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IFOAM Southern African Network Supporting the growth of food grower networks in Southern Africa

A FARMERS' GUIDE TO IMPROVING SOIL QUALITY Sylvia Kuria

### <u>WHY WE NEED TO</u> FOCUS ON SOIL HEALTH

USING EFFECTIVE MICROORGANISMS TO BOOST SOIL FERTILITY

Alan Rosenberg

MALAWIAN FARMERS ADOPT BIONITRATE AMIDST CHEMICAL FERTILISER CRISIS

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SPECIAL EDITION: CELEBRATING SOIL

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## **ABOUT ISAN**

### INTERNATIONAL FEDERATION OF ORGANIC MOVEMENTS (IFOAM) SOUTHERN AFRICAN NETWORK

ISAN is a regional network of organisations and individuals actively supporting the development of a sustainable, ecological organic agricultural sector in southern Africa. Its values align with IFOAM–Organics International's (IFOAM\_OA) principles of Health, Fairness, Ecology and Care.

ISAN was formed during the second Africa Organic Conference held in Zambia in 2012 to represent Southern Africa Development Community countries: Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mozambique, Namibia, Seychelles, South Africa, Kingdom of Eswatini, Zambia and Zimbabwe. To date, the following countries are active in ISAN: Botswana, Lesotho, Malawi, Madagascar, Namibia, South Africa, Swaziland, Zambia and Zimbabwe.

ISAN aims to develop and coordinate programmes and networks of common interest at the regional level working through National Organic Agriculture Movements (NOAMs), the Intercontinental Network of Organic Farmers' Organisations (INOFO) and the Network of Organic Agriculture Researchers in Africa (NOARA), all of which have chapters in the region.

For more information, contact: chair@isan.ifoam.bio

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## **EDITOR'S NOTE**

#### By Fortunate Nyakanda, ISAN chair

Dear Readers,

We could not survive without healthy soils that support the growth of plants for food, medicine, fibre, energy and construction, enable the circulation and retention of water, are home to millions of beneficial organisms that support ecosystem functioning, and more. In this, our seventh edition, we celebrate soils and we showcase ways in which farmers, gardeners and land stewards can boost the health of soils using organic and regenerative practices. We are grateful to our contributors for sharing their knowledge and experience with us on this topic.

We start by exploring the web of life in the soil and the role of soil organisms – earthworms, mycorrhizal fungi and beneficial bacteria – in maintaining the health of soils and supporting the growth of plants. Next, we delve into the role of farmers in keeping our soils healthy through soil conservation practices – cover cropping, crop rotation and reduced tillage – that build levels of organic matter in the soil and improve its structure. This work by farmers happens at all scales and we highlight agroforestry as a large-scale regenerative practice. All manner of soil enhancement practices and products are covered – from composting to biofertilisers and use of effective microogranisms (Ems), as well as an exploration of the use of Rhizobium inoculants.

We hope that this edition will both inspire and inform you on ways in which to keep the basis of life on Earth – soils – healthy and 'happy'! Follow posts on our <u>Facebook page</u> for follow-up discussions.

Yours in organics Fortunate

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# **HEALTHY ORGANIC SOILS**

- Anchor plants by supporting root systems to grow.
- Contain oxygen that roots use to break down sugars and provide energy to plants. And contain water that feeds the plants.
- Provide the nutrients and minerals that plants need to grow.
- Modify the temperature around the plants' roots.
- Soils are 'home' to millions of organisms and insects that:
  - Help control pests and diseases
  - Cycle nutrients through the soil to feed plants
  - Improve soil structure by aerating it and allowing oxygen and water to enter.
    - Capture and store water, making it available to plants through their roots and to soil organisms and insects.
    - Trap pollutants and stop them from polluting groundwater.

02

• Filter rainwater and regulate its discharge, helping to prevent flooding.

 Store carbon and prevent it from entering the atmosphere - which is essential to mitigate the greenhouse gas emissions that are driving climate change.

# LIFE IN THE SOIL

We take soil for granted. Often because we can't 'see' the life in it and the many services it provides daily to support life above ground. These <u>services</u> include regulating the climate, supporting primary production (for food, fibre, medicine, construction and animal feed), conserving nutrients, sequestering carbon, purifying water and controlling erosion.

#### What is soil?

An official definition of soil is <u>"the surface mineral and/or organic layer of the earth that has</u> <u>experienced some degree of physical, biological and chemical weather</u>". Soil is made up of **biotic (meaning living or once-living)** things like plants or insects and **abiotic (meaning non-living)** materials like minerals, water and air. Soil is thus a mix of living and non-living materials that react with each other to create a powerful medium that supports life on Earth.

Soils form in different ways in different parts of the world due to different climatic conditions, what plant life and organisms exist in the area, the length of time it has taken to form and the landscape. These factors determine the ratio of sand, silt and clay in soils in different areas. Most soils are a combination of these.

#### What is soil health?

When we talk about soil health, we are talking about the ability of soils to continue functioning as a living ecosystem and to continue contributing to <u>broader ecosystem services</u> – supporting water and nutrient cycling, acting as a base for primary production, contributing to provision of water and air, etc. Soil health is therefore far more than just soil fertility, which is needed to grow crops.

Soil is a renewable resource meaning that it can replenish itself, but it takes a very long time to create new soil. <u>It can take up to 10 years to form 1cm of soil in some climates and</u> **thousands to hundreds of thousands of years in very dry or cold climates**. The volume of fertile topsoil on Earth is at its deepest 30cm and up to <u>1cm of this soil is being lost every year</u> in some places through unsustainable practices. In sub-Saharan Africa, about <u>65% of agricultural land is degraded</u> – meaning that the quality of biological and chemical life in the soil is reduced – and therefore less able to support food production activities, maintain biodiversity levels, slow down erosion and ensure ongoing water cycling and retention.

#### The soil food web

There is a dynamic dance of elements going on below our feet. This is sometimes called the *Soil Symphony* to describe the complex and interconnected systems of life that exist within soil. Bacteria, fungi, protozoa, nematodes, earthworks, insects and many other life forms are interacting with each other, forming a rich ecosystem that supports life on Earth, including ours. Watch the famous '<u>Symphony of Soil'</u> documentary that was filmed on four continents featuring farmers and scientists looking at the dynamic relationship we have with soil.

### Some of the beneficial lifeforms in our soils



#### Key players in the soil food web

- **Bacteria** work to break down complex organic compounds into simpler ones and cycle these through the soil ecosystem. Some bacteria species produce antibiotics that stop pathogenic fungi. Some are also able to fix atmospheric nitrogen. Bacteria help to develop soil structure and bind soil particles together. This helps prevent erosion.
- **Earthworms** are really important for soil health. They tunnel through the soil creating channels for air and water to enter the soil. They also help to break down organic matter, which then releases the nutrients that plants need to grow.
- **Underground fungi** take the carbohydrates that they need to survive from plant roots and in return they help plants access the nutrients that they need - like phosphorous and nitrogen, by forming a fine network that spread out from plant roots to find the nutrients that plants need. They thereby create gaps for air and water to flow into and through the soil. This boosts soil fertility and helps to prevent compaction. These fungi can also help to protect plants by producing chemical compounds that stop the growth of soil pathogens.
- **Nematodes** are tiny worms that feed on dead organic matter, breaking it into smaller pieces and releasing nutrients into the soil. They also regulate populations of bacteria, fungi and other smaller organisms by eating them. Some nematodes, however, are parasites and feed on plants' root systems damaging the plant or infecting it with disease.
- **Protozoa** are single-celled microorganisms that can be beneficial or harmful depending on the species. Some eat fungi and bacteria, helping to control their populations. They are important for nutrient cycling. Like nematodes though, they can also be parasites feeding off plants and causing damage and disease.

And then there are animals and birds above ground that contribute through their consumption and waste processes to contributing nutrients to the soil. Plants provide shelter for soil and their roots act as stabilising agents – and when their lives are over or they are harvested, this returns as 'food' to the soil. Water is critical for soil health as it helps to transport nutrients through the soil and it supports effective plant growth.

## WHY WE NEED TO FOCUS ON SOIL HEALTH

We cannot survive without healthy soils. Soils support all life. They are a source of water and nutrients for plants for food, medicine, grazing, clothing and construction. They filter ground water, they store organic carbon, they recycle organic matter, they are home to the millions of microorganisms that build soil fertility and enhance soil structure. We cannot survive without healthy soils, but human activities are driving soil degradation.

#### Our soils are dying

Sub-Saharan Africa has one of the highest levels of soil degradation in the world. About <u>65% of all</u> <u>African agricultural land is degraded</u>. This is due to a lack of nutrients in the soil, soil erosion and soil acidification. Soil degradation threatens our farmers' ability to grow food, protect biodiversity and mitigate and adapt to climate change.

Key drivers of soil degradation are deforestation, urbanisation, intensive farming and pollution. These activities diminish soils' ability to support life – both within it and above land – and severely limit its ability to renew itself.

- Deforestation changes the dynamic ecosystems in soil, which can lead to radical changes in its
  fertility or structure. The land is exposed to rain and wind, which makes it easier for soil to
  wash away. It lowers nutrient levels in the soil, lowering its ability to support life. <u>Africa is losing
  our forests faster than the global average of 0.8% a year</u> due to human activity related
  primarily to industrial agriculture and mining.
- Population growth in cities and towns is driving expansion of urban areas into farming land and this often has negative consequences for soil health. It is not just the expansion onto farming or wild land that is problematic. People in urban areas tend to consume more packaged and processed goods and dispose of more waste. <u>Urban soils are "subject to sealing, compaction, erosion and contamination".</u>
- <u>Intensive farming practices in the industrial model harm soils</u>. The practice of monocropping robs the soil of nutrients, reduces the volume of organic matter and of microbial life in the soil and contributes to erosion. Chemical fertilisers and pesticides contaminate groundwater and harm soil life. Mechanical tilling compacts soil, reducing its ability to absorb and store water.

#### Why we need soils

Below are just some of the key reasons that we need to urgently pay attention to soil health.

- Soil regulates water cycles. It can <u>"absorb, store, and filter water, reducing runoff and erosion</u>". It provides the water that we, animals and plants need to survive.
- Soil supports biodiversity by providing a habitat for organisms that cycle nutrients, build and maintain soil structure, decompose organic matter and provide pollination services.
- <u>Soil stores carbon about a quarter of the global carbon pool</u> as organic matter. Healthy soils will play a key role in the fight to mitigate greenhouse gas emissions.
- Soil is the basis of agriculture it "provides the physical, chemical, and biological basis for crop production, supplying nutrients, water, and anchorage for plants."

### ORGANIC FERTILISERS AND BIOFERTILISERS

Fertilisers are very important for soil health. A fertiliser is a substance added to the soil to enhance its ability to support healthy plant growth. There is growing interest in organic fertilisers and in biofertilisers in Africa. This article gives an overview of the different types.

#### All about organic fertilisers

Organic fertilisers are made up of natural elements with no added chemicals or salts, which can contaminate the soil. They are made from natural sources like animal manure and plant residues. Organic fertilisers offer many benefits to farmers, including:

- Slow release of nutrients to plants over a long period of time. This reduces the risks of overfertilising, which can lead to pollution of the environment and damage of crops.
- Improving soil texture and enabling it to hold water for longer periods.
- Supporting higher levels of fungal and bacterial activity in soils, which supports nutrient cycling and plant growth.
- Enhancement of soil structure leading to more air and water entering the soil.
- Adding bulk to the soil helping soil particles to bind together. This reduces erosion.

There are various sources of organic fertilisers, some of which are described below.

- **Manure:** The waste produced by livestock is an excellent source of nutrients like nitrogen, phosphorus, and potassium. Manure can also be derived from slaughterhouse waste.
- **Bone meal:** Made from the ground-up bones of animals, it is high in phosphorus, essential for root development and flower production.
- **Blood meal:** Made from animal dried blood, it is a good source of nitrogen for plant growth.
- **Fish emulsion:** Made from fish waste, this is a rich source of nitrogen, phosphorus, and potassium. It is commonly used as a liquid fertilizer.
- **Seaweed:** A good source of micronutrients like iron and zinc as well as growth hormones that can promote plant growth and development.
- **Green manure:** Refers to plants that are grown specifically to be turned under and used as a fertiliser. Green manure crops include Sunhemp, Velvet beans and Sesbania.
- **Peat**, an accumulation of partially decayed vegetation/organic matter under acidic conditions.
- **Bat guano** is the excrement of bats and is high in nitrogen, phosphorus, and potassium. It is commonly used as a soil amendment and fertilizer.
- **Worm castings**: This is the waste produced by earthworms, which is high in nutrients like nitrogen, phosphorus, and potassium and also improves soil structure and water retention.
- Rock phosphate: A naturally occurring and slow-releasing mineral high in phosphorus.
- **Food processing waste:** Fruit and vegetable industrial solid and market waste include items removed from fruits and vegetables during cleaning, processing, cooking, and/or packaging.

#### What are biofertilisers?

Biofertilisers are substances that contains microbes, which mobilise and increase the supply of nutrients to plants to help them grow. They contain living organisms, including mycorrhizal fungi, blue-green algae, and bacteria. These can either be applied to seeds or directly to the soil. When applied to seeds, plant surfaces or soil they colonise the rhizosphere (soil zone surrounding the plant roots where the biological and chemical features of the soil are influenced by the root) or the interior of the plant and promote growth by increasing the supply of nutrients to the host plant.

There are various types of biofertilisers:

- Acetobacter: This bacteria colonises the plant roots fixing atmospheric nitrogen in the soil and then forming colonies inside the crop tissues to provide nitrogen to the plant. It also helps to suppress pathogens in the soil, stimulate plant hormones and make phosphates soluble. It encourages root growth and branching enabling the plant to reach more nutrients. An example of an Acetobacter fertilizer is the Rhizobium inoculant used in production of legumes.
- **Azospirillum:** This is also a type of nitrogen-fixing bio-inoculant that produces a large number of biologically active substances such as vitamins and various acids. They help to improve germination, support root development and fix nitrogen.
- **Mycorrhiza:** Mycorrhiza fungi form a symbiotic relationship with plant roots to increase the absorption of phosphorous, water and minerals from the soil. It helps plants to develop healthy and dense root systems and restores soil fertility. It is also helps to protect crops from root diseases. It is particularly beneficia for crops such as onion, garlic, carrots, potatoes, tomatoes, peppers, cucurbits, asparagus, herbs, and lettuce.
- **Phosphate Solubilizing Bacteria (PSB):** PSB is widely used to support plant growth. It helps to regulate the decomposition of organic matter to make nutrients like nitrogen, phosphorus and potassium available to plants. It also stimulates root growth and increases disease resistance.
- **Potassium Solubilizing Bacteria:** This biofertiliser improves plants' photosynthesis ability and support higher yields and quality of produce. It helps to form mono acids and proteins that are absorbed by plant roots.



## A FARMERS' GUIDE TO IMPROVING SOIL QUALITY

#### By Sylvia Kuria

When I started my journey as an organic farmer, I must say I was quite ignorant when it came to the issue of soil management. I felt that since I was farming sustainably, whatever intervention I would employ on my soil would give me good results. I had learned that diversity is good and I went ahead and planted several vegetables and fruits. Naturally, some did well and others did not. I guessed that this was mainly because of different factors including my soil type, altitude, effects of pests and diseases, and other factors. I was in this state for about two years until I was challenged to stop assuming the state of my soil and take a soil test to ascertain our soil type.

#### A soil test is the first step!

You can imagine how painful it was for me when I bought expensive vegetable seeds, prepared a nursery, planted them and nothing germinated! I was in total shock because we had employed all our nursery management practices to a tee! When the frustration became too much, I finally took my soil for testing. Statistics show that only 8% of Kenyan farmers take their soil for testing. This is quite appalling! It means that 82% of farmers are not farming to their full potential because they have no idea what is in their soil and what kind of crops or interventions they need to employ for maximum output. To cut a long story short, my soil had a very high pH of 8, which means that my soil was sodic, basically highly alkaline, or with high salts. Sodicity in soil is the presence of a high proportion of sodium ions relative to other cations. Our farm is in a semi-arid area also close to a volcanic mountain in the Rift Valley, which would explain why the soil was alkaline. Sodic soils inhibit germination and plant growth and causes stress to the plants, which become susceptible to pests and diseases.

#### What is soil pH?

Soil pH is a measure of the acidity or alkalinity of the soil. The scale ranges from 0 to 14 with 7 being neutral. Most soils have pH values between 3.5 and 10.



In higher rainfall areas the natural pH of soils typically ranges from 5 to 7, while in drier areas the range is 6.5 to 9. Soils can be classified according to their pH value: 6.5 to 7.5—neutral. The ideal pH range for growing fruits and vegetables is 6-7. Inherent factors that affect soil pH include climate, mineral content, and soil texture. The pH of newly formed soils is determined by the minerals in the parent material. Any pH reading below 7 is acidic and any pH above 7 is alkaline. A pH of 7 indicates neutral soil. The pH is important because it influences the availability of essential nutrients.

#### What crops do well in acidic and alkaline soils?

Once you know your soil pH, it is good to consider crops that do well depending on your soil. We should however continually work towards getting an ideal soil pH of 6-7 to enable us to make soil nutrients available to plants and help us grow a wide variety of fruits and vegetables.

Crops that thrive in acidic soils (PH 1-5.5)	Crops that thrive in alkaline soils (PH 8-11)
Rice	Asparagus
Cassava	Leek onion
Mango	Kale
Pineapple	Beetroot
Citrus	Sunflower
Berries	Mustard
Potatoes	Yellow onions

#### Strategies for building good soils

- **Green manure:** This is my all-time favourite go-to method for improving the quality of my soil. It entails planting legumes like beans and then incorporating them back into the soil when they are about 4-5 weeks old before flowering. Green manuring is an effective way to improve soils as it helps to build the soil's organic matter and structure, supplies nitrogen for the following crop, prevents the leaching of soluble nutrients in the soil, and provides ground cover to prevent damage to soil structure. Green manuring is favourable for large-scale farmers who might not manage to have access to compost for large tracts of land.
- **Composting:** This is a common soil amendment method that is used by many farmers. It is favourable for smaller-scale farming. I have found that there are many methods of making compost, and I will not go into the details of which are the best methods.

In my own experience I have found a few composting tips that have ensured high quality compost:

- Avoid using weeds that have flowered and seeded because seeds do not easily die.
- Add yeast and molasses. Yeast works as a fungus that helps break down compost and the molasses is food for the yeast to multiply quickly.
- Add essential microorganisms (EM1) to the compost to ensure an array of beneficial fungi and bacteria that enrich our compost as well as soils.
- Add wood ash as this helps to neutralise the pH and keep it balanced.
- Keep compost moist to ensure the microorganisms have a favorable condition to multiply and do their work of breaking down the compost.

Composting can be seen as time-consuming and laborious, but it improves the structure and health of your soil by adding organic matter, helps the soil retain moisture and nutrients and attracts beneficial organisms to the soil, and reduces the need for pesticides and fertilisers.

• **Crop rotation and companion planting:** These are beneficial practices when building soil. I have found that rotating my crops with legumes helps to increase nitrogen and carbon material in my soil especially if I incorporate the plants in the soil. Legumes as companion plants also help the soil as well as reduce fertiliser costs as they provide nutrients for companion plants. In my experience, I have found beans as leguminous plants are normally good companions for maize, potatoes, brassicas, cucumbers and tomatoes.

#### The most important step is patience...

This is the most important step in building good soils, patience! It takes consistent dedication and patience to make sure that we build our soils to an optimum where we can grow food to ensure we deal with chronic food insecurity and hunger on the African continent.

"In my journey as a farmer, I have been encouraged to see how my soil has grown and improved over the years and it keeps me going as I always say one of the best things I will leave as an inheritance for my children is rich soils to grow food for many generations to come!"

## ROLE OF BIOLOGICAL NITROGEN FIXATION IN FARMING SYSTEMS OF ZIMBABWE: LEGUME INOCULANT TECHNOLOGY

#### By Emmanuel Chikwari, Head of the Zimbabwe Chemistry and Soil Research Institute

Our Earth's atmosphere is made up mostly of nitrogen gas (about 78% of the atmosphere), oxygen (21%), argon (0.93%), carbon dioxide (0.04%) and smaller amounts of other gases. All lifeforms (people, animals, plants and other life) need nitrogen to survive, but usable forms of nitrogen are limited. For example, plants cannot absorb it from the atmosphere through their leaves. There are, however, organisms such as rhizobia bacteria that can help to 'fix' nitrogen in the soil making it accessible to plants through their root systems.

This article explores this topic of biological nitrogen fixation (BNF) using legumes in the context of Zimbabwe's farming systems. Using legumes to fix nitrogen in the soil is an affordable and sustainable way to boost soil fertility without having to buy expensive and often scarce mineral nitrogen fertilisers.

BNF is the microbial fixation of atmospheric nitrogen through a symbiosis between legumes and rhizobia bacteria. N2 + 6H+ + xATP + 6e- = 2NH3 + xATP + xPi

#### What are rhizobia?

Rhizobia are soil bacteria that form nodules on the roots of their host plants. Rhizobia and their host plants have a symbiotic relationship – meaning that both parties benefit from the relationship. It is a specific relationship in that Rhizobia strains will select particular plants to act as their hosts.

- There are many strains of Rhizobia and they each select particular legume varieties as their host plants. It is important to understand that not all Rhizobia will work to fix nitrogen for all legume types or they won't all work as effectively.
- Rhizobia occur naturally in the soil but may be present in low numbers and in some cases may not nodulate certain leguminous species.
- There is a need to be specific and apply effective strains in seed dressing form, i.e., through inoculants. Rhizobium inoculants are biofertilizers based on nitrogen-fixing Rhizobium bacteria packaged in a carrier medium. The carrier medium in use at the Zimbabwean factory is bagasse, a fibrous inert material, generated when sugarcane juice is extracted from sugarcane. Food is added together with bagasse to ensure the bacteria multiply under favorable conditions to a population close to a billion bacterial cells.
- The Rhizobium bacteria infect the very small root hairs and create nodules.
- Effective Rhizobium strains fix nitrogen by forming a few large nodules near the crown of the plant. These are pink inside when young.



Caption: Example of a Rhizobia nodule

#### Why should you inoculate your seed?

Few soils contain effective root nodule bacterial strains necessary to promote maximum growth of legumes. The aim of inoculation is to get as many viable nitrogen fixing bacterial cells from the inoculum on and around seed root when germination occurs. For effective nodulation there is need to inoculate large numbers of effective strain and ensure that the right strain is in close proximity to roots of the germinating seedling.

#### **Inoculation and sowing**

Inoculation is the addition of effective Rhizobium to legume seed just before planting for the promotion of BNF using the method below:

- Mix about 5% sugar solution (3 tablespoons of sugar in 1 litre water for 100 kilograms soyabean seed) with 100 grams of soyabean inoculant (1 sachet ).
- Sprinkle the mixture onto the seed so that every seed is completely coated. Seeds are sown in moist soil as soon as possible after inoculation.

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Caption: Contrast between inoculated (top half) and uninoculated soyabean crop (bottom half)

#### How much nitrogen is fixed through BNF?

Legume crops differ in the amounts of nitrogen fixed through BNF. Below are examples of common crops with amount of nitrogen fixed in kilograms per hectare.

Grain legume	Amount of N fixed (kg/ha)		Equivalent amount of AN (kg/ha)	
Soya bean	100 -	180	290 -	520
Sugar bean	50 -	65	145 -	190
Cowpea	250 -	350	725 -	1000
Ground nut	100 -	125	290 -	360
Pigeon pea	200 -	280	580 -	810

#### Legume inoculant production in Zimbabwe

Zimbabwe has the second largest legume inoculant factory in Africa (after South Africa) located in Marondera at the Soil Productivity Research Laboratories at the Chemistry and Soil Research Institute. The factory produces inoculants for grain legumes (soyabeans, cowpeas, groundnuts, sugar beans and peas and pasture legumes (lucerne, lab lab, sunnhemp, velvet beans, etc.). About 90% of the inoculants produced are for soyabeans.

#### Is it economical to use legume inoculant technology?

Legume inoculant technology is a low-cost nutrient source of nitrogen for legume crops, which are essential for improving national food, nutrition and income security. It is very economical compared to the use of mineral fertilisers.

About 250 kilograms of ammonium nitrate is needed for one hectare of soyabean when using mineral fertilisers at a cost of roughly US\$300. In contrast, only one 100-gram sachet of inoculant at a cost of US\$5 is needed for one hectare of soyabean. The current global crises, such as the Ukraine-Russia crisis, highlights the need for more locally available and affordable solutions for farmers, such as Rhizobium inoculant technology.

For more information, contact Emmanuel Chikwari on chikiema@yahoo.co.uk.



Captions: Examples of Rhiozobium inoculants for soyabean, sugar bean and ground nut crop

## **REVIVING SOIL: BOSCHENDAL'S PATH TO REGENERATIVE AGRICULTURE**

#### By Hannah Hopper

Boschendal Estate is made up of a collection of farms and historical homesteads. It is nestled in the picturesque Drakenstein Valley between the renowned wine regions of Franschhoek and Stellenbosch. Boschendal is one of South Africa's oldest wine estates and fruit farms, with a history spanning over three centuries. It is well known for its holistic approach to natural production and commitment to preserving the environment.

Charles Edmonds is the General Manager of Farming at Boschendal and is passionate about regenerative agriculture. Edmonds emphasises the distinction between sustainability and regenerative agriculture. While sustainability aims to maintain a certain level to prevent decline, regenerative agriculture seeks to fix what is broken. Boschendal has charted a path towards rejuvenating their soils guided by five major principles of regenerative agriculture limited disturbance, soil cover, diversity, living roots, and animal integration. In 2021, Boschendal Estate set a target to increase the soil organic carbon (SOC) levels from approximately 1% to 3% within three years. SOC is a measurable component of soil organic matter and is a key determinant of soil quality, fertility, and atmospheric carbon dioxide (CO2) fixation. To achieve their goal, Boschendal implemented regenerative agriculture practices.

Instead of traditional ploughing, they embraced minimum tillage, furrowing and seeding. Recognising the opportunity when the soil was initially disturbed, they balanced the pH by applying lime and introduced multi-species cover crops. These diverse mixtures of perennials, including Japanese radish, clovers, lucerne, hairy fetch, and grasses, optimised sunlight absorption and improved soil health. Animal integration plays a vital role in Boschendal's regenerative approach. Edmonds introduced 3 cattle, 35 sheep, and 500 chickens per hectare, implementing intensive grazing through strips. The animals deposit approximately 28 tons of manure per hectare. The process starts with the cattle grazing on tall grass for 34 days, followed by the sheep for another 34 days. Finally, the chickens are introduced to contribute nitrogen to the soil. The animals efficiently manage the weeds, leaving only problematic ones that require manual removal.



Biodiversity is another crucial aspect of Boschendal's regenerative agriculture. Through nematode measurements conducted by Nemlab, a wide range of nematode species was discovered, including beneficial ones that help control pathogenic nematodes without the need for chemical applications. Boschendal plans to introduce more fungi through compost teas sourced from the local forest to further enhance soil health. This practice aids in breaking down organic matter and enriching the soil with organic carbon.

Within a remarkable span of nine months, Boschendal witnessed a transformation in their soil. The soil organic carbon increased to 3%. Diagonal sampling on a 1-meter grid also revealed a yield increased from 0.5% to 2.5%. Astonishingly, every 1% improvement in organic matter stores an additional 170 000 liters of water per hectare, resulting in a significant 29% improvement in water retention during the nine-month period. Having surpassed their initial targets, Boschendal now aspires to increase soil organic matter (SOM) to 6-8% and SOC to 5-8%. Their plans include expanding their 11-hectare trial to a larger area of 28 hectares, ultimately regenerating and restoring 40 hectares of land. The ultimate vision is to create an environment where planting a tree is as simple as digging a hole.

Boschendal Estate's journey towards regenerative agriculture highlights the interconnection between healthy soil, plants, animals, and humans. This approach not only benefits society and the economy but also contributes to climate and biodiversity conservation. Building nutrient-dense soils leads to enhanced human health, peace of mind, and resilience.



### USING EFFECTIVE MICROORGANISMS TO BOOST SOIL FERTILITY

#### By Alan Rosenberg

The first step in soil management is to know what we are dealing with under the term 'soil'. The variety of soil formation processes operating on different parent materials under other climatic, topographic and biological conditions over varying periods gives rise to the vast diversity of soils on Earth. Soil, also commonly referred to as earth, is a mixture of minerals, liquids, gases, organic matter and organisms supporting life together.

Soil management is the application of operations, practices, and treatments to protect soil and enhance its performance (such as soil fertility or soil mechanics). It includes soil conservation, soil amendment, and optimal soil health. We must also include the concept of soil regeneration, as vast soil areas have been disturbed, exhausted and or polluted.

Another perspective to the understanding lies in knowing that the soil we work with has three aspects to consider when approaching soil management. These are the mineral, chemical and biological aspects of the soil. Soil health and fertility lie at the intersection of these three aspects. Each is acknowledged and developed to its maximum.

#### The most significant influence that the practitioner has in regenerating and boosting soil health and fertility lies in the potential to influence the biological aspect of the soil.

Biological activities in soil are widely recognised as vital in nutrient cycling and availability to plants, developing and maintaining soil structure, and contributing to 'soil health'. In addition, the biological organisms in the soil give it life and energy and are responsible for driving most of the chemical reactions and transformations that occur in soil.

The array of living organisms in soil is vast. Soil organisms occupy many different niches, perform various functions, and interact in myriad ways with other organisms and the soil matrix.



Caption: The different components of soil and average proportions



Caption: Three aspects of soil health

On closer observation, the soil is teeming with living organisms. Living organisms present in soil include archaea, bacteria, actinomycetes, fungi, algae, protozoa, and awide variety of larger soil fauna, including springtails, mites, nematodes, earthworms, ants, and insects that spend all or part of their life underground, even larger organisms such as burrowing rodents.

The links between soil organisms and how they impact the soil's chemical and physical properties are complex. All of these are important in making up the environment we call soil and in bringing about numerous transformations that are vitally important to life. The microbes living within the soil recycle nutrients such as carbon and nitrogen through the soil system. Much of the organic material added to the litter (the accumulated material at the soil's surface) or within the root zone each year is almost entirely consumed by microbes. The microorganisms found in the soil steer processes that affect mineralisation, nitrification, nitrogen fixation and denitrification.

The following term to become familiar with is humus, decomposed organic matter through biological processes. Humus is formed by soil microorganisms' decomposition of leaves and other plant material. Further, it states that in soil science, humus denominates the fraction of soil organic matter that is amorphous and without the "cellular cake structure characteristic of plants, microorganisms or animals". Humus significantly affects the bulk density of soil and contributes to its retention of moisture and nutrients.

As a result of these microbiological processes, the elements initially consumed by the plants for organic synthesis are returned to circulation, completing the cycle of the elements in the process of life. It is factual that microorganisms play a pivotal role in the life processes of the planet. Unseen, often unknown, and primarily not acknowledged, these microorganisms are the major players in the natural world through their contribution to life processes. Microorganisms influence the cycle of humus in nature in more than one way:

- They bring about its formation from plant and animal residues.
- They continuously transform humus under favourable conditions, and
- They finally decompose it completely or "mineralise" it.
- Their cell substance contributes directly as a source of humus.

In conclusion, we can say that the functions of humus in the soil are mainly threefold:

- **Physical**, modifying the soil colour, texture, structure, moisture-holding capacity and aeration.
- **Chemical**, influencing the solubility of certain soil minerals, forming compounds with certain elements, such as iron, which renders them more readily available for plant growth and increases soil's buffering properties.
- Biological, serving as a source of energy for the development of microorganisms and by making the soil a better medium for the growth of plants, it also supplies a slow but continuous stream of nutrients for plant life.

Altogether, we should be clear that the whole domain of Agriculture — including what is beneath the Earth's surface— represents an individuality, a living organism, living even in time.

"Humus formation can happen naturally, but our task is to develop and maintain "Nature's household" to benefit both ourselves and the 7th Generation."

### SOIL FERTILITY MANAGEMENT IN WEST AFRICAN SAHEL REGION

#### By Harun Cicek & Irene Kadzere FiBL Switzerland

Dryland regions, such as the Sahel, provide food and livelihoods for millions of families. One main limiting biophysical factor to enhancing agricultural productivity in West Africa is is the inefficient use of available rainfall caused by poor soil quality and other factors. Water losses from runoff, and evaporation, among others, can largely be prevented through water conservation and harvesting techniques including tree and shrub integration and reduced tillage.

The systematic integration of crops, shrubs and livestock is a promising strategy for improving livelihoods and technologies such as agroforestry have been shown to improve food production and incomes.Agroforestry is a widespread and age-old practice due to the multiple agronomic, economic and social benefits of woody species. In the Sahel, agroforestry plots are characterised by the presence of key woody species like Piliostigma reticulatum (a tree belonging to the legume family) and Guiera senegalensis (belonging to the mangrove family) in association with crops like sorghum, millet and cowpea.

#### Using woody plants - trees and shrubs - to improve soil fertility

Woody plants, whether trees or shrubs, improve soil fertility by improving fertility under and around the tree/shrub canopy, thanks to their deep root systems, their growth habit and their litter from fallen leaves. This phenomenon of nutrient enrichment to the soil around the trees is thought to result from (i) deep soil uplift of minerals through the root system of trees/shrubs and amendment through litter fall for instance, and (ii) trapping by tree/shrub canopies and deposition of nutrients carried in the dusty wind or other airborne particles. Under the canopy of the trees, the biological activity of macrofauna communities develops, ensuring better soil structuring and functioning. Most studies have found that tree or shrub presence leads to an increase of soil carbon (soil C) or organic matter (OM) content in the vicinity of the tree/shrub, which consequently increases the carbon or organic matter status of the whole field depending on the density of the trees.

In line with OM content improvements in soils, nitrogen (N) content also increases in the soil by the presence of trees and shrubs. Phosphorus (P) availability in regards to shrub presence has been documented in some studies in the Sahel area, but results are less consistent than those concerning C content. An interesting feature of tree/shrub impact on Sahelian soils is the widely acknowledged effects on pH, which is increased in the vast majority of cases. This soil pH increase (less acidic) is expected in line with OM content increases. The higher soil pH is said to stimulate increased availability of cations (some nutrient forms such as of calcium, magnesium, potassium, copper, iron, and others) which are extremely important for crops, and very often depleted in the sandy soils found in the Sahelian region. Some studies in Senegal reported cereal yield increases by the presence of shrubs (G. senegalensis and P. reticulatum) without any application of fertilizers. Those studies where soil nutrients were also assessed using G. senegalensis, Parkia biglobosa, Piliostigma reticulatum and Vitellaria paradoxa trees showed higher contents of carbon, nitrogen and phosphorus under the canopy compared to outside the canopy, further demonstrating the importance of such trees in cropping systems.

#### Methods of managing woody plants for soil fertility

There are different ways to manage shrubs or trees and obtain their biomass for use in soil fertility management. Coppicing (cutting back) is practiced on shrubs, pruning is done both on shrubs and trees, while pollarding is specific to trees. The tree or shrub biomass is used as mulch or incorporated into the soil to hasten decomposition and release of nutrients for uptake by plants. Farmers can obtain biomass from shrubs and trees growing in the field naturally or planted deliberately for this purpose. The biomass can also be collected from trees/shrubs surrounding the fields. In conventional farming, biomass is often augmented with synthetic fertilizers, but under organic management, the farmers can combine the plant biomass with other organic sources of nutrients such as well-prepared compost.



Caption: Example of mulching in Mali where cuttings from various shrubs have been applied to an experimental sorghum field.

Scientific name	Common name	Use/Operation
Piliostigma reticulatum	Camel's foot	Protects the soil against runoff, conserving soil moisture, pods are used in livestock feed
Faidherbia albida	Anaboom	Fixes nitrogen, leaves enrich soils, pods are fed to animals
Parkia biglobosa	African locust bean	Fixes nitrogen, the seeds are processed into "soumbala" mustard for cooking
Pterocarpus species	Vene, Madobia, Kino	This protected tree fixes nitrogen, pumps water from deep soil layers and is used as feed for animals
Anogeissus leocarpa	African birch	Animal feed, fertilizer, crafts
Gliricidia sepium	Gliricidia	Fertilizer species, animal feeding
Lawsonia inermis	Henna	Fertilizer, cultural use (ink), hedgerows
Azadiracta indica	Neem	Soil fertility, medicinal, pest control, shading, animal feeding
Acacia senegalensis	Gum acacia, Gum Arabic, Sudan gum	Gum production, fertilizer species, animal feeding
Guiera senegalensis	Moshi medicine	Mulch to protect and improve soil structure, increase fertility

Table 1: Some common soil fertility-improving tree and shrub species mentioned and preferred by farmers in the Sahel

#### What farmers need to keep in mind about the agroforestry trees

Trees and/or shrubs play a crucial role in satisfying crop nutrient needs while feeding the soil and improving its overall health status. Scientists have demonstrated that the position of the crops in relation to the trees, and the type and architecture of woody plants have an influence on the growth and yield of cereal crops. For instance, cereal crops outside the shea (Vitellaria paradoxa) tree canopy can yield more than those under the canopy while the reverse is true for Faiderhabia albida where crops growing under the tree canopy can yield better as the tree sheds off its leaves during the time when crops are growing. Where planting is done, the choice of shrub and/or tree to plant can have significant consequences on crop productivity, and other benefits to the farmers and their families.

For more information contact Harun Cicek (<u>harun.cicek@fibl.org</u>) Acknowledgments: SustainSahel project

## THE WONDERS OF VERMICOMPOSTING: A SUSTAINABLE SOLUTION FOR HOME GARDENERS

#### By Hannah Hopper

In a world where sustainability is paramount, vermicomposting is a simple yet powerful practice that helps reduce waste, enrich soil and cultivate a thriving ecosystem in your backyard. Harnessing the natural power of earthworms, vermicomposting offers an eco-friendly way to transform kitchen scraps into nutrient-rich compost.

#### Why is vermicomposting important?

Vermicomposting is a win-win situation for both you and the environment. Here are a few reasons why it is an essential practice:

- **Waste reduction:** By diverting organic waste from landfills, vermicomposting significantly reduces the amount of methane, a potent greenhouse gas, released into the atmosphere. Instead, these organic materials are converted into valuable compost.
- **Nutrient-rich compost:** Earthworms are true soil superheroes. As they consume organic matter, they break it down into nutrient-rich castings or vermicompost. This compost is packed with essential plant nutrients, micronutrients, beneficial microbes, and enzymes that promote healthy growth and plant vigor.
- **Soil health:** Vermicompost improves soil structure, moisture retention, and aeration. It enhances the soil's ability to retain nutrients and withstand erosion, ultimately leading to healthier plants with stronger root systems.
- **Biodiversity and ecosystem balance:** Vermicomposting encourages the growth of beneficial microorganisms, fungi, and bacteria, fostering a balanced and biodiverse ecosystem in your garden. Earthworms also attract other beneficial organisms like birds and insects, which help control pests.

#### Setting up your own Vermicomposting system

Now that we understand the significance of vermicomposting let's explore how to set up a basic vermicomposting system at home:

- **Choose a worm bin:** Select a suitable container for your worms, such as a plastic or wooden bin with a tight-fitting lid. Ensure adequate space for worms to thrive, starting with a bin of at least 8-12 inches deep.
- **Create bedding:** Line the bin with moist bedding material, such as shredded newspaper, cardboard, or coconut coir. Dampen the bedding thoroughly, but avoid excessive waterlogging.
- Add worms: Purchase red wigglers (Eisenia fetida) or another suitable worm species from a reputable source. Start with approximately one pound (roughly 1,000 worms) for a small-scale home system.

- **Feed the worms:** Add kitchen scraps like fruit and vegetable peels, coffee grounds, tea bags, and crushed eggshells. Avoid meat, dairy, oily foods, and citrus peels, as they can attract pests or harm the worms. Bury the scraps in the bedding, ensuring a balanced mix of "green" nitrogen-rich materials and "brown" carbon-rich materials.
- **Maintain the system:** Keep the bedding moist but not waterlogged, regularly spraying water as needed. Avoid overfeeding to prevent odours and attract pests. Add more bedding and food scraps as the worms consume the existing materials.
- Harvest vermicompost: After a few months, the worms will convert the bedding and kitchen scraps into dark, crumbly vermicompost. To harvest it, gently push the contents of the bin to one side and add fresh bedding and food to the empty side. The worms will migrate to the new bedding, allowing you to collect the finished vermicompost. The liquid from the bin can also be collected by placing another container below the main bin. This liquid can be diluted with water and used as a powerful fertiliser to spray over plants or vegetables.

Vermicomposting empowers gardeners with a sustainable solution to recycle organic waste, nourish their plants, and contribute to a healthier environment. By establishing your own vermicomposting system, you reduce waste and cultivate a thriving ecosystem that supports the growth of your garden. With a little effort and the humble earthworm as your ally, you can transform kitchen scraps into nutrient-rich gold while positively impacting the planet.



### VERMICOMPOSTING

## MALAWIAN FARMERS ADOPT BIONITRATE AMIDST CHEMICAL FERTILISER CRISIS

#### By Goodfellow Phiri

Too many people consider urine fertiliser a taboo to apply for crop production but in Malawi the trend is changing. Goodfellow Phiri, founder and director of a private firm, Environmental Industries, has set the change.

"I have applied urine fertilizer to my crops for 3 years now and my crop stand has always stood out better than the rest applied with chemical fertilisers," said a Mr Chanza, one of the local farmers in Lilongwe. "The crop yield is either at par or better than that from the crop applied with chemical fertiliser", he concluded.

Goodfellow Phiri, an agriculturist, founded Environmental Industries in 1996 with a mission to harness environmentally friendly technologies for organic farming. In 2012 with only US\$200 he started with own urine harvested from family members, his wife and three children using an own-made ecological sanitation toilet. He set up a demonstration garden in his backyard. "It was a crazy idea, everyone including my wife laughed at me," Phiri said. The urine was collected and subjected to fermentation to become fertiliser. He branded his product, Bionitrate fertiliser. Today, 11 years down the line, Bionitrate fertilizer has saved Malawian farmers from the chemical fertiliser crisis and demand has risen. The product volumes have grown from mere 100 litres to 200 000 litres per annum with a work force of 10 permanent employees. "Our limitation is not demand but capacity to reach out to more farmers," Phiri said.

To make Bionitrate fertilizer from urine involves several activities in the value chain. First, we have established the urine collection facilities with space given to us by Lilongwe City Council in their crowded public markets. The city gave us the space considering that the facility will lead to improved sanitation and hygiene when people visit the facility to dispose of urine and solid wastes. However, to us the urine is raw material for organic fertiliser. We collect the urine to positioned treatment tanks where it is treated by aging for chemical changes. The process eliminates the bad smell and possible pathogens. The process is monitored with scientific instruments to determine maturity. The final product is liquid fertiliser for crops and also raw material for solid organic fertilisers.

Bionitrate fertiliser is a rich source of nitrogen, phosphorus and potassium. The scientific analysis shows Bionitrate is rated at C/N 21 (carbon/nitrogen ratio), which is a standard for organic fertiliser in Malawi. To grow crops 100% organic with Bionitrate fertilizer, one needs to apply compost manure into planting stations for basal dressing before planting the crop and later on after the crop is established, say three weeks old, apply Bionitrate for top dressing, hence completing nutrient requirements for the crop. Application is directed into the soil at the base of the plant drilled with small holes for the liquid fertilizer. Bionitrate fertiliser is applicable to all fruiting and vegetative crops such as wheat, maize, vegetables, flowers, lawns, bananas, hemp, rice and so on. Dilution of the fertilizer is at 1:5-15 litres of water depending on the age and type of the crop and soil condition.

Bionitrate fertilizer has more applications than just liquid organic fertilizer.

- It is used as raw material for other organic fertilisers for enhancement of nitrogen. Farmers are blending compost manure and animal manure with Bionitrate fertiliser for nitrogen fortification.
- It can also be applied to maggot farming for protein. The nitrogen in Bionitrate is transformed into protein and is used for growing maggots.
- In badly degraded acidic soils, Bionitrate fertiliser is a viable alternative to agricultural lime for soil amendment. When applied for crop production, it serves as fertiliser as well as neutralising soil acid leading to reconditioned soil state.

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Though Malawi is an agro-based economy with about 80% of her 20 million people engaged in agriculture, Bionitrate fertiliser has encountered slow growth to adoption. Malawians have been addicted to chemical fertilisers for more than 50 years and to change mindset to organic fertilisers made from human waste, it has taken Goodfellow Phiri intensive effort in educating the farmers with demonstration gardens annually.

Malawi imports over 600 000 metric tons of chemical fertiliser annually but due to high prices, this is beyond the reach of many smallholder farmers. This is why many smallholder farmers are resorting to organic fertilisers including Bionitrate which is way cheaper than chemical fertilisers. The government of Malawi is developing a standard for organic fertiliser to make it officially acceptable effective this year 2023.

Bionitrate has gained popularity within Malawi and beyond reaching directly to farmers and indirectly through corporates who buy for their beneficiaries. "We have received trainee delegations from Malawi, Togo, Ghana, Zambia, Mozambique, who come to learn about Bionitrate fertiliser technology for replication in their countries.

This year with chemical fertiliser value chain disruptions caused by the Russia/Ukraine war, we have seen a rise in demand for Bionitrate fertiliser by over 100%. We have now an increase of commercial farmers buying the product and bookings for next growing season are already pouring in. The demand is projected at 100 000 000 litres this year. Therefore, Bionitrate fertiliser is bound to stay in Malawi and beyond. Environmental Industries is achieving its mission: to turn urine fertilizer into a commercial product for Malawi and Africa.



For more information, visit www.environmentalindustriesmw.com

Caption: Preparing bionitrate for application in mazie Caption: maize field treated with bionitrate field

# KNOWLEDGE HUB SOUTHERN AFRICA (KHSA)



The Knowledge Hub for Organic Agriculture in Southern Africa (KHSA) is part of the Knowledge Centre for Organic Agriculture in Africa (KCOA), a collaborative country-led partnership funded by the German Federal Ministry of Economic Cooperation and Development (BMZ) and implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and non-governmental organisations across Africa.

The KCOA aims to scale up adoption of agroeoclogical and organic farming practices through five knowledge hubs in Africa. The South African-based Sustainability Institute supports project implementation in southern Africa. Activities are focused in Zambia, led by Participatory Ecological Land Use Management (PELUM) Zambia; in Namibia led by the Namibia Nature Foundation (NNF) in collaboration with the Namibian Organic Association (NOA); in South Africa led by the South African Organic Sector Organisation (SAOSO) and in Malawi, led by Kusamala and Soils, Food and Healthy Communities. The other hubs are implemented by GIZ and country implementing partners in North, West and Eastern and Central Africa.

#### What's happening in Zambia?

PELUM co-hosts Agroecology, Social Accountability and Climate Change Media (ASACC) Awards PELUM successfully co-hosted the annual media awards ceremony on 31 March 2023 awarding 24 journalists for producing good quality stories in the categories of agroecology, social accountability and climate change. Journalists represented several media categories, including television, radio, online and newspaper genres. Information and Media Services Permanent Secretary Kennedy Kalunga graced the occasion. PELUM, in collaboration with other civil society organisations, initiated the 2017 ASACC awards to stimulate media interest in pursuing and publishing stories on agroecology and sustainable land-use management. This was followed by the training of a cohort of journalists to grow their ability to report on agroecology and organic agriculture.

#### <u>PELUM collaboratively spearheading push for Agroecology</u> <u>Strategy</u>

PELUM Zambia spearheaded a technical working group meeting with 16 other civil society organizations in attendance. The consortium championing agroecology, social accountability and climate change issues discussed the development of the National Agroecology Strategy and how the government could lead in its formulation. The meeting also discussed the Comprehensive Agriculture Transformation Support Programme (CATSP) drafting and submitting recommendations to the government, highlighting gaps as well as the proposed solutions that could be incorporated to ensure smallholder farmers benefited from the programme.



Caption: Members of the technical working group following deliberations, Lusaka, Zambia

#### What's happening in Malawi?

<u>Kusamala Institute of Agriculture and Ecology: Training of Teams of Trainers in Organic Agriculture</u> With the support of the KHSA and the Sustainability Institute, Kusamala hosted the first International Federation of Organic Agriculture Movements (IFOAM)-Organics International Training of Teams of Trainers (ToT) to be held in Malawi from 17 to 21 April 2023. The ToToT was facilitated by IFOAM-Organics International's Patricia Flores.

The ToToT was designed to support national teams of master trainers comprising teams of existing trainers in strengthening their design and facilitation skills in promoting the adoption of ecological organic agriculture in Malawi. More than 70 people applied from different organisations, 18 were selected for the training representing a range of non-governmental organisations and government extension services working in the south, central and northern regions of Malawi. The five-day training included sessions delivered by local experts on the state of ecological organic agriculture in the country, the value chain and participatory guarantee systems and a field visit to the organic Moyo Farm in Lilongwe.



Caption: Malawi ToToT participants receiving their certificates, Eden Estate, Lilongwe, 2023

#### Soils, Food and Healthy Communities (SFHC) holds participatory theatre training

From May 11-13, SFHC held a participatory theatre training for farmers in the region. The training aimed to equip farmers with the skills they need to engage their communities in a meaningful way. The training began with a focus on storytelling. Farmers were encouraged to share stories from their own experiences and their communities.

These stories were then used as the basis for four distinct plays: one on gender, one on deforestation and climate change, one on post-harvest management, and one on food budgeting. The second day of focused on perfecting the plays. Farmers practiced their lines and worked on their blocking. They also learned about community engagement and interactive theatre techniques. The third day was set aside for final rehearsals and community performance. Unfortunately, there was a funeral in the village, so the performance was postponed to the next farmers' meeting in June.

Five of the thirty participants said that they had never been involved in any drama performance before. On a scale of one to ten, fifteen of the twenty-five farmers who had done theatre before said that they had a confidence level of below five in terms of their performance skills. At the end of the training, however, everyone had a confidence level of above six on how confident they felt to disseminate knowledge products using theatre and other participatory community engagement techniques. The farmers were particularly impressed with the interactive theatre techniques they learned. They felt that these techniques would be very effective in engaging their communities in discussions about important issues.

The SFHC plans to offer more participatory theatre training in the future. The organization believes that this type of training is essential for empowering farmers to take control of their development. In addition to the benefits mentioned above, participatory theatre can also have several other positive effects on communities. For example, it can promote social cohesion, encourage critical thinking, raise awareness of important issues and empower people to take action to improve their lives. If you are interested in learning more about participatory theatre, or if you would like to organise a participatory theatre training in your community, please contact SFHC.





Caption: (LHS) Theatre training; (RHS) Farmer roleplaying

#### What's happening in South Africa?

#### PGS South Africa"s PGS Lesotho mission

As part of the KHSA Pollinator Programme, Lesotho hosted a mentoring programme in March with the regional Pollinator and Permaculture specialist, to capacitate organic farmers with permaculture principles and best practice as they apply directly to the Lesotho context. The seven-day mentorship and training mission resulted from a request from the Lesotho pollinator who expressed to PGS SA the need and relevance for the PGS farmers in Lesotho to improve their land management and production methods by embedding permaculture design methods and principles into their farming practices. Feedback from the Pollinator indicated that the mentorship mission was relevant, informative and potentially very useful to their current work in designing farmer's sites, training of organic ecological agricultural courses and extension work. The Lesotho PGS training was attended by 19 PGS farmers and others interested in organic agriculture.



Caption: A permaculture demonstration gardens visited during the mentorship tour Credit: Rory Clarke

#### PGS South Africa launches a Resource section on their website.

PGS South Africa (PGS SA) has expanded their website offering, adding the Resources section. The open-source section of the website will house various resources which are accessible to everyone, not only PGS SA members but potential members as well as the wider organic sector network. "The plan is to grow the resource to become the go-to knowledge hub for PGS groups, small-scale farmers and those seeking knowledge on organic farming, a place to go for PGS specific resources", says Sasha Mentz, PGS SA Coordinator. The resources include "customer facing information", "PGS practitioner foundational and operational resources", and in June sections for "Farmers market development online training" and "PGS sectoral webinar series" recordings will be added. Visit the PGS SA website on <u>www.pgssa.org.za</u>.

#### Market access opportunities for PGS farmers

Under the theme "From the Field to the Farmers Market - Learn how to shape the organic value chain and set up a farmers' market or alternative retail space", KHSA, PGS SA and SAOSO in April launched an online training webinar series. The weekly online training consists of 9 modules, ranging from production planning in preparation to have a consistent supply of produce for a farmers' market to experiences and case studies presented by a coalition of farmers markets in the United States of America. PGS SA members through the Pollinator Programme across provinces in South Africa have started planning to launch farmers markets in their respective areas, in some cases in partnership with agri-preneurs who will be responsible for running the market while farmers focus on growing produce.

#### PGS farm assessments and organic certification

It has been a busy time in South Africa, with PGS groups visiting each other's farms and performing assessments for organic certification. The KHSA Pollinator Programme has been instrumental in the uptake of PGS membership in the country, due to the capacity provided by the programme. Across 7 provinces of South Africa, 17 farm visits have taken place and 15 farms have received organic certification in the last quarter. Pollinators, assisted by Co-pollinators usually conduct these farm visits, sharing responsibilities and skills. All PGS groups in South Africa use the SAOSO Standard for Organic Production and Processing, (save for the Biodynamic PGS which uses Demeter) for their organic farm assessments and certification.

#### PGS Sectoral webinar series: Sharing experiences and best practise in Africa

PGS South Africa and Ghana PGS, supported by KHSA will be hosting a bi-weekly webinar series from the 14 June to 16 August 2023 on sharing experiences and best practice among PGS groups in Africa. Oluwami Benedict of PGS Ghana and Sasha Mentz of PGS South Africa will host PGS industry experts to discuss experiences, best practice and PGS initiatives from various countries. The first of its kind, the webinar series will be available as a resource on the PGS SA website, and it will be available as a reference for PGS initiatives.

PGS South Africa (PGS SA) and Ghana PGS, supported by the Knowledge Hub for Organic Agriculture in Southern Africa (KHSA), invites you to the webinar series:



### Participatory Guarantee Systems to grow organic agriculture in Africa: sharing experiences and best practices.

<ol> <li>The challenge of honouring the fundamentals of PGS: 14 June 2023</li> </ol>
2 PGS as a catalyst to shape the growth of national organic sectors: 28 June 2023
3. Making PGS groups sustainable: 5 July 2023
4 PGS groups and the certification of agro-processed produce: 19July 2023
<ol> <li>How PGS groups organise for market and integrity of production: 2 August 2023</li> </ol>
6 Synergies between PGS and other initiatives and development programmes: 16 August 2023
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ORGANIC SECTOR IN AFRICA

## Register by clicking here.

# **EVENTS AND SOIL RESOURCES**

### **UPCOMING EVENTS**

• Building Community for Land Access: 'Meeting the African Farming Community', 14 June 2023, online

Panel of two to three land-seekers and landowners sharing their stories. Small groups with mixed landowners and land-seekers sharing their stories and getting to know each other. Register <u>here</u>.

• Organic & Natural Products Expo Africa, 14-16 September 2023, Sandton, South Africa

The Organic & Natural Products Expo Africa is the first exhibition of its kind in Africa which aims to become the continent's must attend event for the sector. The expo will encompass several product categories in the organic and natural products sector: from food & beverages, ingredients & raw materials, health foods, dietary supplements and nutrition to cosmetics and hygiene products, beauty and personal care products, household products and organic gardening. Findout more <u>here</u>.

### **SOIL RESOURCES**

• Soil Song by Sounds of Isha Watch here.

• Songs For The Soil

Read more <u>here</u>.

• Video: How To Make Compost - The Simplest Easy Method To Compost Piles Watch <u>here</u>.

• Video: Massive Soil Improvement Using Leaf Mulch Watch <u>here</u>.

• Video: How to Transform Bad Soil Into Good Soil Watch <u>here</u>.

• Video: What Happens When You Bury Kitchen Scraps in The Garden Watch <u>here</u>.

• Video: What Happens When You Use Ash in The Garden Watch <u>here</u>.

# **STATISTICS AND TRENDS**

#### THE WORLD OF ORGANIC AGRICULTURE: SOUTHERN AFRICA STATISTICS

#### See all Southern African statistics here.

#### Organic Exports by Country (2021)

Country	Exports (MT)
South Africa	28 139
Madagascar	6 947
Mozambique	5 311
Malawi	3 566
Lesotho	793
Zimbabwe	314
Zambia	93
Namibia	14

#### Dry Pulses: Organic area by Country (2021)

Country	Area(Ha)
South Africa	174
Mozambique	13
Namibia	7
Zambia	7

#### Cereals: Organic area by Country

Country	Area(Ha)
South Africa	1 868
Zambia	213
Zimbabwe	1

#### Tropical and Subtropical Fruits: Organic Area by Country (2021)

Country	Area(Ha)
Madagascar	7 976
South Africa	1 551
Mozambique	807
Zimbabwe	29

#### Oil Seeds: Organic area by Country

Country	Area(Ha)
Mozambique	28 303
Zambia	2 755
Namibia	7
South Africa	3

## UPDATE ON EUROPEAN UNION REGULATIONS RELATED TO SOIL HEALTH

Organic production is a sustainable management system that is based on the principles of respect for nature's systems and cycles and enhancement of the state of the soil, the water and the air; of the health of plants and animals; and the balance between them. Further principles are the responsible use of energy and natural resources, the appropriate design and management of biological processes and the restriction of external inputs. As we are focused on soil this issue, it is worth noting a specific principle related to soil:

Organic principle related to soil: The maintenance and enhancement of soil life and natural soil fertility, soil stability, soil water retention and soil biodiversity, preventing and combating loss of soil organic matter, soil compaction and soil erosion, and the nourishing of plants primarily through the soil ecosystem,

As noted in our previous edition, the European Union regulations related to organic production have been revised. Below are key updates of changes pertaining to soil fertility management.

• Fertilisers, soil conditioners and nutrients: Only the products and substances listed in the new regulation may be used in organic production as fertilisers, soil conditioners and nutrients for plant nutrition, litter improvement and enrichment or algae cultivation.

- Soil management and fertilisation: In organic plant production, tillage and cultivation practices shall be used that maintain or increase soil organic matter, enhance soil stability and soil biodiversity, and prevent soil compaction and soil erosion.
- The fertility and biological activity of the soil shall be maintained and increased by the use of multiannual crop rotation including leguminous crops as the main or cover crop for rotating crops and other green manure crops; in the case of greenhouses or perennial crops other than forage, the use of short-term green manure crops and legumes as well as the use of plant diversity. In all cases, by application of livestock manure or organic matter, both preferably composted, from organic production. Operators shall keep records of the use of those products, including the date or dates on which each product was used, the name of the product, the amount applied and the crop and parcels concerned.
- The total amount of livestock manure used in the in-conversion and organic production units shall not exceed 170 kg of nitrogen per year/hectare of the agricultural area used. That limit shall only apply to the use of farmyard manure, dried farmyard manure and dehydrated poultry manure, composted animal excrement, including poultry manure, composted farmyard manure and liquid animal excrement.

- Operators of agricultural holdings may establish written cooperation agreements exclusively with operators of other agricultural holdings and undertakings which comply with the organic production rules, to spread surplus manure from organic production units. The maximum limit shall be calculated on the basis of all of the organic production units involved in such cooperation.
- Preparations of micro-organisms may be used to improve the overall condition of the soil or to improve the availability of nutrients in the soil or in the crops.

#### Soils and conditioners authorised for use in organic production

Where the nutritional needs of plants cannot be met by the measures provided for above points, only fertilisers and soil conditioners that have been authorised for use in organic production shall be used, and only to the extent necessary. The following is a list of authorised inputs for organic soil fertility management:

- •Farm-yard manure (comprising a mixture of animal excrements and vegetable matter, animal bedding and feed material).
- ·Dried farmyard manure and dehydrated poultry manure
- Composted animal excrements, including poultry manure and composted farmyard manure.
- Liquid animal excrements (use after controlled fermentation and /or appropriate dilution).
- Composted or fermented mixture of household waste (product obtained source separated household waste, which has been submitted to composting or to anaerobic fermentation for biogas production. Only vegetable and animal household waste)
- Peat (use is limited to horticulture).
- Mushroom culture wastes (the initial composition of the substrate shall be limited to products from this list).
- Dejecta of worms(Vermicompost) and insect frasssubstrate mixture
- Guano
- Composted or fermented mixture of vegetable matter, which has been submitted to composting or to anaerobic fermentation for biogas.
- Biogas digestate containing animal by-products codigested with materials of plant or animal origin but should not be applied to the edible parts of the plant.
- Products or by-products of animal origin( blood meal, hoof meal, horn meal, bone meal or degelatinised bone meal, fish meal, meat meal, feather, hair, skin meal, wool, fur, hair, dairy products).
- Products and by-products of plant origin for fertilisers.
- Algae and algae products (as far as obtained by physical processes including dehydration, freezing and grinding, extraction with water or aqueous acid and /or alkaline solution and fermentation.
- Sawdust and wood chips (wood not chemically treated after felling).
- Composted bark (wood not chemically treated after felling).
- Wood ash (from wood not chemically treated after felling.
- Soft ground rock phosphate( product obtained by grinding soft mineral phosphates and containing tricalcium phosphate and calcium carbonate as essential ingredients)

- Aluminum-calcium phosphate (product obtained in amorphous form by heat treatment and grinding, containing aluminum and calcium phosphates as essential ingredients)
- Basic slag (product obtained in iron- smelting by treatment of phosphorous melts and containing calcium silicophosphates as its essential ingredients).
- Crude potassium salt (product obtained from crude potassium salts)
- Potassium sulphate, possibly containing magnesium salt (product obtained from crude potassium salt by a physical extraction process, containing possibly also magnesium salts.
- Calcium carbonate such as chalk, ground limestone and phosphate chalk (only of natural origin).
- Mollusc waste (only from organic aquaculture or from sustainable fisheries)
- Egg shells (factory farming origin is forbidden).
- Magnesium and calcium carbonate (only of natural origin (Magnesium chalk, ground magnesium, limestone).
- Magnesium Sulphate (only of natural origin).
- Calcium chloride solution (only for foliar treatment of apple trees, to prevent deficit of calcium).
- Calcium Sulphate (Gypsum) (Product of natural origin containing calcium sulphate at various degrees of hydration.
- Industrial lime from sugar production (by product from sugar production from sugar beet or sugar cane).
- Industrial lime from vacuum salt production (by products of vacuum salt production from brine found in mountains)
- Sodium chloride
- Stone meal, clays and clay minerals
- Leornardite (Raw organic sediment rich in humic acids (only if obtained as a by-product of mining activities).
- Xylite (only if obtained as a by-product of mining activities (e.g., by product of brown coal)
- Organic rich sediment from freshwater bodies formed under exclusion of oxygen (only sediments derived from sources free from contamination of pesticides, persistent organic pollutants and petrol like substances).
- Biochar-pyrolysis product made from a wide variety of organic materials of plant origin and applied as a soil conditioner( from untreated plant materials).

### **Dung Woman the Beautiful**

### <u>by Mariana S. Tupper</u>

The woman at my right shoulder has been maligned for too long.

She is generous, and strong, and she knows it, but that does not prevent her shedding her tears.

Her gifts are in her moisture, it is true: she rots, digests, breaks down the whole into elemental parts.

Yet her gifts, despite her name which recoils many, lie in her fecundity.

Down in the Earth Kitchen, Dung Woman mixes great potions of former feasts to serve again, feed the people again, grow plants tall and lush and green.

She is dark and rich, mysterious in her magic. As the Keeper of Black Gold, this lady is surprisingly humble.

Dung Woman, you are beautiful! I come to you with dirt on my face and soil under my fingernails. I embrace your being with smudges on my clothes, manure on my boots, and sawdust in my hair.

*I kiss the Earth, knowing you are there.* 

