

NEWSLETTER



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Soil Health Edition



Why Soil Health?

By Erwin Kinsey, Vice President of ECHO

“A good person leaves an inheritance to their children’s children.”

-Proverbs 13:22

Renewing the earth for our children’s children is possible through efforts to manage rainwater and soil conservation. Soils are among the world’s most valuable resources, but have become the largest exports from runoff into rivers, lakes and oceans with no hope of their returning to where they began. Typical annual soil

loss on cultivated land in the district where ECHO lies is in excess of 17 Tons per hectare. This must change.

Communities can lead soil conservation and fertility enhancement by simple methods to arrest erosion, increase organic matter through green manure/cover crops (GM/CCs), compost, manure, and mulch. Adoption of soil and water conservation measures, GM/CCs, and conservation agriculture will transform landscapes and increase sustainable

production. This will improve food security and decrease poverty, making for a better earth.

We at ECHO challenge readers to share their feedback, experiences and questions on ECHO’s forums concerning the technologies described in this newsletter. Find the list of ECHO’s ‘Best Practices’ on page 3 under the article, “Replenishing Your Soils”.

Let us hear back from you.

—EK

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Introduction to Soil Structure and Health

Taken from the “[Comprehensive Assessment of Soil Health](#)” manual from Cornell University¹

ECHO East Africa is a non-profit, Christian organization helping to improve lives through sustainable hunger solutions.

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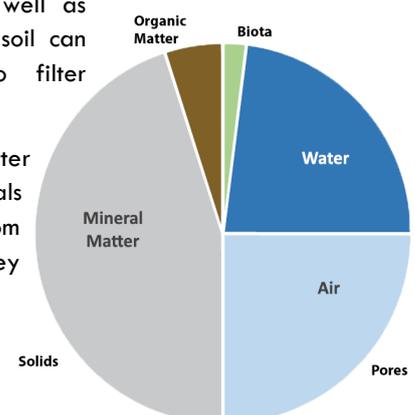
Like any living entity, plants require nutrients to live, grow, and reproduce. Those who live off the land know the importance of keeping soils healthy for crops to grow to their full potential. In figuring out how to do this, you must first understand how the condition of your soils affect the crops you produce.

There are 3 main features that determine how a soil will function – mineral solids, soil organic matter, and pore size. The largest component of a soil is the mineral solids,

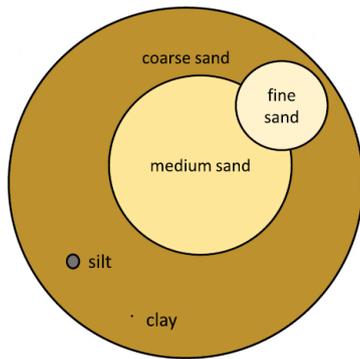
which are characterized by their size: clay being the smallest particle and sand being the largest. The size of these mineral solids can determine how fast nutrients are exchanged as well as how much water a soil can hold or allow to filter through.

Soil Organic Matter (SOM) are materials that originated from living organisms. They not only contribute nutrients to the soil, but also help determine how those

nutrients move throughout the soil. Another important role both mineral and organic parts of soil play is in “carbon sequestration”. (cont’d on pg. 2)



Intro to Soil Health *(continued)*



This occurs when the organic matter binds with the mineral matter, preventing further release of carbon into the atmosphere. This plays a major role in helping to alleviate climate change by reducing carbon dioxide in

the atmosphere.

The third soil feature to be mindful of is pore size. Pores are the spaces found in between the physical parts of soil and whose sizes are largely determined by the types of mineral matter you have. Clay soils have smaller pore sizes while sandy soils have larger pores (the larger the mineral solids, the larger the pore size). Pores are what allow for nutrient transfer, as well as movement of air, water, and microorganisms.

Soil health is so important, not only for agriculture but environmentalism as well. Healthy soils not only support healthy crops, but also sequester carbon, filter water, and can even detoxify harmful chemicals.

The materials for this article were taken from the Cornell "Comprehensive Assessment of Soil Health" which can be found through the ECHO community if you [Click Here!](#)

Good Soils have . . .

- A good physical feel—no clumps, dark with organic matter, crumbly, not compacted
- Good depth to allow roots to dig deep
- Sufficient water storage as well as water drainage
- Enough nutrients but not to excess
- Large populations of beneficial organisms
- Resistance to erosion



Acidic Soils of the Tropics

Taken from an article written by Robert D. Harter, PhD²

Acidic soils are soils with a pH lower than 7. For most plants, having a pH between 6 and 7.5 is ideal (see table 1 for more exact numbers), but soils can become dangerous when their pH drops beneath 4.5. As the pH drops, aluminum becomes more soluble, toxicifying the soil and harming the plants. Bacteria activity and nitrogen fixation (the process in which atmospheric nitrogen is 'fixed' into an organic form that is useable for plants) also decreases if the soils become too acidic.

So how does it happen? Soil particles typically carry a slightly negative charge, which is what holds positive cations like calcium, manganese, potassium, sodium, and others in place. However, the attraction between the slightly negative soil and hydro-

gen ions in water are much stronger. This means that with heavy rainfall (which is naturally slightly acidic) and well-drained soils, the hydrogen ions will replace the other cations (nutrients) in the soil. This is also known as leaching, when the nutrients get replaced and pulled down and out of the soils by being replaced by hydrogen ions.

Luckily, there are some simple solutions to acidification of soils. Limestone is commonly used to help raise soil pH, although this might not be a viable option for subsistence farmers due to availability and expenses. The "slash and burn" farming you often see employed in the tropics can also decrease acidity due to a release of nutrients from the burned materials, although this isn't

a very sustainable option. For small-scale farmers, using crushed bones for their calcium content to help raise their soil pH can be an alternative.

It is important, however, not to overdo it. When you raise your pH too high using limestone, you run the risk of reducing porosity of your soils which can lead to poor drainage. When adding limestone, the recommended pH level to bring your soil up to is around 5.5—at this level, the aluminum in the soil is deactivated and the risk of over-liming is low.²

To read the full article, follow [this link](#) to download the pdf.

Table 1. Ideal pH Levels for Common Crops³

Maize	6.8
Wheat	6.8
Oats	7.5
Barley	7.5
Soybean	6.8

Soil Testing Recommendations

By Neil Rowe Miller, Agriculture and Livelihoods Technical Advisor, Eastern Africa

Soil infertility is a key constraint to crop production for small farmers. Soils throughout Sub-Saharan Africa are degraded and deficient in nutrients and organic matter. As a result, there is a growing demand for soil testing services from farmers and NGO staff who want guidance on which inputs are best, and how much they should apply to restore soil health and fertility.

Given the wide range of soil testing options which are available, it is important to identify which tests are most useful. Some tests are helpful in developing recommendations for how farmers manage crops. Other tests may not help make crop management decisions, but they are useful in training farmers to think about soil health. Still others are appropriate in monitoring and evaluation of the effects of a project on soil nutrients and soil health.⁴

For the full article, follow [this link](#) to read the "Conservation Agriculture Newsletter" written by Neil Miller.

Types of Soil Testing:

- **Soil pH** affects the availability of many of the nutrients which are needed for good plant health. In addition, farmers can improve the pH of acidic soils by using lime and/or wood ash. Soil pH testing using pH strips costs less than \$0.15 per sample, and thus individual small-scale farmers can afford to have their fields tested.
- **Complete soil nutrient tests** should include pH, phosphorus (P), and potassium (K). Additional soil tests for calcium, magnesium, and cation exchange capacity are sometimes included at no additional cost, but are less helpful since they aren't generally as limiting.
- **Soil organic matter (SOM) testing** — Since SOM provides many benefits for soil health and fertility, our goal for tropical soils is generally to maximize SOM. Thus, testing for SOM doesn't help in making management decisions—farmers should always apply more if they can!
- **Nitrogen testing** is often expensive and the nitrogen content of the soil changes rapidly, especially with wet conditions. For this reason, nitrogen testing is not generally helpful in developing fertility recommendations.
- **Micronutrient testing** is also expensive and the availability of most micronutrients is strongly influenced by soil pH. Furthermore, micronutrient fertilizers are rarely available for small scale farmers. For these reasons, it is generally better to focus on good soil pH management rather than to spend time and money on micronutrient testing.³

Replenishing Your Soils

Follow [this link](#) to read the full article

Lands that are most at-risk for degradation or desertification are those with fragile ecosystems or in places with higher populations. Poor farming practices that don't concentrate on replenishing the soils after taking from them are also a major issue leading to decreased land quality. Unprotected soils are vulnerable to compaction and erosion as well as sun exposure which can kill off valuable microbial populations.

It is important to remember you must give to receive, and that rule is no different when considering our soils. Read ECHO's Best Practices for improving soil quality to learn a few steps you can take to improve the quality of your land.⁷

- Build up soil organic matter through the use of leguminous cover crops and/or trees
- Cover the soil with crop residues, living mulches, and/or dispersed trees
- Disturb the soil as little as possible, leaving organic mulches on the soil surface
- Concentrate fertility close to plants
- Utilize micro-catchments and, where possible, water-holding structures such as sand dams to capture and hold rainwater for agricultural use
- On sloping land, establish barriers along contours to minimize erosion
- Build resiliency through diversification, integrating crops, trees, and animals into small farms in ways that cycle nutrients as efficiently as possible.
- Select and implement farming systems that incorporate multiple conservation agriculture principles.

Soil Texturing Flowchart

Use this flowchart to help determine your soil type

Step 1. Place a spoonful of soil into your hand and add water drop by drop. Knead the soil until the aggregates are broken down and the soil feels like moist putty. Does it remain in a ball when squeezed?

No → The soil may be too dry or too wet; either add more water or soil until it is the proper consistency

No → The soil is the right consistency but it still doesn't hold. This means your soil is sand with 1-10% clay



Step 2. Place the ball of soil between your thumb and forefinger. Gently push upwards with your thumb to create a ribbon, making sure to keep even thickness and width. Continue slowly making the ribbon until it breaks from its own weight. Does the soil form a ribbon?

No → Loamy Sand, 0-15% clay

Yes → Does soil make a weak ribbon less than 2.5cm long?

No ↓ Yes ↓

Does the soil make a ribbon 2.5-5cm long before breaking?

Yes ↓

Excessively wet a small pinch of soil and rub it in the palm of your hand. If the soil feels...

- Gritty—sandy clay loam, 20-35% clay
- Very smooth—silty clay loam, 27-40% clay
- In between—clay loam, 27-40% clay

No ↓

Excessively wet a pinch of soil and rub it in the palm of your hand. If the soil feels...

- Gritty—sandy loam, 0-20% clay
- Very smooth—silt or silt loam, 0-27% clay
- In between—loam, 7-27% clay

If your soil makes a ribbon 5cm or longer, excessively wet a pinch and rub it into the palm of your hand. If the soil feels...

- Gritty—sandy clay, 35-55% clay
- Very smooth—silty clay, 40-60% clay
- In between—clay, 40-100% clay

For full article, email Neil Miller at: neil.rowe-miller@tearfund.org

Project Highlights and Impact Stories

Written by Sophia Kasubi, ECHO East Africa Executive Assistant



ECHO trainer and facilitator, Happy Lukumai, showing visitors Chaya—a plant species very similar to cassava whose leaves and tubers are eaten. Benefits of using Chaya include high protein and calcium content, being generally pest-free, and being a perennial plant that grows continuously throughout the year.

ECHO trainer and facilitator, Charles Bonaventure, and ECHO partner, Roland Bunch, discussing the benefits of using sprouted grains for feeding livestock. Sprouted grains are easier to digest for the animal and high in vitamins.



NaneNane Agricultural Show

Every year, Tanzania uses the first week of August to celebrate farmers across the nation in a festival known as Nanenane.

ECHO East Africa participated in Nanenane to showcase and educate farmers on ECHO's best practices of sustainable agriculture and appropriate technologies. From August 1st through the 8th, agricultural fairs are organized in different cities all over the country, culminating in a national holiday on the final day. This year, the theme was "Agriculture, Livestock, and Fisheries for Economic Growth".

Nanenane brought together private companies, government departments (regional and local), farmers, and NGOs to showcase the latest developments and opportunities in the world of agriculture.

Irish Dairy Goats

200 imported dairy goats and training funds were provided by BOTHAR, an Irish NGO, through ECHO East Africa. Between August and November 2019, ECHO East Africa collaborated with local church partners and district government livestock staff to select 200 small-scale farmers to learn how to care for the imported Irish dairy goats, a breed which produces more milk than the local variety. The participants were selected based upon criteria perceived as 'needy' and 'capable of preparations and managing the dairy goats by zero-grazing'. They were recruited from two districts in collaboration with two dioceses of the Evangelical Lutheran Church of Tanzania, the ELCT North Central Diocese West, and the ELCT Meru Diocese.

Having a reliable source of milk will increase the farmer's food security and health. Income generated from selling goats can also be used to contribute to the family's well-being.

The aim of the project was to increase both food security and income generation through milk. The beneficiary must give away the first kid the goat births as to keep the breed circulating throughout the village. After the first kid, the participant keeps any other offspring the goat produces.



ECHO interns were tasked with collecting baseline data about health and lifestyle of the recipients. They surveyed 68 of the initial 100 participants with questions which showed and overall positive trend in food security.

Project Highlights and Impact Stories *(continued)*



Pictured above is ECHO East Africa's Innovation Coordinator, Harold Msanya, showcasing a modified plow that simultaneously sows seed and fertilizer as it is pulled along.

Local Seeds and Food Fair

On August 30th, 2019 ECHO East Africa and partner organizations (Islands of Peace, RECODA, World Vegetable Center, TABIO, TPRI, TOAM, MESULA and MVIWATA) co-organized a local food and seed fair in Karatu. The fair was used as a learning forum opportunity for farmers and various stakeholders in Arusha and outside the region. Approximately 600 people attended the event.

ECHO East Africa showcased seeds with an emphasis on the top four green manures/cover crops—Jack Bean, Mucuna, Lablab, and Pigeon Pea for soil health. ECHO was also there to educate and promote agriculture technologies for use in conservation agriculture.

Staff Spotlight

Q&A with ECHO Gardener and Trainer Adiveckson Mamkwe

Q: When did you start working for Echo and how did you hear about it?

A: I started in September 2012. I used to work with Erwin Kinsey [ECHO Vice President] at his house, so I heard about ECHO through him.

Q: What do you like about ECHO? What could be improved?

A: I like the interaction with people and staff, as well as learning new things. ECHO is like a college, where you are learning new things all the time. There can be some small challenges when working with people but that is normal anywhere.



Q: What is/was your dream job?

A: As a kid I wanted to be an electrician. But then I came to find out that I would enjoy anything I did. Before ECHO, I was working as a carpenter and auto mechanic.

Q: If you didn't have to work, if money wasn't an issue, what would you do?

A: There's nothing like eating, and there's nothing like agriculture. If I could, I would move out of town, out of Arusha, where I can cultivate and find my own food.

Q: If you had a superpower, what would it be?

A: Flying, I think one day it will be possible.

Q: Who knows you the best in the entire world?

A: God knows me the best.

Resources and Further Reading

Interested in learning more about soil health? Click on the logos below!



If you have any questions or comments on the materials in this newsletter, please email me at:
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