soil volume is explored for nutrients and water by the crops. Liming also improves the availability of some micronutrients. Liming is good for most crops, including maize, but should help legumes such as groundnut, cowpea and soyabean the most. In widespread on-farm experiments, lime raised maize grain yields by between 0.6 and 2.6 t/ha.

How much lime should be applied?

The amount of lime to apply depends on the difference between the existing soil pH and the desired pH, as well as the lime requirement of the soil. Lime requirement is defined as the amount of lime needed to raise a unit mass of soil by one pH unit. The sandy soils that are commonly found in communal areas are weakly buffered and hence have a lower lime requirement when compared with heavier clay soils.

Because some crops are more sensitive to soil acidity than others, the target soil pH depends on the crops to be grown. It is also a function of organic matter content of the soil, the cost of liming and the rate at which soils become acidic. For the most widespread maize-based cropping systems, the target value is between pH 4.5 and 5.5 for the humid tropics since local crops are somewhat tolerant to acidity. In the tropics, acidification is rapid due to excessive leaching. For most crops grown in Zimbabwe a target soil pH value of pH 5.0 is a good compromise.

Table 1. Soil acidity status (percentage of sites) in twelve smallholder areas around Zimbabwe

Location	pH Range		
	4.14-4.19	4.20-4.50	4.51-4.84 4.85-5.61
Mhondoro	15	55	20 10
Chivhu	60	30	10 10
Wedza	33	0	33 34
Zvumba	12	48	28 12
Murehwa	80	0	0 20
Nharira	40	30	20 10
Buhera	50	10	40 0
Serima	40	50	10 0
Gokwe	0	0	8 92
Zhombe	0	0	15 85
Chirumanzu	41	25	14 20
Zvishavane	0	5	35 60
Mean	30	20	20 30

Testing of soils to determine lime needs

The soil pH needs to be tested to work out the amount of lime to apply per unit land area. Many AGRITEX staff can do this or can advise on who can help. For sandy soils, as a rough guide, 150 kg per ha of lime should be applied for each 0.1 unit that the pH needs to be increased. Split applications over two years are better because sandy soils are weakly buffered. A rate of 300-500 kg lime per hectare should be safe to apply every 3-5 years.

How and when to lime soils

Apply lime to land that will be planted to maize. A rotated legume planted in the following year will benefit later. The best time to apply lime is at winter ploughing after harvesting (to make use of residual moisture). This allows the lime to react with the soil and correct the acidity so that the soil is ready for planting at the onset of rains. The required amount of lime is broadcast on the soil surface and ploughed under using a mouldboard plough or preferably disced into the soil. Incorporate the lime well by re-ploughing before planting. Avoid incorporating lime just in the top few centimeters of soil because this may lead to over-liming part of the soil.

It is uneconomical, poor management practice, and even dangerous to apply more than the recommended amount of lime as this results in generation of more acidity. Over-liming may lead to the unavailability of P and some micronutrients (Zn) and the subsequent manifestation of nutrient deficiency symptoms in the field. Nutrients would have been converted to unavailable forms. Avoid liming fields that have received good amounts of manure in the past two years. There is a need to ensure that liming is matched with adequate amounts and types of fertilizers to avoid crop nutrient disorders that are a result of an increased biological demand for nutrients.

Lime as a cattle supplement

Lime can be mixed with salt, single-superphosphate, and 5% urea + molasses to form a cattle lick to be used during the dry season. This will improve the condition of cattle and the quality of manure in communal areas.

Availability of lime

Lime is readily available in most large outlets selling fertilizers. However there is a need to encourage dealers in many smallholder farming areas to stock lime and make it available to farmers. The price of one 50 kg bag of lime is Z\$70.00 (ca. US\$2, January 2000) in rural stockists and far less in urban outlets.

How can I get more information?

To obtain information on liming of acid soils please contact.

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LIMING OF SMALLHOLDER SOILS IN ZIMBABWE



Bags of lime in a depot

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A good crop of maize after liming (left) compared with no lime (right foreground)

Most of the soils found in smallholder areas of Zimbabwe are acidic. This is one of the main reasons that crops grow poorly.

Lime is a low cost amendment which makes soils less acidic. Lime has been widely used by commercial farmers in Zimbabwe for many years and smallholder farmers are now beginning to benefit from it.

Just a few hundred kg of lime per hectare will allow crops to yield more by increasing the growth of roots, availability of mineral nutrients and the crop response to fertilizer.

Maize benefits from liming but legumes such as groundnut should benefit even more.