

Soil health Improvement Technologies (SITs) to Enhance Drought and Nutrient Resilience in Zimbabwean Soils

Project Background Information/Introduction:

Severe food insecurity and hunger have increased in sub-Saharan Africa (SSA) and this has been partly attributed to climate change and soil degradation. It is estimated that more than two-thirds of agricultural land in SSA is severely degraded and that production of major food crops including maize will decline by more than 30% by 2050 due to rising temperatures and changing rainfall patterns. Without innovative solutions, the United Nations Sustainable Development Goals, most of which are underpinned by soil health, and in particular goal number two of eradicating hunger by 2030, will unlikely be achieved, especially in SSA where about 230 million people are currently facing serious food shortages. The food deficits are anticipated to worsen in future, especially in urban areas (UA), as the demand for food, fibre and feed has been soaring up because of the rapidly increasing human population and changing human diets. In SSA, the urban population is projected to double from 298 to 595 million by 2030. Yet economic growth in many developing countries has not been keeping pace with population growth leading to high rates of unemployment. Consequently, many people including young men and women in urban areas in SSA have been forced to resort to agriculture for their livelihoods, albeit on marginal soils demanding immediate research into alternative soil improvement technologies to halt land degradation and enhance crop yields. In addition, the population rise and the resultant rural-to-urban migration due to incessant droughts, crop failures and economic hardships are driving an unprecedented increase in urban settlements in Zimbabwe, with an inevitable increase in municipal water treatment residual (WTR) production and the associated environmental challenges of disposal. Water Treatment residual is a by-product of municipal clean water treatment which is normally disposed to landfill. The water industry is also interested in exploring low-cost alternative means of waste disposal for their WTR, allowing them to move towards zero waste and fit into the circular economy and achievement of SDG 12 which relates to responsible production and consumption. Some studies have explored the use of WTR as a soil amendment. The use of WTR is therefore critical not only to improve soil and crop productivity but also to protect the environment. The impact of this study lies in using locally available mineral and organic “wastes” as SITs to improve nutrient and water use efficiency and thus enhance drought and nutrient resilience in soils.

Research Aim/Objectives/Questions/Hypotheses:

The main objective of this study is to evaluate the impact of WTR in combination with organic nutrient resources as a soil improvement technology for improved nutrient retention, drought resilience, crop productivity, and environmental protection, in urban agriculture in Zimbabwe under a changing climate.

Research strategy:

This study combines qualitative and quantitative approaches that include urban agroecosystem characterization surveys and analysis, greenhouse, field and laboratory experimentations and simulation modeling. Additionally, this research will use X-ray CT-scanning for imaging plant roots in situ to investigate how amendments influence plant root development and ultimate plant growth. Metagenomic analyses will be used to monitor changes in soil microbial profiles, with the objective of obtaining correlative evidence for the possible role of the soil microbial route in propelling plant productivity and resilience to water stress.

Contributions to the SDGs:

This work will leverage other related initiatives to achieve the United Nations soil health-related sustainable development goals and is aimed at help achieving Goals number 1, 2, 11, 12 & 13.

Lessons learnt and key takes/reflections:

Poor soils make people poorer, poor people make soils worse, and desperate humanity does not care about sustainability and stewardship'-Rattan Lal & Bobby Stewart. This study is motivated by this quote which sums up why it's pertinent to invest in soil health to secure the needs of future generations which is the thrust of the United Nations Sustainable Development Goals.

Project Information:

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- Project Duration: 3 Years
- Project Resources (funded by): Durham University
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