Status, priorities and needs for sustainable soil management in Zambia

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Introduction

Zambia has an area of 750,000 km$^2$ with about 13.9 million people and ample land resources.

Out of 9 million ha cultivable land, only 14% is cropped in any year.

About 55 - 60% of the land area is covered by natural forest and 6% of Zambia's land surface is covered by water.
Agro-ecological regions and soil distribution

The country is classified into three agro-ecological regions based on soil types, rainfall, and other climatic conditions.

Agro-ecological Region I
Annual rainfall is <750mm

The region contains a diversity of soil types ranging from slightly acidic Nitosols to alkaline Luvisols with pockets of Vertisols, Arenosols, Leptosols and Solonetz.
The physical limitations of region I soils
Hazards to erosion, limited soil depth in the hills and escarpment zones, presence of hardpans in the pan dambo areas, poor workability in the cracking clay soils, problems of crusting in most parts of the Southern province, low water-holding capacities and the problem of wetness in the valley dambos, plains and swamps.

Chemical limitations of region I soils
Some soils have salt content of which sodium is predominant, causing problems of sodicity and salinity, acidity and low nutrient reserves and retention capacity.
Agro-ecological Region II
Rainfall 750-1000mm.
Subdivided based on differences in soil types.

Sub-region IIa, soils are largely classified as Lixisols, Luvisols, Alisols, Acrisols, Leptosols and Vertisols

These are some of the best agricultural soils in Zambia and they host much of the country’s commercial farming sector.
Agro-ecological Region II
Rainfall 750-1000mm.
Subdivided based on differences in soil types.

Sub-region IIb
Contains a range of Arenosols, Gleysols, Histosols, and Podzols

LEGEND
Contains a range of Arenosols, Gleysols, Histosols, and Podzols

KEY
District boundary

Scale 1: 2,500,000

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The physical limitations of region II soils
low water holding capacity,
shallow rooting depth,
rapid physical deterioration,
erosion hazard and poor workability

Chemical limitations of region II soils
low nutrient reserves and retention capacity,
low calcium, magnesium and phosphorous,
low organic matter content and high acidity in some pockets
Agro-ecological Region III
High rainfall region of Zambia >1000mm per annum.

Predominant soils: Acrisols, and some Ferralsols developed under conditions of high leaching intensity

Soils are characterized by soil acidity, low bases retention capacity, low soil organic matter, low general soil fertility and soil degradation
Main Challenge of Agriculture Productivity in Zambia

The declining soil fertility

- soil erosion and degradation and little or non-use of manure or chemical fertilizer and the ravages of erratic rainfall.

Need to improve and manage soil fertility in Zambia

There are several options of positive soil fertility management practices available to farmers
Summary of soil fertility management practices in Zambia

<table>
<thead>
<tr>
<th>Technology Category</th>
<th>Practice</th>
<th>Advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural Practices</td>
<td>Crop rotation</td>
<td>Reduction in fertilizer use, improved soil fertility, pest and disease control, weed control (e.g. striga)</td>
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<td>Legumes after cereals</td>
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<tr>
<td>Agro forestry improved fallow</td>
<td>2-3 year fallow phase with tree species like Gliricidia, Acacia, Leucaena, Sesbania, Tephrosia, etc</td>
<td>Improve soil fertility, control and avoid soil erosion, cost effective or reduce the use of chemical fertilizer, improve soil structure</td>
</tr>
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<tr>
<td>Cultural Practices</td>
<td>Green manure crop fallows</td>
<td>Improve soil structure and fertility, leading to vigorous growth of the following crop and reduce erosion</td>
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<tr>
<td></td>
<td>Velvet beans and Sun hemp either incorporated or left on the surface</td>
<td></td>
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<tr>
<td>Compost manure practices</td>
<td>Mixed plant residues, animal dung, earth / soil materials, wood ash, water</td>
<td>Improves soil structure, reduce erosion and improves water and nutrient holding capacity of the soil</td>
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<td>Erosion control practices</td>
<td>Conservation tillage</td>
<td>Erosion control and rain water infiltration</td>
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<td>Ripping, basins and minimum tillage</td>
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<td>Contour conservation</td>
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<tr>
<td></td>
<td>Vertiver grass</td>
<td></td>
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<tr>
<td>Liming</td>
<td>Dolomitic (more magnesium than calcium) or calcitic (more calcium than magnesium) lime</td>
<td>Reduces soil acidity, make nutrients readily available for crop uptake and eliminates aluminium toxicity</td>
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<td>Inoculum</td>
<td><em>Rhizobia</em> inoculum</td>
<td>Enhances biological nitrogen fixation in legumes and increases yields</td>
</tr>
<tr>
<td>Fertilizers*</td>
<td>Basal and top dressing fertilizers</td>
<td>Supply the nutrients needed for enhanced crop production</td>
</tr>
</tbody>
</table>

*Wherever possible, it is recommended that farmers should combine organic and inorganic nutrient sources for sustainable crop production*
Thank You

for your attention