

Regenerating soils for future generations

An online webinar series to support multipliers working with farmers in East Africa

Organized by Knowledge hub for organic agriculture in EastAfrica Project[KHEA]

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Bio Gardening Innovations[BIOGI] 11/2/2024



‘We borrow land for future generations’ African proverb

Focus of the presentation

- Life in the soil –role of microorganisms
- Bio availability of Plant nutrients-why it matters
- Practical strategies to combine soil microroganisms with mineral nutrients for healthy soils

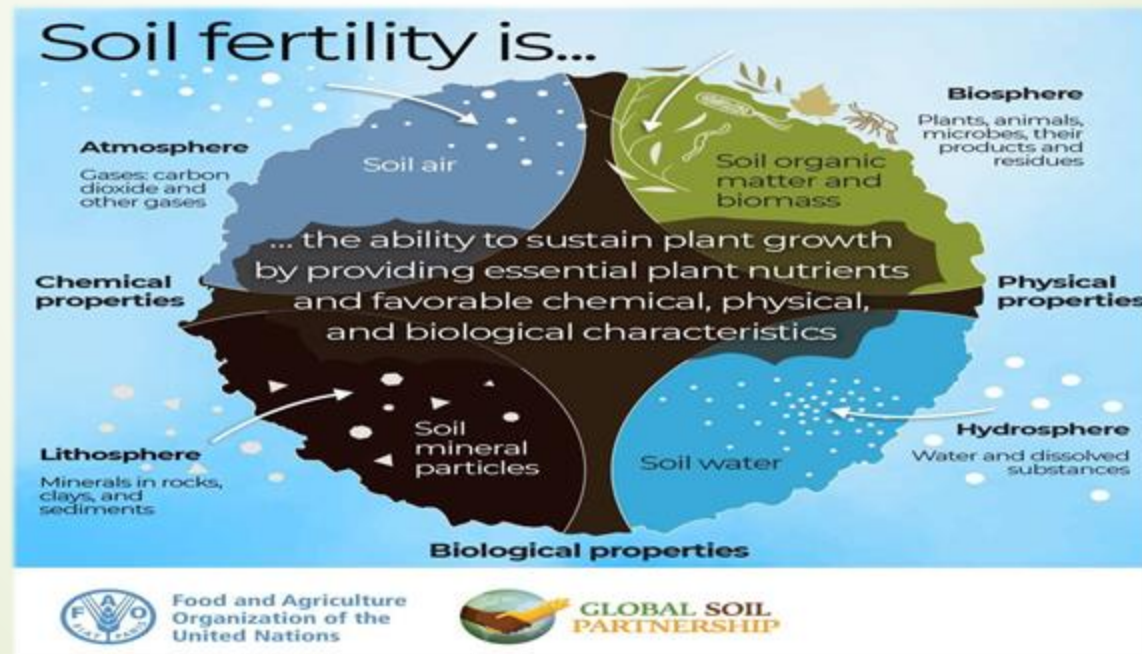
Living organisms

picture credit FWWafula

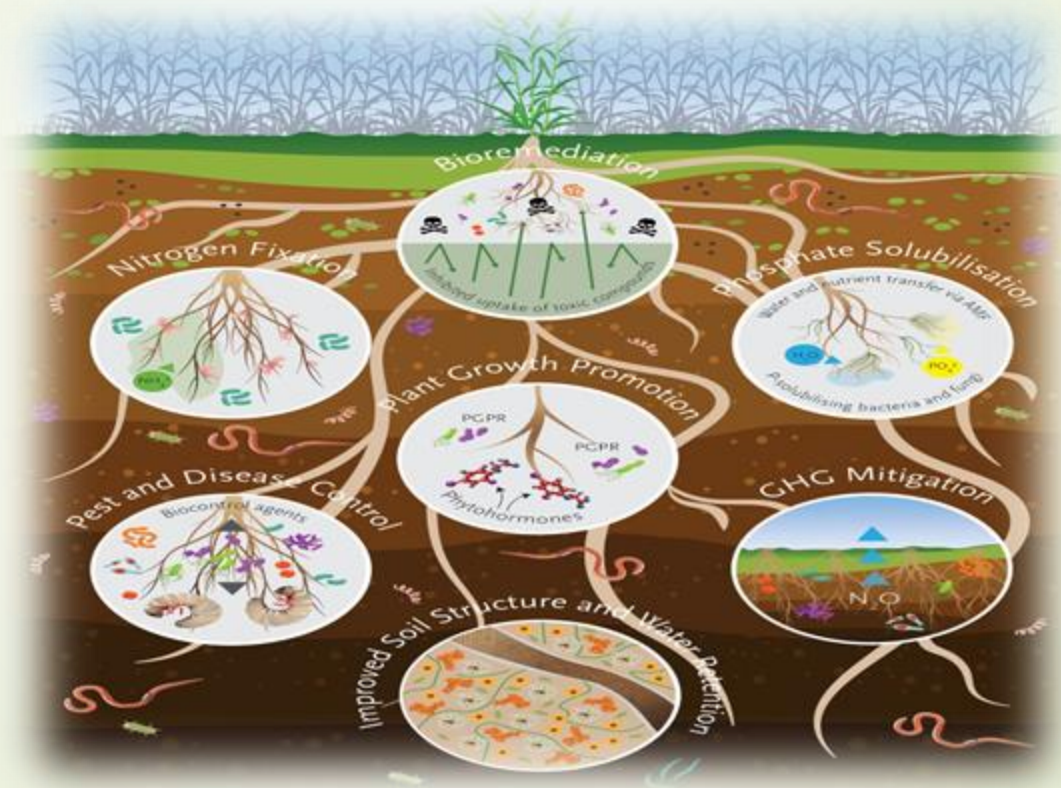



Life in the soil

- Presence of microbial life gives soils their highest biological properties and value in supporting plants and to a greater extent healthy crops. A balance between minerals, organic matter and microbial life gives the soil its best performance=fertility

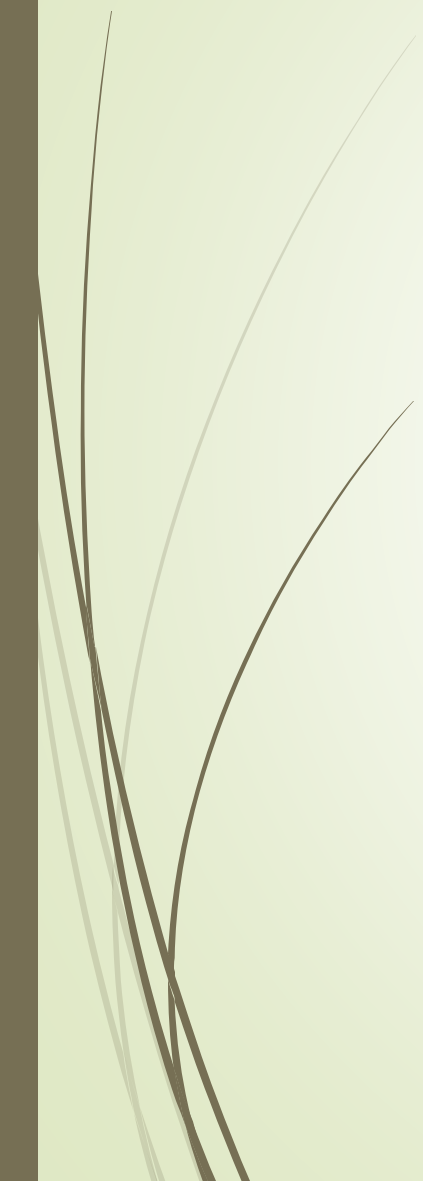


Microbial presence and their roles



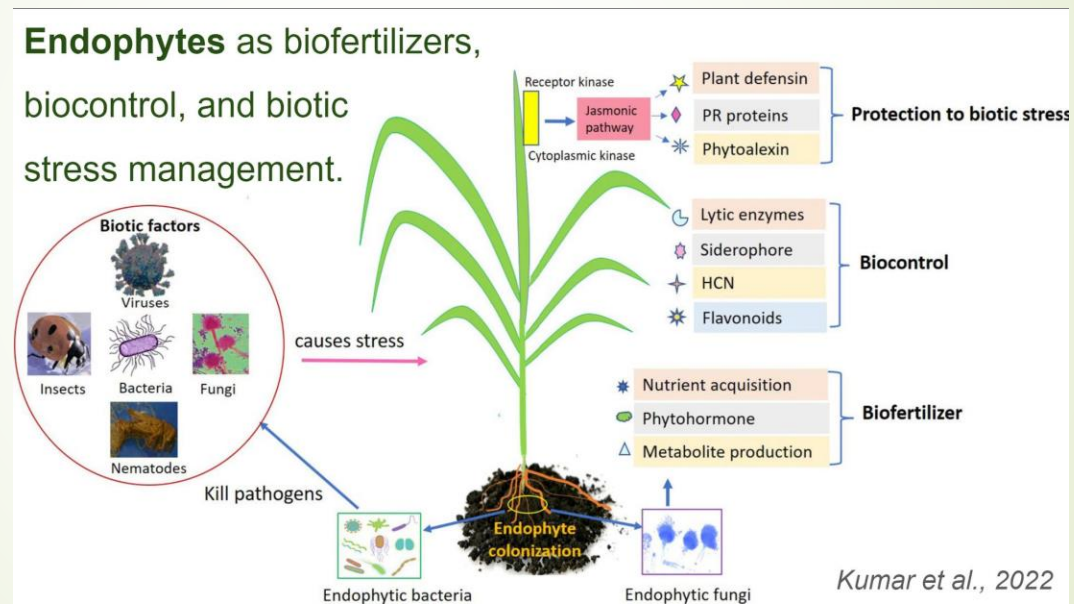


Biological role of soil microbes

- Nitrogen fixation
 - **Phosphorus solubilization**
 - **Pest and disease control**
 - **Plant growth promotion**
 - **Bio remediation**
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Symbiotic association Endophytes and ectophytes

eg *Arbuscular mycorrhiza*

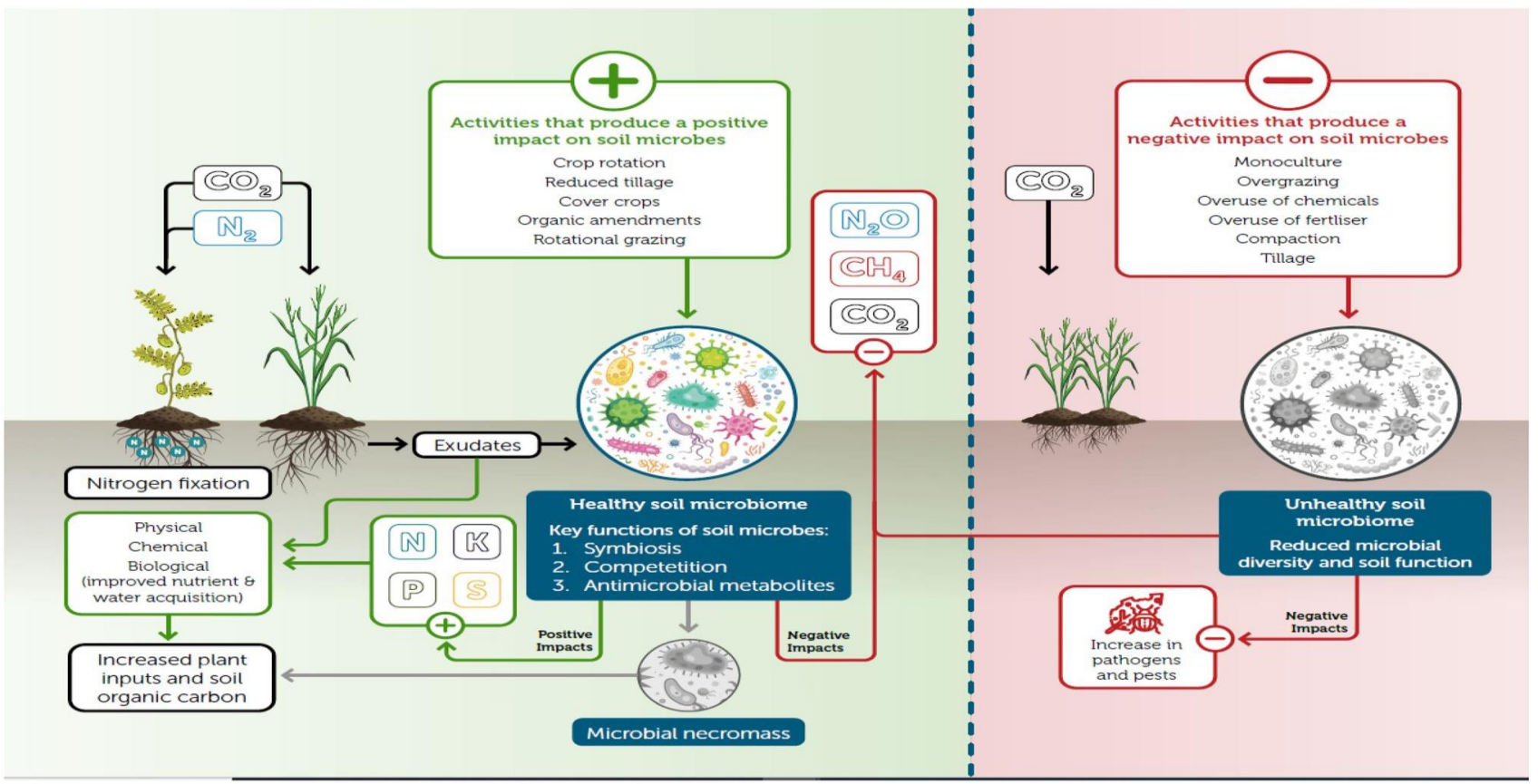




Practical ways to achieve endophytic inoculation

- **1. Seed coating and dressing**
- Solid bio stimulant
- Crushed plus ash plus clay soil [we use soil from termite hill]
- **2. lactic acid preparation**
- Spray on compost
- **3. Composting, bokashi and other biostimulants [liquid and solid]**

Living vs dead soils



Microbial symbiotic cycle

🌱 Seeds harbor diverse microorganisms enhancing plant growth and resistance to stress, both biotic (e.g., pathogens, herbivores and insects) and abiotic stress factors (e.g., drought, heavy metals and salt) thereby improving crop performance and soil health.

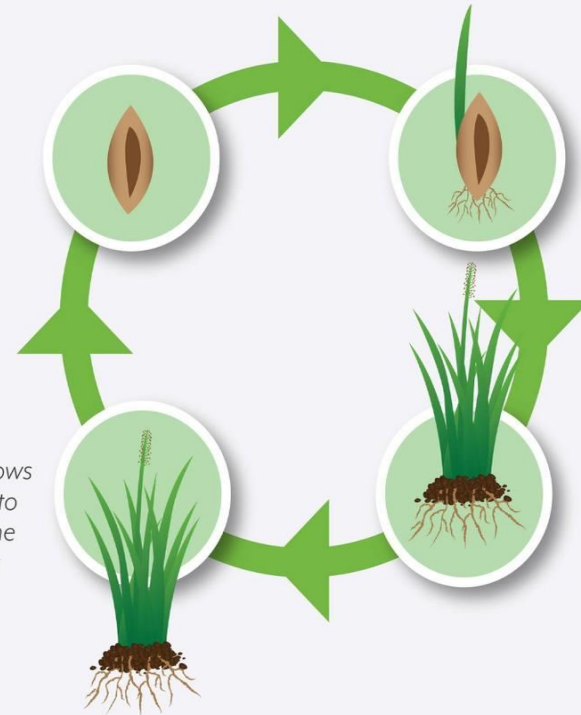
🌱 'Primary symbiont hypothesis': Plant defenses interact with seed-borne microbes, influencing seed germination and growth.

🌍 Seed microbes from previous generation partially pass to next generation (vertical transmission), supplemented by microbes from soil, air, and animals, companion plants (horizontal transmission).

📊 Seed endophytes colonize the entire plant tissues without causing harm and play vital roles in enhancing host fitness, nutrient uptake, phytohormone synthesis, and defense against pathogen-induced damage through mechanisms such as antibiosis, production of lytic enzymes, secondary metabolites, and hormone activation.

ENDOPHYTE LIFE CYCLE

Endophyte is found in the embryo of an infected seed



The endophyte grows into the emerging leaf as the seed germinates

The endophyte grows up the stem and into the seed head of the reproductive plant

The endophyte is concentrated in the base of the plant, not in the roots



Results and Implications

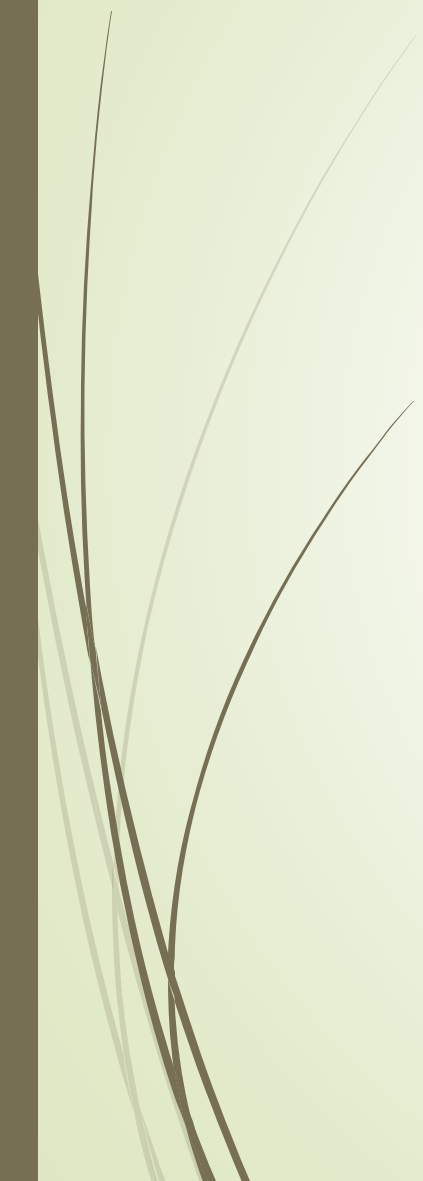
➤ **Nutrient dense foods**





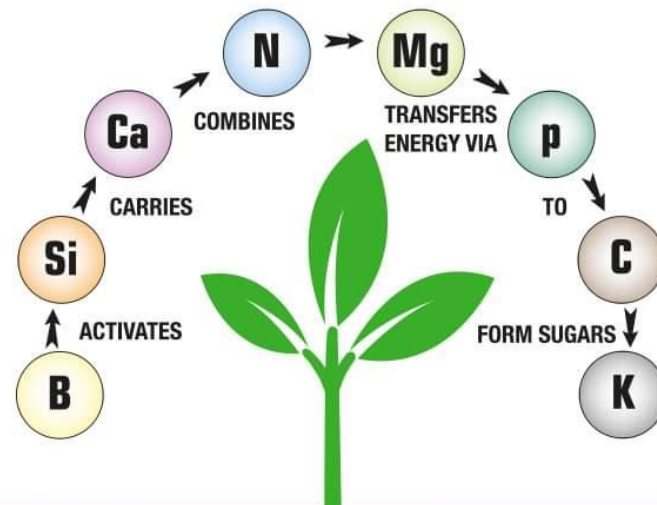
Biochemical sequence of some essential nutrients

<http://aptus-holland.com/biochemical-sequencing-101/>

- **Boron**-allows sap fluids to move up and down
 - **Silica/silicon**-highway, facilitates efficient transport of plant nutrients
 - **Calcium**-nutrient carrier
 - **Nitrogen**-basis of AA, protein formation and DNA
 - **Magnesium**-essential in energy transformation process-photosynthesis
 - **Phosphorus**-energy transfer in plants from source –leaves to where required
 - **Carbon**-CO₂ plus water makes sugar and release O₂
 - **Potassium**-=distributer of synthesized sugars
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Nutrient sequence

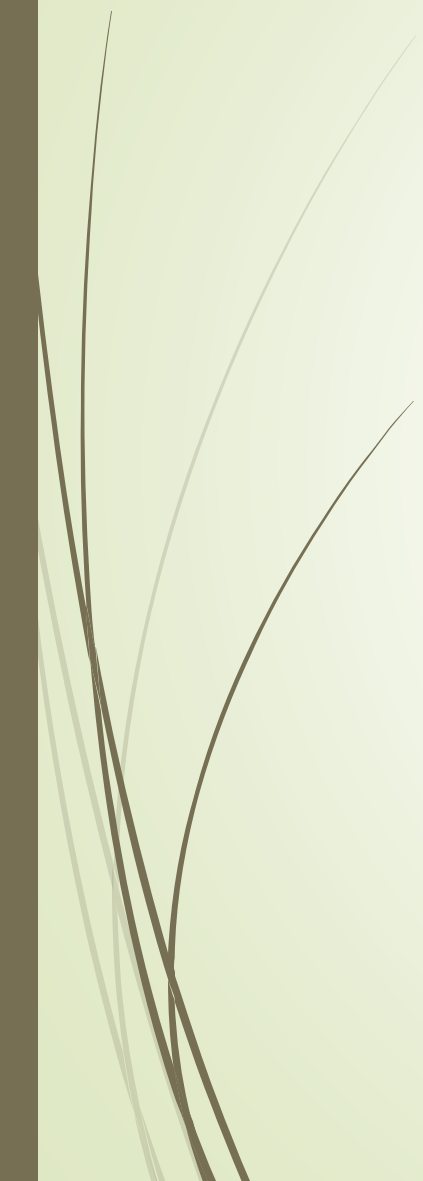
When nutrients in soils are unbalanced, the biochemical sequence is broken, and less efficient



THE BIOCHEMICAL SEQUENCE OF PLANT NUTRITION

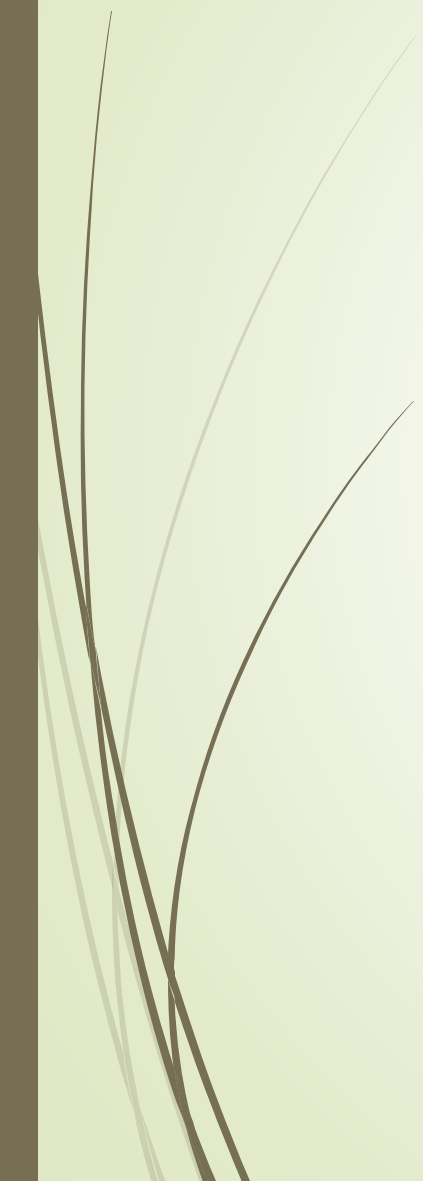


Practical ways to enhance biochemical properties

- Organic Foliar fertilization-increases and activates more microbial presence and action on the leaves
 - Targetted nutrient provision for deficiency on plants and in soils
 - Crop diversity for diverse nutrient cycles and efficient flow
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Physical properties

- Tree/crop integration in the crop land –agroforestry
 - Composting
 - Bokashi
 - Mulching
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Mulching and crop diversity

picture credit Fwwafula





Practical water soluble calcium

- **Materials**

- 12 egg shells

- 4 li vinegar

- Open container[glass or plastic bucket

- **Procedure**

- Dry and Crush the egg shell

- Put in open pan fry –let dry, blow out membranes

- Add in open container with vinegar, stir to get them foaming and bubbling.

- After a day or two when no more bubbles, strain the shells and bottle your water soluble calcium. Can reuse the shells or add l your compost pile.

- Use 1:1000[1ml :1 liter water]

- Suitable for fruit trees and other crops just before fruiting eg tomatoes

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Thank you

picture credit Fwwafula



References

- <https://www.frontiersin.org/journals/plant-science>
- <http://forestgeomat.ffg.ulaval.ca/brf/>
- Kumar et al., 2022
- Bell et al. 2024
- Food and agriculture organization of the united nations
- Global soil partnership

Resources

<https://www.youtube.com/watch?v=Yv288F4Tbo>