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**THE IMPACT OF SOIL ACIDITY AMELIORATION ON GROUNDNUT
PRODUCTION ON SANDY SOILS OF ZIMBABWE**

by

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ABSTRACT

The bulk of Zimbabwe's groundnut (*Arachis hypogaea* L.) crop is grown on sandy soils in the smallholder sector where sustainable production is hindered by acid soil infertility. The study goal was thus to examine the effects of soil acidity amelioration by four Ca-containing materials on nutrient composition, vegetative and reproductive growth, and quality of groundnut to formulate ameliorative strategies to improve productivity on acid soils. The effectiveness of calcitic lime (CL), dolomitic lime (DL), gypsum (G) and single superphosphate (SSP) in ameliorating soil acidity was determined in field experiments conducted for three seasons at two Research Stations in Zimbabwe, and in greenhouse experiments conducted for two seasons at Harare Research Station. In both experiments the lime application rates were from 0 to 4000 kg ha⁻¹, while G application rates were from 0 to 3450 kg ha⁻¹, and those of SSP were from 0 to 250 kg ha⁻¹. Calcitic or dolomitic lime applied at 2000 or 4000 kg ha⁻¹ increased soil pH and Ca and Mg contents in the pod and root zones, and in the plant material. Gypsum and SSP applications at 200 and 250 kg ha⁻¹ respectively, had no significant effects on pH, Ca and Mg levels, but when applied in equivalent amounts of Ca as lime, gypsum improved soil Ca status. Effects of the four ameliorants on the N, P and K levels in the soils and in plant material were generally neither significant nor consistent. The direct and residual benefits of application of CL or DL were manifested in improved plant stands, better growth, nodulation, productivity and quality of

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groundnut. Gypsum applied at equal Ca rates as CL or DL was the superior Ca-source in improving pod and kernel quality. By the end of the third season, the increases in cumulative kernel yields due to application of 4000 kg ha⁻¹ lime over non-application were up to 319%. The major growth-limiting factors on the studied acid soils were identified as deficiencies of Ca and Mg, and low pH *per se*.

In a field experiment conducted to evaluate the tolerance of 15 groundnut genotypes to soil acidity, significant differences in yield and nutrient utilization efficiency of the genotypes were observed, implying that productivity on acid soils can be increased by growing genotypes efficient in uptake and utilization of nutrients.

Results from greenhouse and growth chamber studies conducted to examine the effects of pH (3.0 - 7.0) and its interactions with Ca (0 - 2000 μ M Ca) on early seedling growth and reproductive growth of groundnut indicated that low pH *per se* has a major detrimental impact on seedling survival, growth, pod formation, yield and quality of groundnut, but not on germination. The adverse effects of low pH were more pronounced in the absence of Ca, and became progressively less as the solution Ca concentrations increased. Further experiments showed that it is feasible to mitigate the adverse effects of soil acidity on groundnut germination and seedling survival by pelleting seeds with small amounts of CaCO₃, or priming with CaSO₄.

Key words: *Arachis hypogaea*, calcium, germination, nutrient efficiency ratio (NER), nutrient use efficiency (NUE), pH, seed pelleting, reproductive growth, seed priming, soil acidity amelioration, vegetative growth.

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