Capitalizing on Sustainable Agriculture

Natural Fertilization and Soil Management

Compost Workshop

Okahandja, August 9th 2013

Soil & More International

Why compost?

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Sustainability = Ability to Sustain

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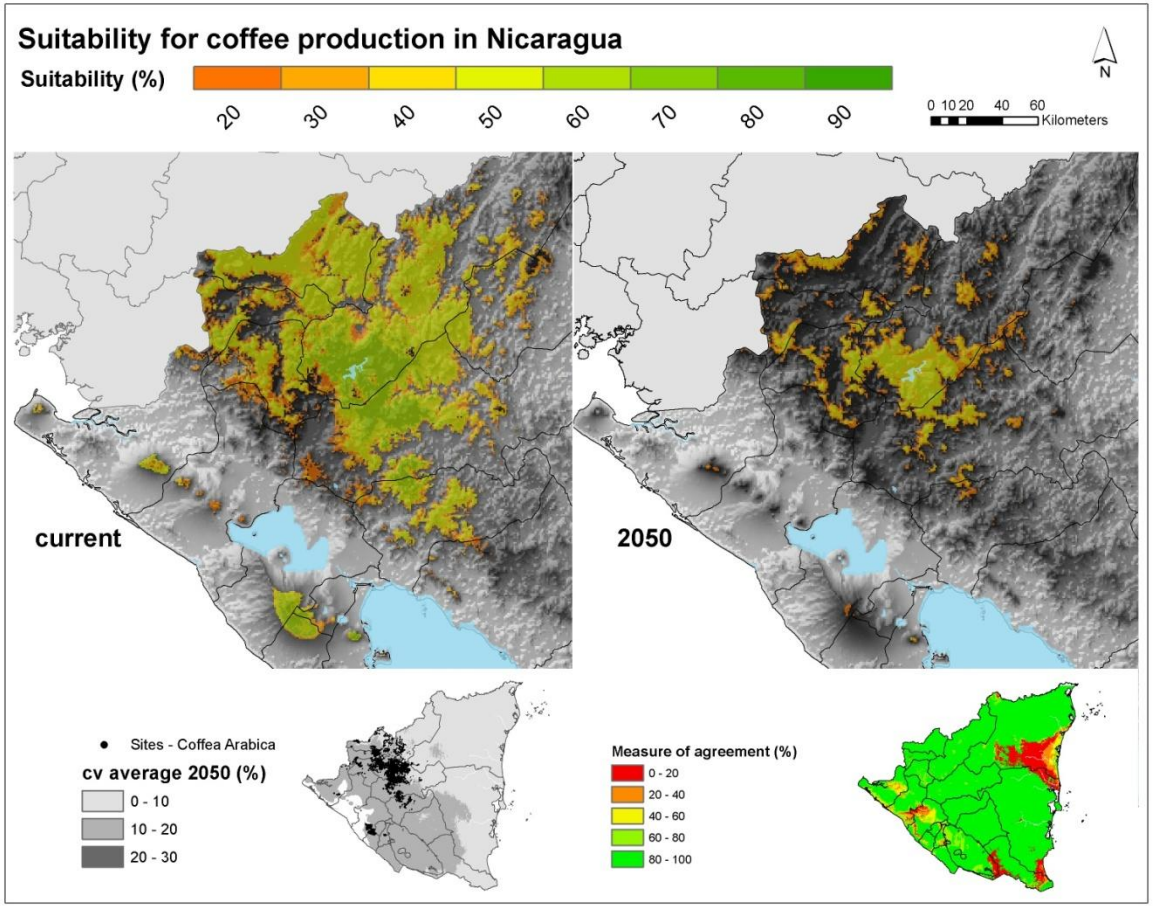
Composting:

Structure and Soil Life

Soil Structure

…there is not enough resources



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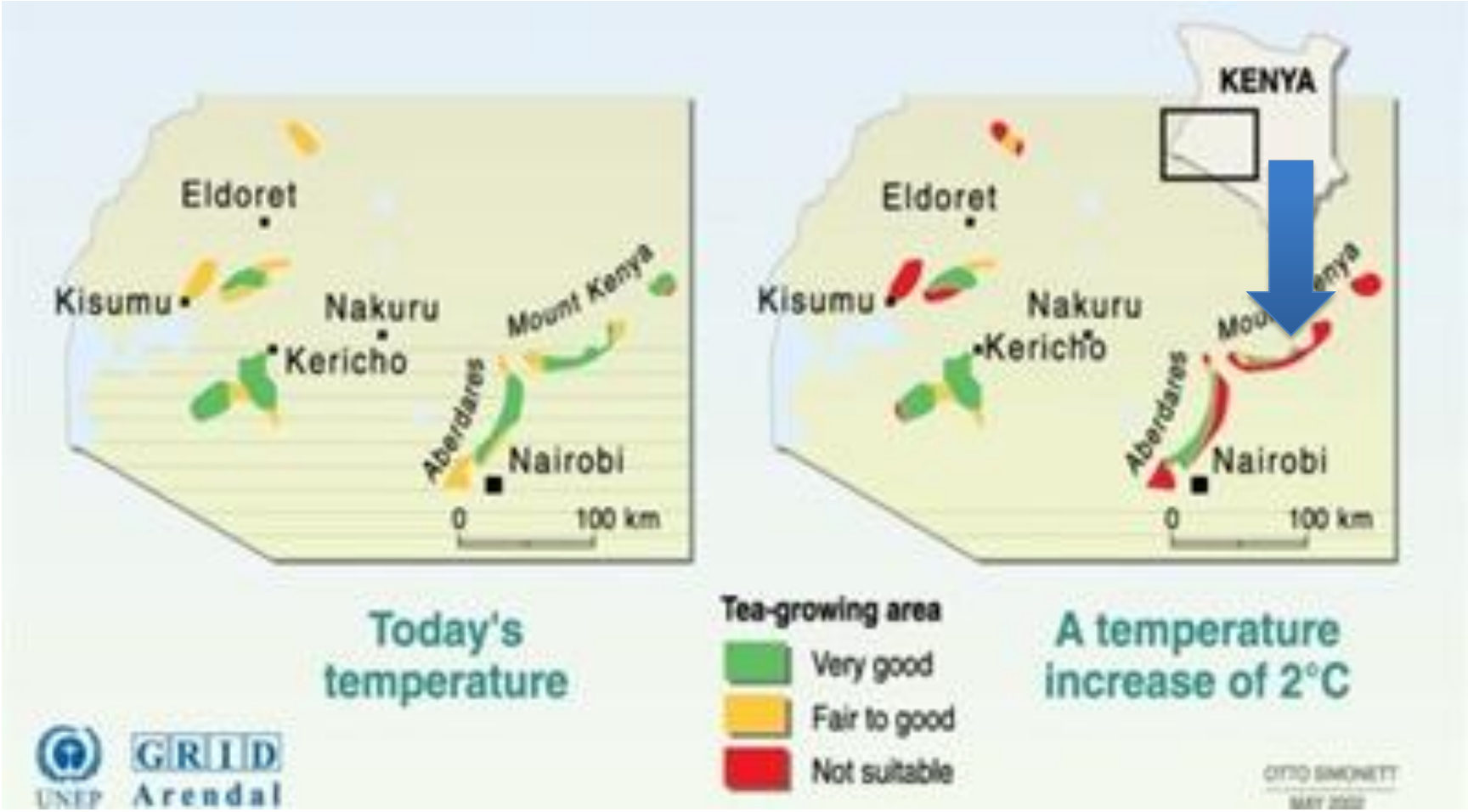

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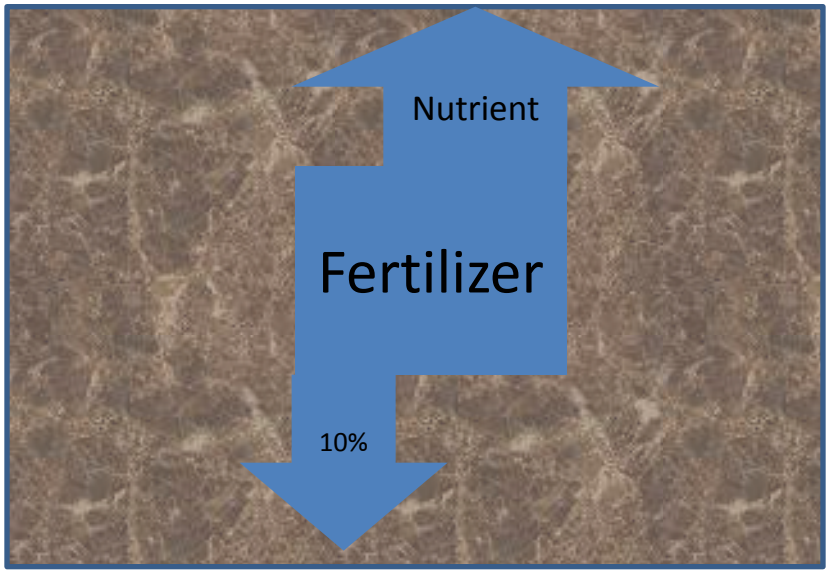
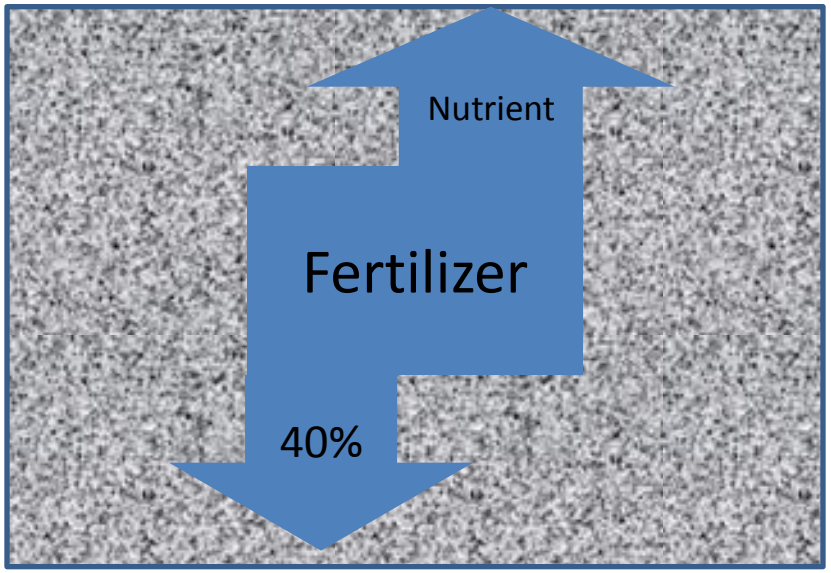
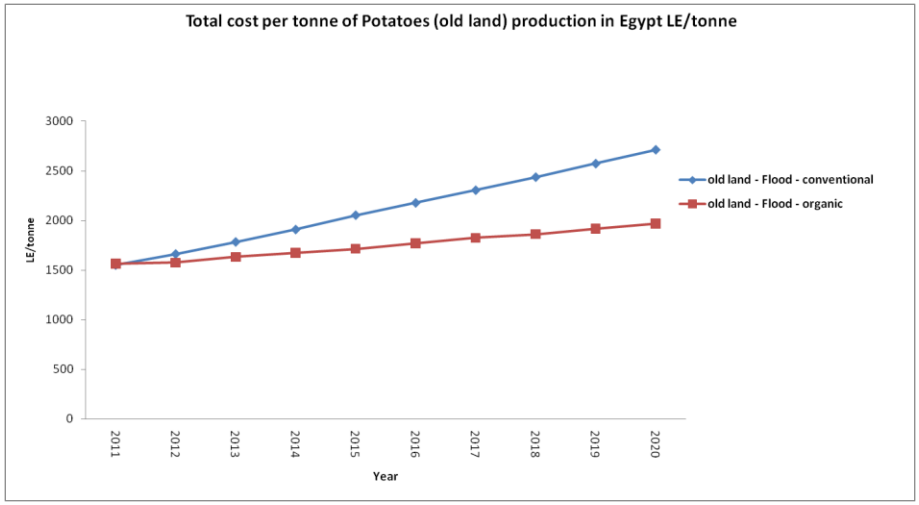




…everything else is too expensive

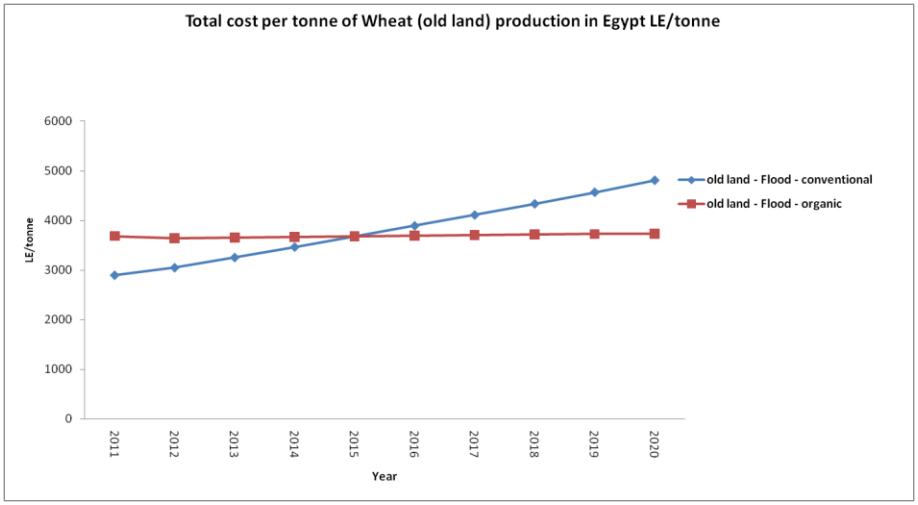
Potato Production Cost

blue = conventional; red = organic



Wheat Production Cost

blue = conventional; red = organic



Sustainable Food Lab/Cool Farm Institute

Soil Life

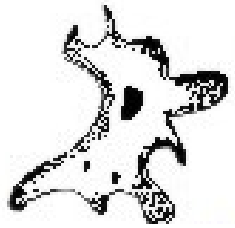
Soil life & natural fertilization

Bacteria
C/N ratio 5:1

Protozoa
C/N ratio 30:1

Nematodes
C/N ratio 100:1

6 Bacteria



temp. C/N ratio 30:6

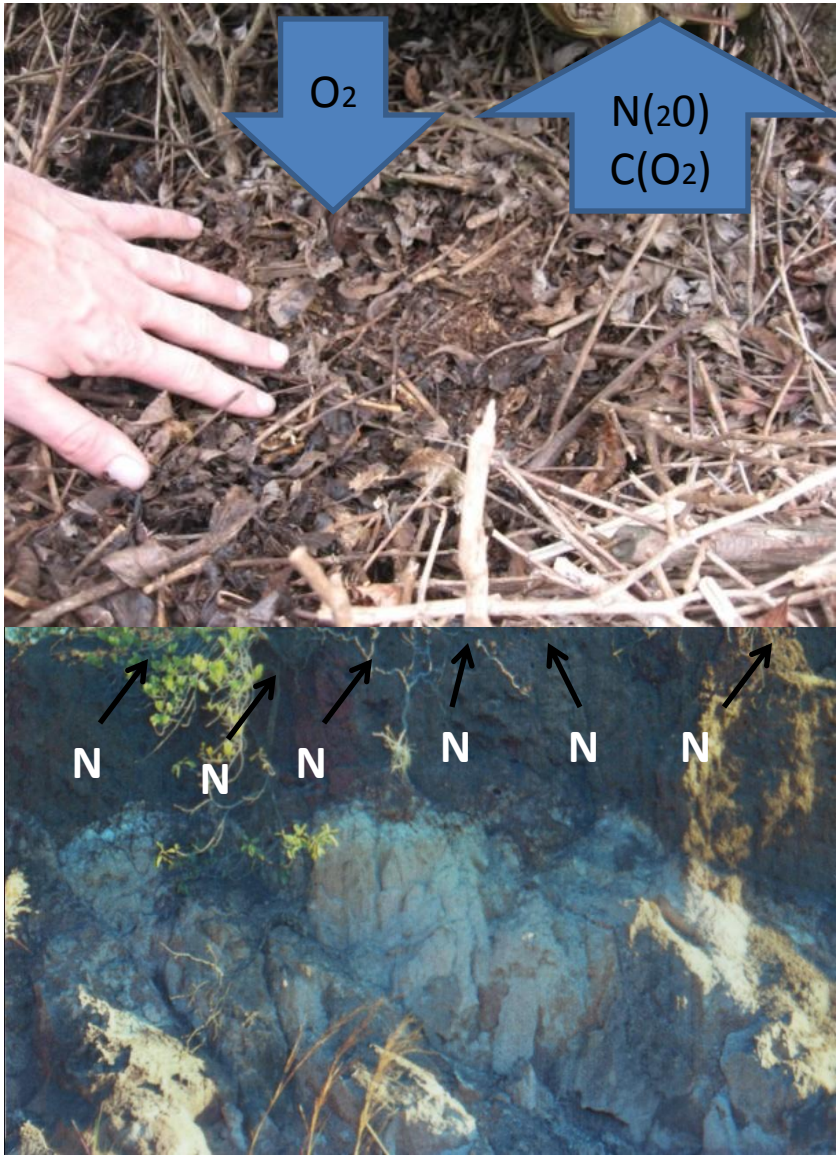
5 N's

stable C/N ratio 30:1

Challenges

Oxydation of Carbon's and Nitrogen's → Evaporation = LOSS

Microbes in mulch compete with roots on Nitrogen as energy source for breakdown of biomass

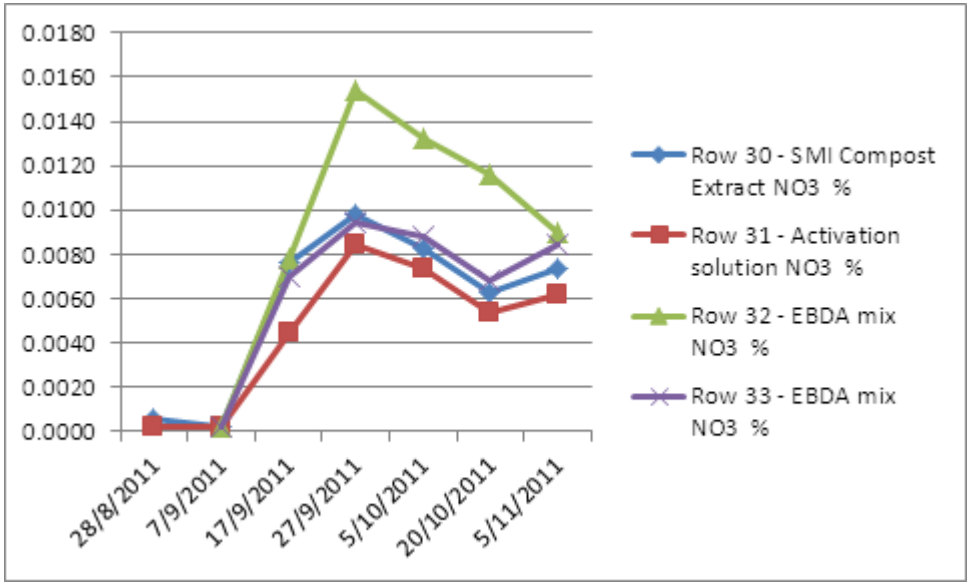


Compost extract/tea trials: Egypt

4 control trials showed

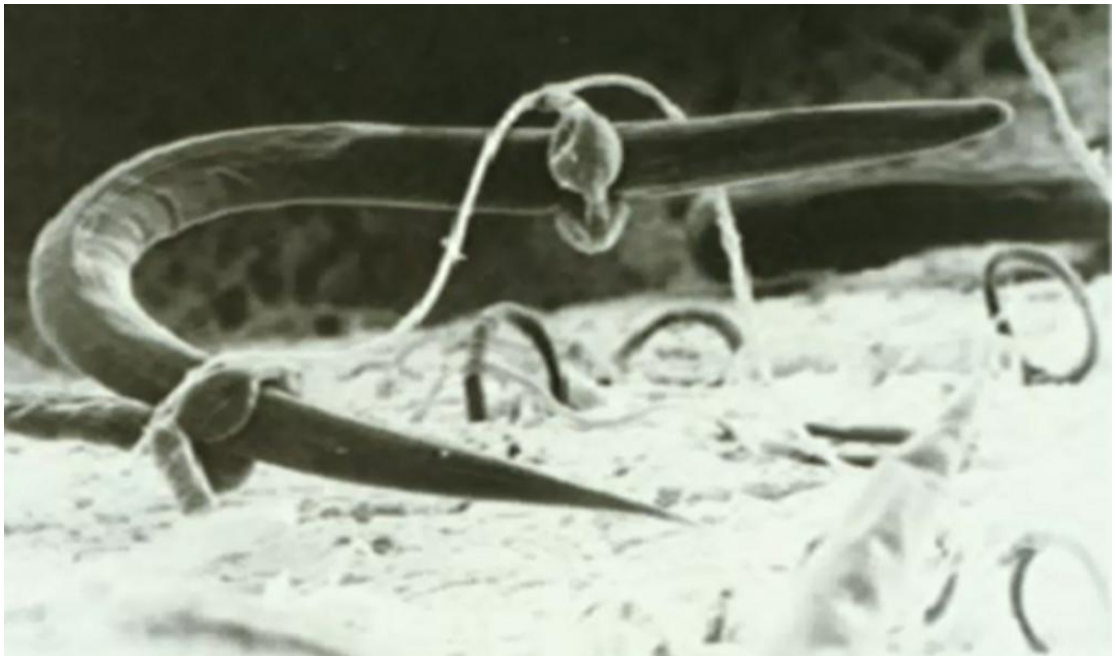
→a nutrient availability increase of 5-6 times within 15 days

→a decrease of harmful Nematodes populations of 90% within 15 days



Similar trials with comparable results were carried out in India, Kenya, Poland

Microbial Powerhouse



Basics about compost

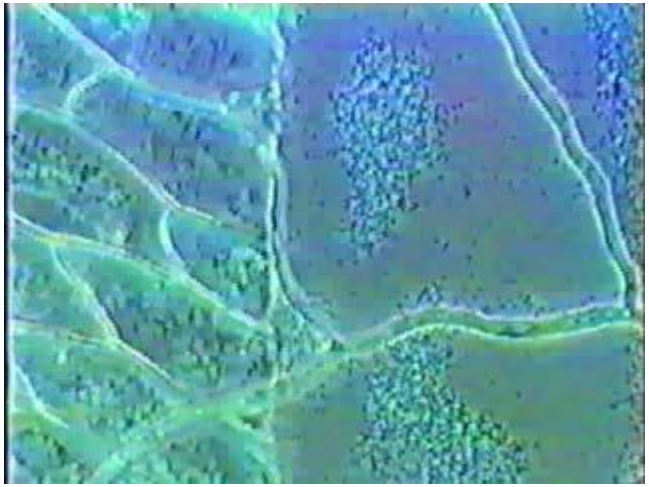
- Various options:
  - Mechanically turned/aerated
  - Static

- Common basis:
  - Aerobic, humification process
  - Microbial driven

Microbial process

2 major organism groups are instrumental in the break-down part of the composting process

Bacteria: Break down nitrogen rich green organic matter



Funghi: Break down woody, dry lignin/cellulose organic matter

There is a third group that is responsible for HUMUS build-up after the organic matter is broken down: the Actinomycetes

Fungi and Actinomycetes

Actinomycetes under the microscope

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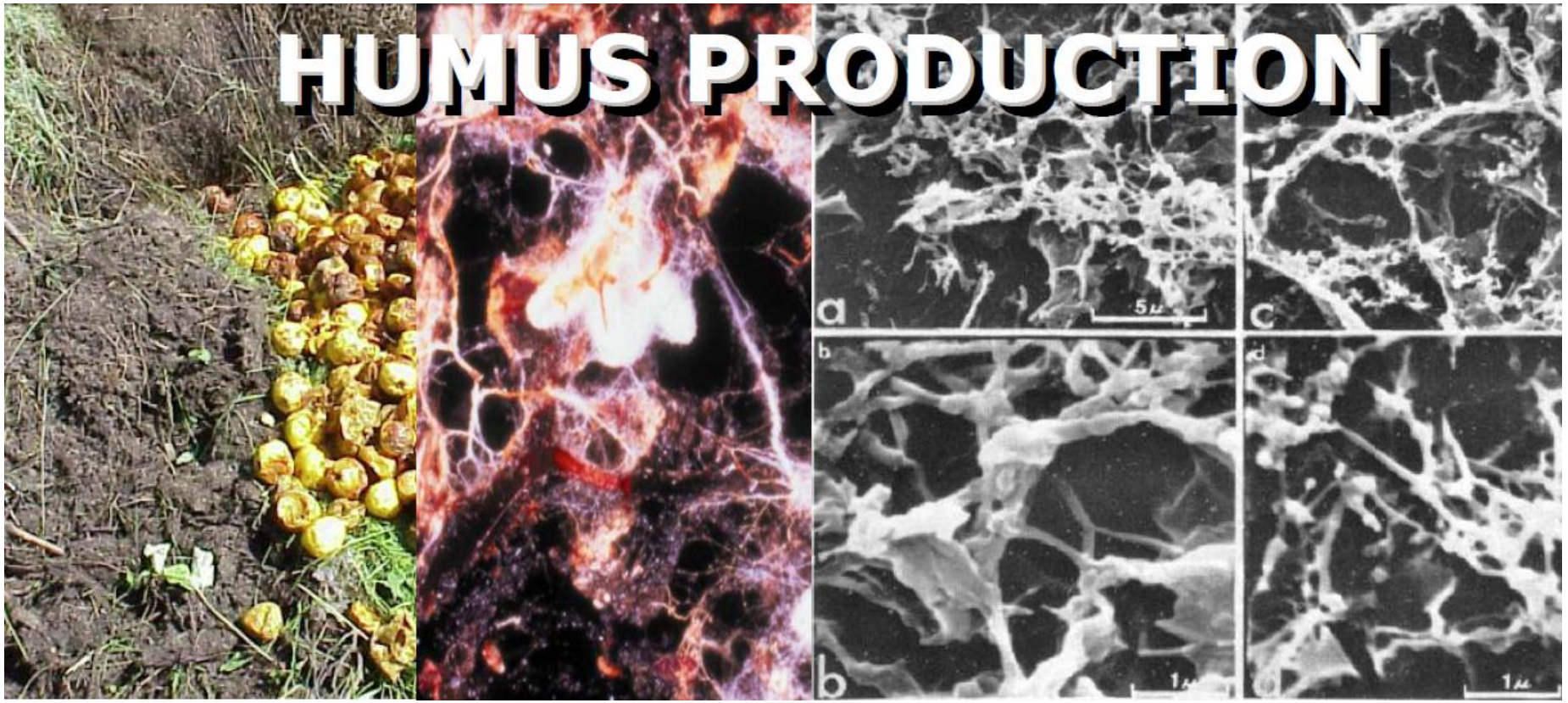


Organic matter is food for Micro-organisms
What they exhude is Humus = stable organic nutrient storage

Composting is a natural process of humifying organic matter

Ingredients are there



First Steps Taken

KTDA, Iriaini

Sangana, Baragwi

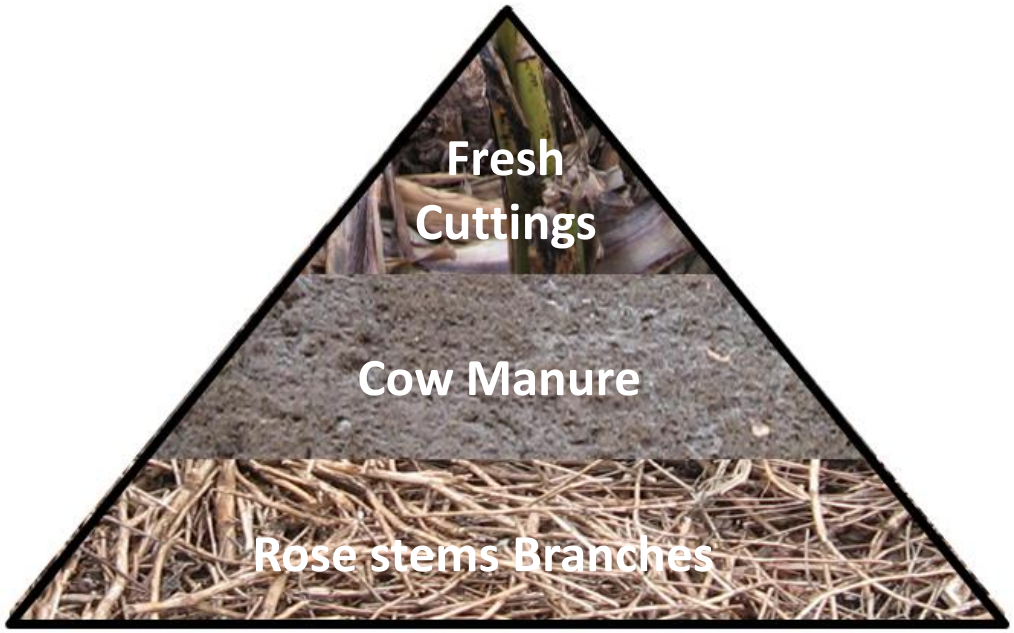
Input Materials

- Brown
  - Straw
  - Branches
  - Woodchips
- Green
  - Grass
  - Fresh green leafs
  - Waste fruit
- Manure
  - Chicken
  - Cow
  - Horse
- Clay

General Formula

- Brown: 40-50%
- Green: 30%
- Manure: up to 20%
- Clay: 5-10%

Small-Scale Controlled Microbial Composting



Closed & Controlled Carbon/Nutrient Cycle

Stabilized Humues aber 10-12 weeks

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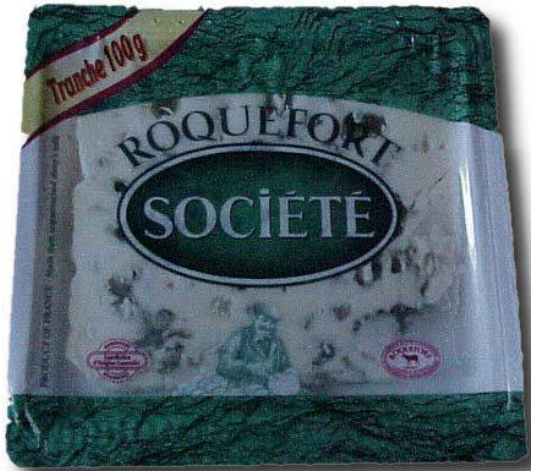
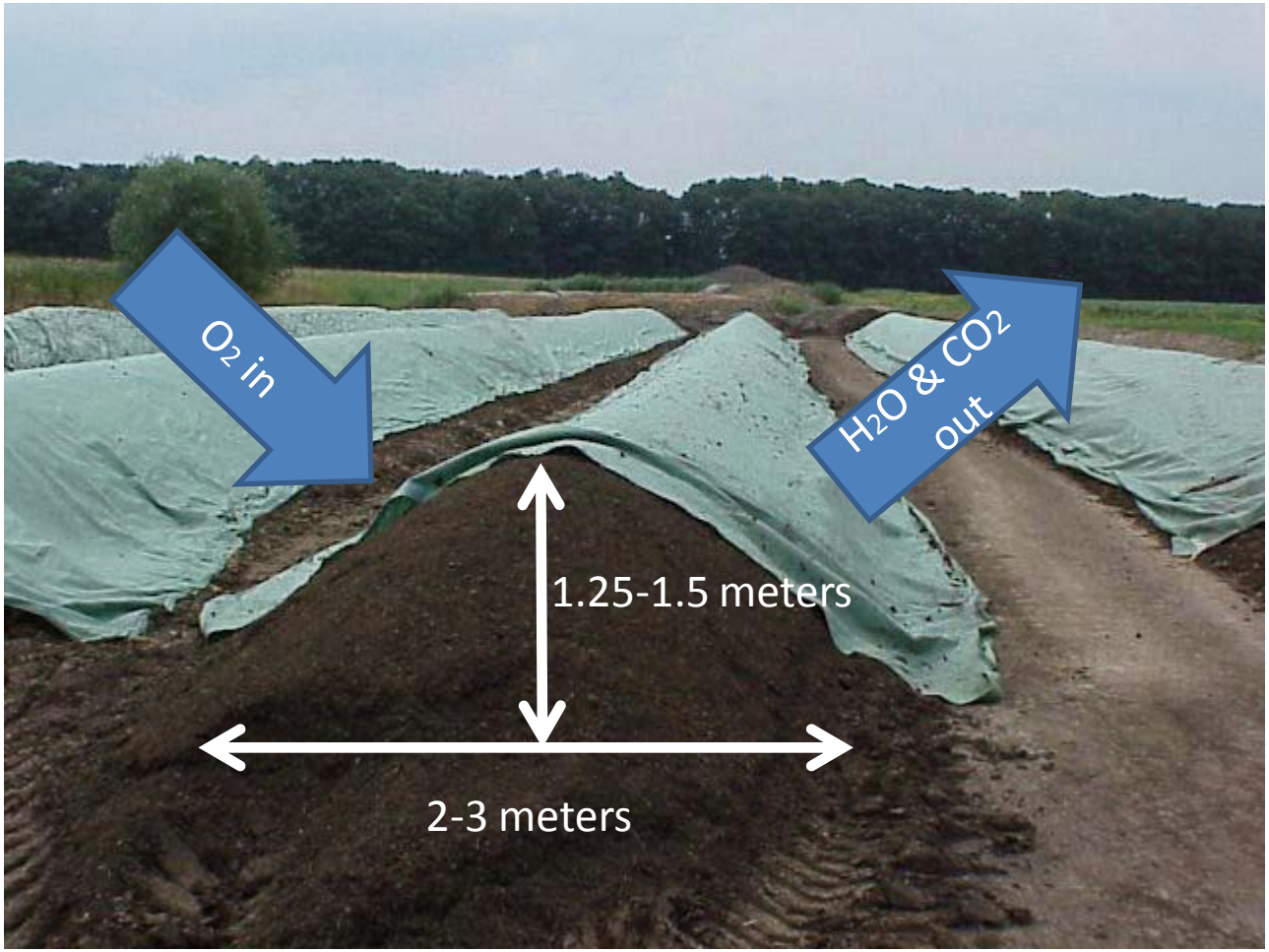
To inoculate or not to inoculate



There is no question, use a starter (where ever possible)

Requirements



Pile Construction

1. Load layer by layer
2. Driest material below
3. Wettest material in the middle
4. Heaviest material on top

Attention for detail is imperative.

Better to spend some time on pile construction to get things right, then to waste time and perhaps your pile on correcting…



Monitoring

Check daily (if possible) for the first 3 weeks and turn when the control equipement indicates

Temperature

>65º C = TURN

CO_2

>16% = TURN


FIATAGRI


20
16
12
8
4
0


رقم الشعلة (7)
رقم الكوبه 8

Large Scale

Quality Indicators

Ph	**6.5 - 7.5**
EC	1.5 - 3.0
Final temperature	**20 - 25°C**
Nutrients	Organically Bound
Humidity	20 - 40%
Micro-organisms	106 - 1 o9 per gram
Water Holding Capacity	60%
Organic matter %	25 - 60%
Crumb size	0.1 - 1.5 cm
Weeds	**NO !**
Trace elements	Bio-fixed
Bulk density	600kg - 1 m3
Disease suppressiveness	**Measurable**
Nematodes	20 - 30 per gram soil
Humus value	60 - 80
Dominance	**Fungal or bacterial**
Aerobic/Anaerobic ratio	10:1
Actinomycetes	Approx. 3 x 106
Pseudomonads	Approx. 7 x 105
N-fixers	Approx. 5 x 104
Chroma	Minimally phase 3
Diversity index	Approx. 12
Biological N potential	Minimally 100kg/ha

It’s all Natural

- No compost without microbes
- Humification in soil is a natural but very slow process – 10 cm in 2000 years
- Compost speeds this up
- It’s beneficial to increase microbes in compost
- All microbes required on your farm are available on your farm – concentration might be useful though
- If you want to speed up the process you need to increase the number of microbes

Why add Microbes

- In order to make the compost process more stable, homogenous and quicker
- Different inputs need different composting times:
  - Fresh, green materials compost quicker than woody materials
  - A homogenous population of microbes can speed up the composting process and give better results

Microbes in Composting

- Starter developed by Ehrenfried Pfeiffer (aerob)
  - Controlled Microbial Composting (CMC) Methodology
  - Further developed by Lübke (Austria)
  - Ellaine Ingham (USA)
- Mix of Batceria, Fungi and Actynomycetes
- EMs (Effective Microorganisms) – waste water (often lacto-acid bacteria) - anaerob
- Humification – vs. Fermentation

- Ready made mixes – UK, Austria, Germany, Japan etc. – some more useful than others
- Our Approach:
  - Before buying something from abroad – use/improve local microbes (workers)
  - Create conditions that enhance local microbes
- Importing Microbes can cause trouble:
  - Customs / Environmental Agencies
  - You need to know what they are in order to assess potential side-effects

Where to Find Microbes?

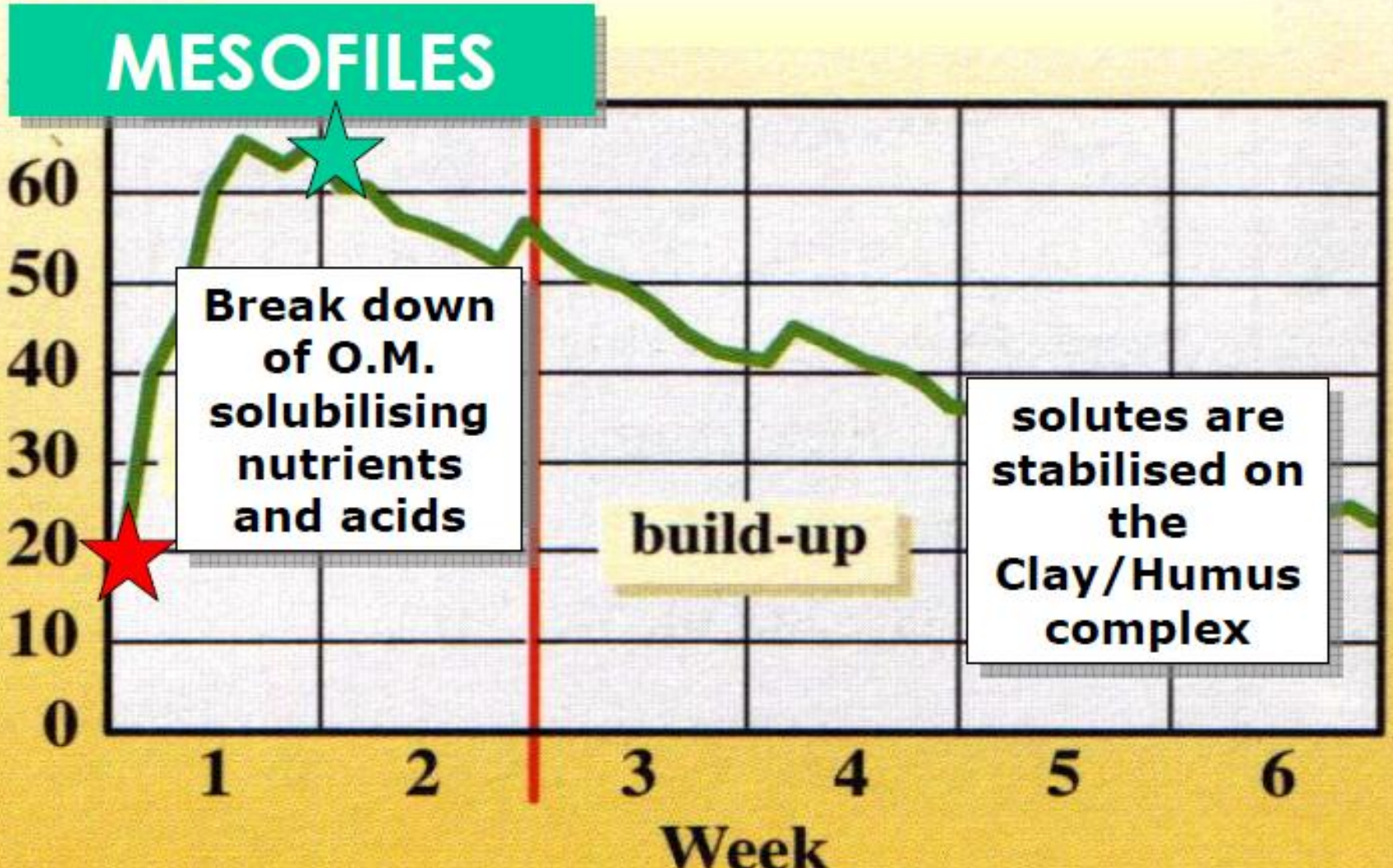
Preferably use your own local starters, if you are not sure what's in the magic bags

- How to increase the population of microbes?
- Let’s look at the composting process

Compost Process

- Two phases:
  - Breakdown (of biomass)
  - Build Up (of humus)
- Different groups of microbes involved
  - Break-down – thermophiles (like heat)
  - Build up – mesophiles (moderate temp.) and the actynomycetes (humus build-up)

The composting process



To kick-start compost process you need highly active compost starter

How to produce your own compost starter?

Compost Starter

- Compost Starter:
  - Collect each 30kg of partly decomposed material from the types of biomass you will use as a major input for your compost
  - Collect each 1m^3 per biomass category: brown/dry straw or woody; green/fresh leafy; manures.

Compost Starter

- Please note, generally for composting but particularly for compost starter production, please use as many as possible different materials per biomass category
- Build a compost pile (also called windrow) on a 1 by 2 meter ground area putting at least three layers of dry/brown, manure and green/fresh in this sequence, starting with dry/brown in the bottom

Compost Starter

- Apply between each layer a mix of a part of the 30kg of semi-decomposed materials
- Apply about ¼ m^3 of water during the windrow setup in between the different layers
- Compact the windrow at the end, forcing it into a triangular shape at 1 meter height
- Cover the windrow with a 5cm thick layer of straw or with a semi-permeable fleece type textile.

  →Don’t use plastic to cover the windrow!

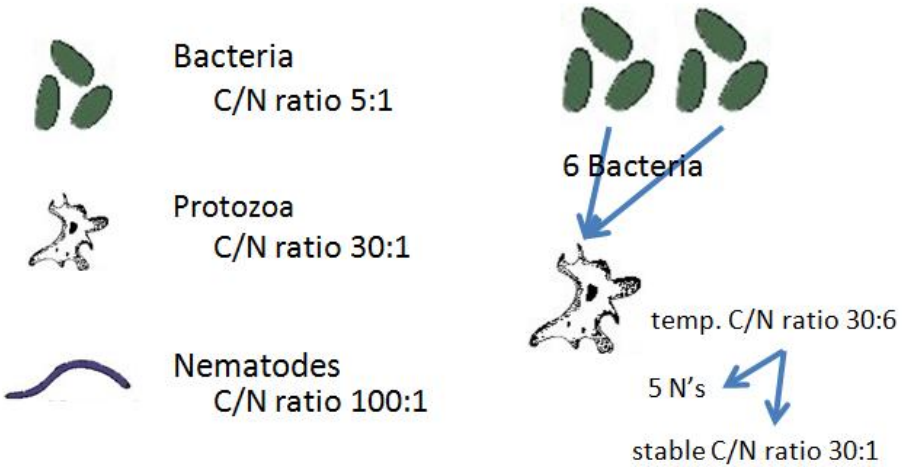
Compost Starter

- Your compost starter (cocktail of microbes) is ready after 7-10 days when the windrow core temperature is highest (65° C) = microbes are most active
- After the 10-12 weeks, when the materials are fully decomposed, the compost/compost starter is in a more stable and less active form than if you take it already after 2 weeks. It is not of inferior quality, just less active and the microbial composition is not optimal.

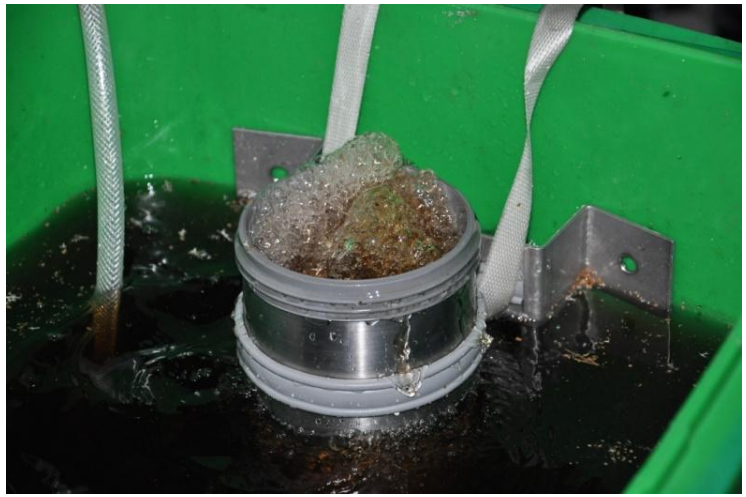
In both cases, especially in the second scenario it is advisable to "activate" the compost/microbes.

How to activate the compost and microbes?

Compost Extract/Starter



Compost Extract/Starter



Compost Applications

- Crop specific
- Purpose specific
- Situation specific (irrigation)

- Common scenarios
  - Incorporated into soil
  - Mixed into mulch
  - Solid/liquid

Sinai, Egypt

Minya, Egypt

Liquid application Kenya

Liquid application in Egypt and RSA

again...

The Composting Process serves several important purposes

- Minimal leaching losses
- Concentrated nutrient content
- Make the compost weed free
- Make it pest and disease free
- Further sanitize the material

Compost is more effective than fresh manure and less risky

Quality Compost is able to suppress diseases, improve soils, make structure, hold water, is home to micro-organisms, is humified and granular of structure, smells nice not foul etc.

Check if your compost can suppress diseases….!!!!

This afternoon

- We will setup a static windrow
- Using locally available material
- Look at setup process
- Explanation of upscaling options

- Having FUN

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Thank You

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