

bokashi composting

recyclefoodwaste.org

microbes

**microorganisms = microbes =
microscopic organisms**

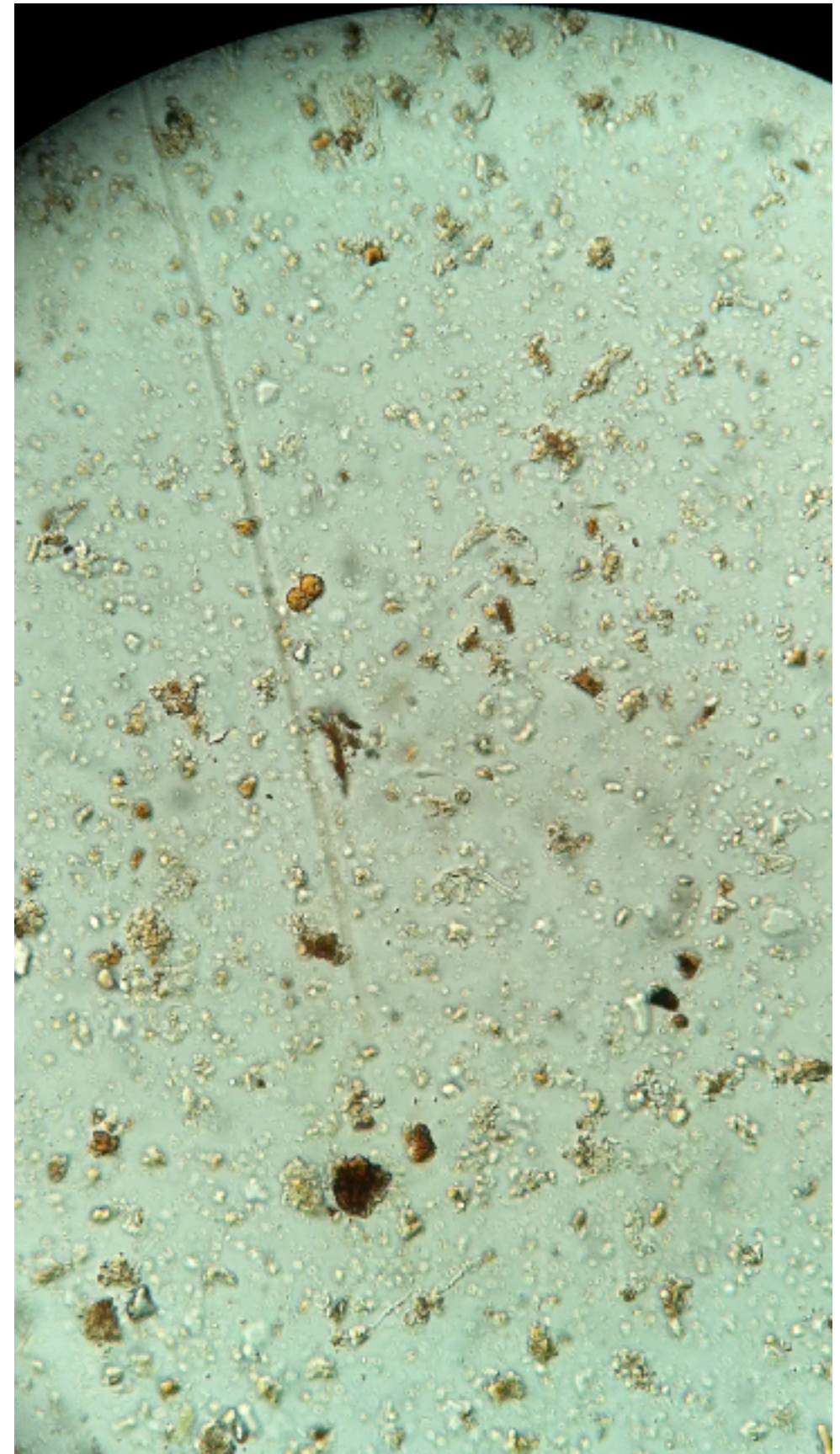
archaea, bacteria, fungi, algae, protozoa,
microscopic plants, microscopic animals

pathogens – disease causing by toxins or cell damage
bacterial, fungal, viral, parasitic, prionic (protein)

Microbes are everywhere

Necessary for all of life

They terraformed our planet.



fermentation

fermentation – where microbes break down complex molecules into simpler ones.

Different kinds of fermentation

lactic-yeast fermentation

methane fermentation (anaerobic digesters)

We've been **fermenting foods** and **beverages** since ancient times to **feed our bodies**.

Now we're **fermenting food waste** to **feed the soil** and **plants**.

Results: alcohol, antioxidants, coenzymes, bacteriocins

Generally, anti-pathogenic, anti-rotting (preservation)

Nutrients more bioavailable

sauerkraut

kimchee

yogurt

kefir

cheese

dark chocolate

vanilla extract

bread

hard salami

mead

wine

beer

organic matter & compost

organic matter

once-living organisms:
dead plants, dead organisms
decaying or decayed (humus)
the forest floor

organic matter in soil

improves/maintains **microbial life**
adds **nutrients**
adds **organic matter content**

compost

decayed organic matter

composting

the process of decaying organic matter



soil parts

organic part 1%~5%

humus/organic matter

inorganic part ~45%

rock/mineral particles:

clay	silt	sand
< 0.004 mm (< 0.00016 inch)	0.002 ~ 0.060 mm (0.00008 ~ 0.00236 inch)	> 0.060 mm (> 0.00236 inch)

water ~25%

air ~25%



bokashi

- Japanese term,
fermented organic matter
- Since mid-1700s (?)
- fermentation starter from pristine forest/mountain valley soils
- with EM (Effective Microorganisms),
1982 (Teruo Higa), easier to make bokashi
- mid-2000s, 25% of towns in Japan,
some form of bokashi



100 metric ton bokashi,
banana plantation,
Costa Rica



bokashi purposes

- **soil amendment**

- microbial inoculant
- nutrients
- organic matter content
- reconnect cycle of soil life



St. Mary's Urban Farm, 521 W 126th St Harlem NY

- **fermentation starter**

- ferment food waste
- ferment mud balls



Cardinal Spellman High School, Bronx NY

Other Uses



Barge with Activated EM treating polluted canal, Japan



*EM Mud Balls, Lower East Side, NY
(El Jardin del Paraiso community garden,
La Plaza Cultural community garden)*

COMPARISON AT GURNEY DRIVE

Mangrove Trees Grew Vigorously



16 August 2009



6 April 2010



*Mudball event and results
One Million Apologies to Mother Earth Event
Penang, Malaysia 2009*

How to make bokashi



blackstrap molasses



EM-1



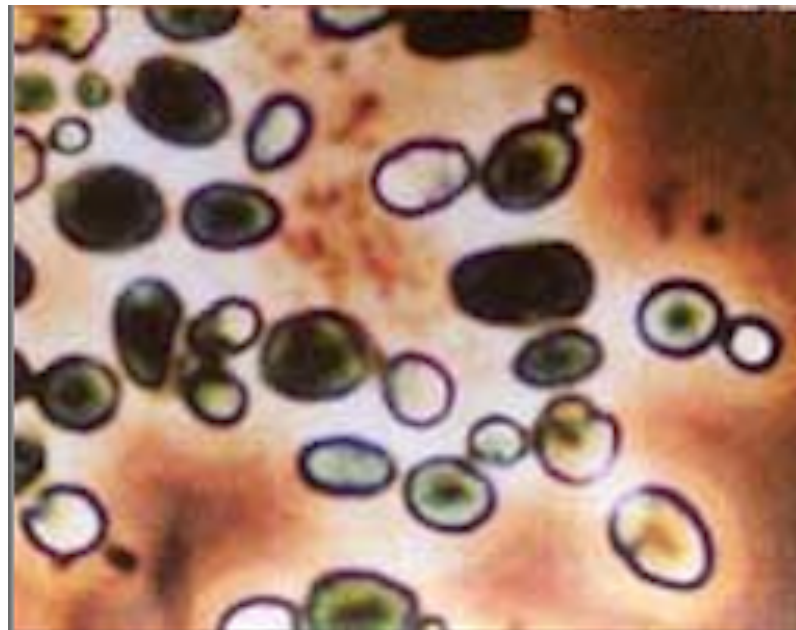
organic material
wheat bran



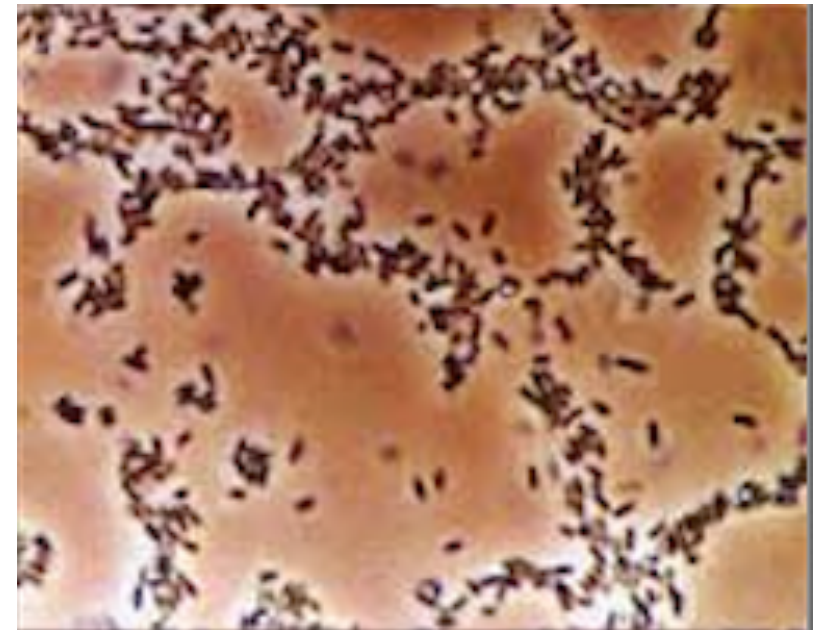
Effective Microorganisms

EM, EM-1

Combination of
3 groups of
microbes



yeast



lactic acid bacteria



phototrophic bacteria

The microbes in EM-1

EM-1 ingredients (U.S. version as of May 2010). EM-1 Microbial Inoculant (full name) is OMRI Listed (Organic Materials Review Institute), omri.org, and can be used by certified organic operations.

ACTIVE INGREDIENTS:

Microorganisms: 1 million colony forming units/cc (units/ml), 1%:

Lactobacillus plantarum, *Lactobacillus casei*, *Lactobacillus fermentum*,
Lactobacillus delbrueckii, *Bacillus subtilis*, *Saccharomyces cerevisiae*,
Rhodopseudomonas palustris

INACTIVE INGREDIENTS:

96% Water and 3% Molasses

Lactic Acid Bacteria

L. plantarum - in saliva (first isolated); liquefies gelatin

[foods found in: sauerkraut, pickles, brined olives, kimchi, Nigerian ogi, sourdough, cheeses, fermented sausages, stockfish]

L. casei - in human intestine and mouth; known to improve digestion and reduce lactose deficiency and constipation ; complements growth of *L. acidophilus*

[foods found in: cheddar cheese, green olives]

L. fermentum

[foods found in: sourdough]

L. delbrueckii

[foods found in: yogurt, mozzarella cheese, pizza cheese, Hartkäse, Berg-Alpkäse, Bleu de Bresse, Bleu de Gex, Fourme d'Ambert]

Bacillus subtilis - commonly found in soil; can survive extreme heat; natural fungicidal activity; used in alternative medicine; can convert explosives into harmless compounds; used in safe radionuclide waste; produces amylase enzyme (present in saliva; breaks down starch into sugar)

[foods found in: Japanese natto (fermented soy beans), Korean cheonggukjang (fermented soybean paste)]

Yeast

Saccharomyces cerevisiae - brewing and baking, top-fermenting yeast (ale)

[foods found in: baked breads, coffeecakes, pastries, croissants]

[beverages found in: beer, wine, mead, cider, vinegar]

Phototrophic Bacteria

Rhodopseudomonas palustris - naturally found in soil and water, a food source for small organisms (zooplanktons, small crustacea); a natural detoxifier; degrades odors in agricultural and industrial waste; stimulates growth of actinomycetes (white 'mold') which suppresses the growth of pathogenic fungi, improves soil structure, humus formation, helps soil retain water, and breaks down tough plant materials; benefits growth of certain crops and fruits; also found in earthworm droppings, swine waste lagoons, marine coastal sediments, pond water. [foods found in: Swiss cheese]

Other bokashi materials

rice bran

coffee chaff

cocoa husk

coconut coir (shredded)

wood shavings

leaves

direct soil application:

rice bran + fish meal + oil cake

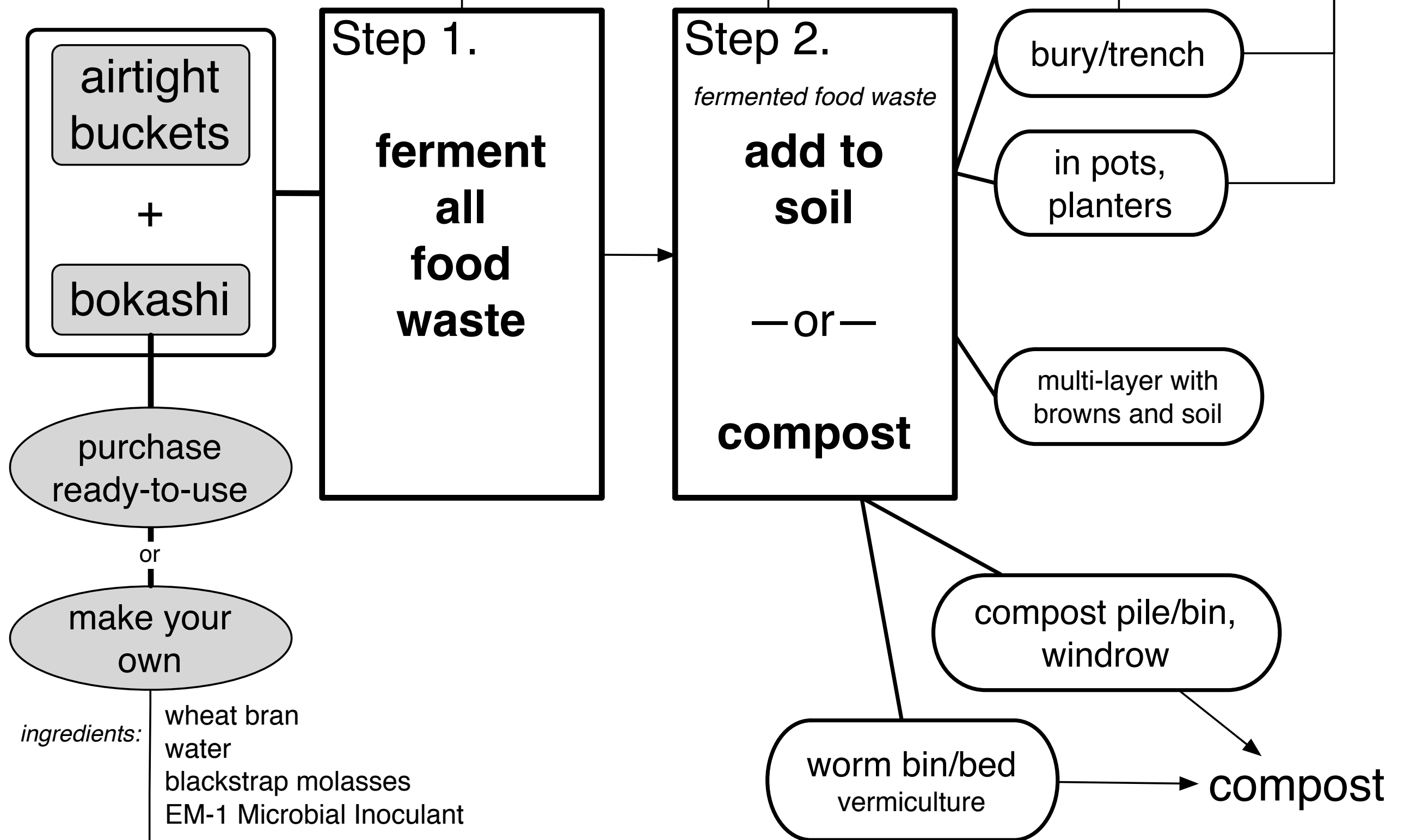


coffee chaff

The bokashi method of recycling food waste

recyclefoodwaste.org

2 weeks to ferment → 2 weeks in soil → then plant.



bokashi composting

Step 1

‘pickle’ food waste

Step 2

as soil amendment



*El Sol Brillante Community Garden
and the Children's Garden
East 12th St, Ave A & B
East Village NY*



Step 1. 'pickling'

fermenting food waste

pretreats (safer =>)

microbial pop. increase

release nutrients

organic acids (pH≈3.9)

amino acids (protein building block)

enzymes (breaks down materials)

coenzymes, bacteriocins (anti-pathogens)

antioxidants (naturally preserve)

2 weeks - room temp.

4 weeks - <50°F (enough mass)

all foods

lactic-yeast fermentation

Step 2. 'break down'

adding to soil or compost

as a soil amendment

microbial inoculant

organic matter content

macro- & micronutrients

nutrients avail. & absorb.

2 weeks - warmer seasons

4 weeks - winter (successive)

90%~99% broken down

carbon negative

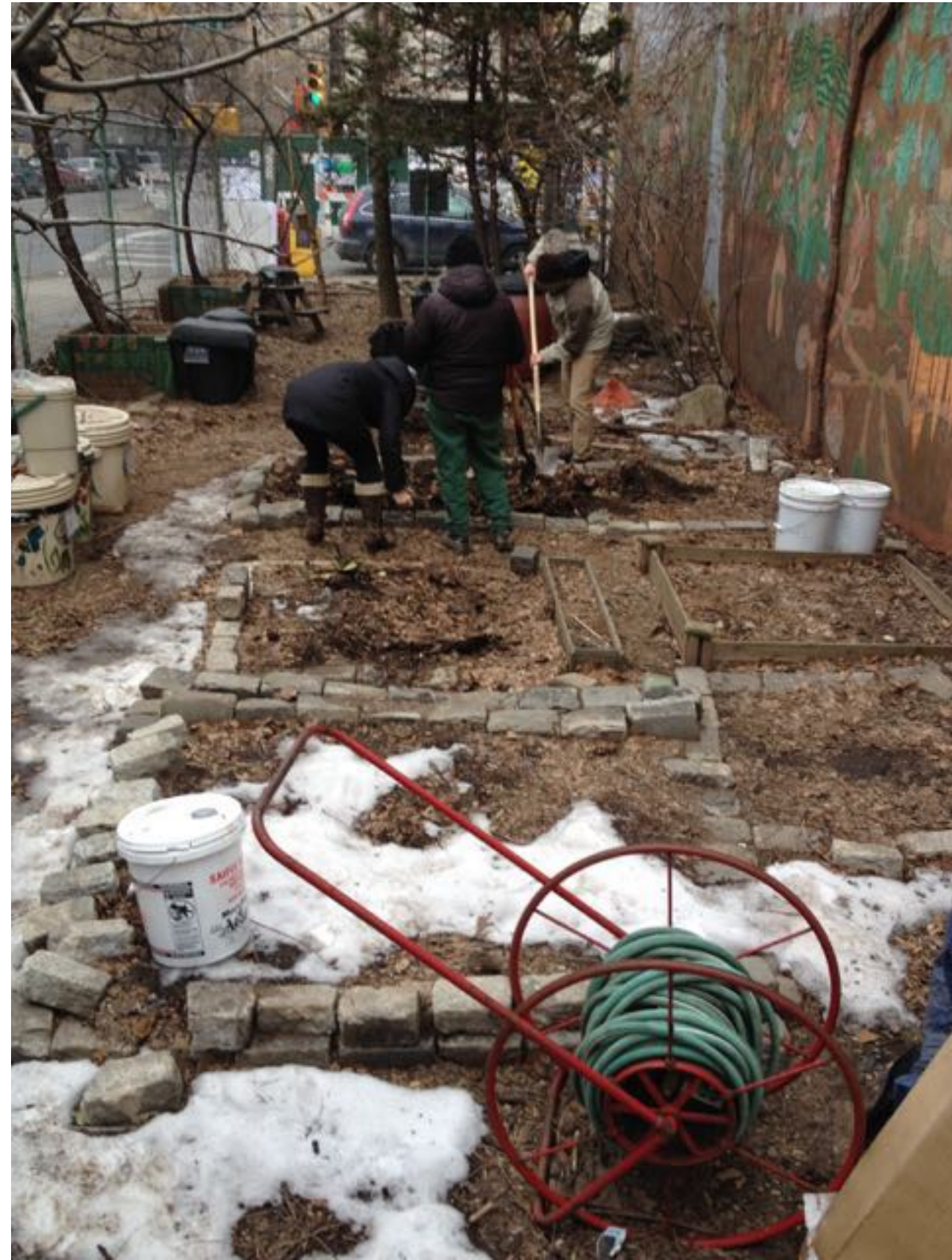


















Active
worm bin

Add only
fermented food waste
(brown mulch)
& garden clippings
→ Unfermented food waste
to black top bin





bokashi methods



Cajica City, Colombia

whole towns

with CSAs

volunteer-based

nonprofit orgs



Nonprofit run by seniors, composting bokashi, packaging for redistribution

many ways



at home

Q&A

organic matter

wheat bran

water (1 cup/pound)

liquid mix

blackstrap molasses
(1 % of the water)

EM-1 (1 % of the water)