

bokashi

recyclefoodwaste.org

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Bokashi Brief

bokashi = fermented organic matter

microbial inoculant and/or fermentation starter

- Different bokashi methods
- Different bokashi types
- Focus: bokashi composting
[or bokashi method of recycling food waste]

But this will be an overview beyond bokashi composting

How to make bokashi



blackstrap molasses

1% to water



EM-1

1% to water



organic material

wheat bran



mix to ~30% moisture
(1 cup water/lb)



pack airtight to ferment



after 2 weeks, ready to use
“wheat bran bokashi”

bokashi provides

microbes

nutrients

organic matter

bokashi composting

Not composting

Can be integrated with composting methods

2-Step process

Originally, not about food waste/composting

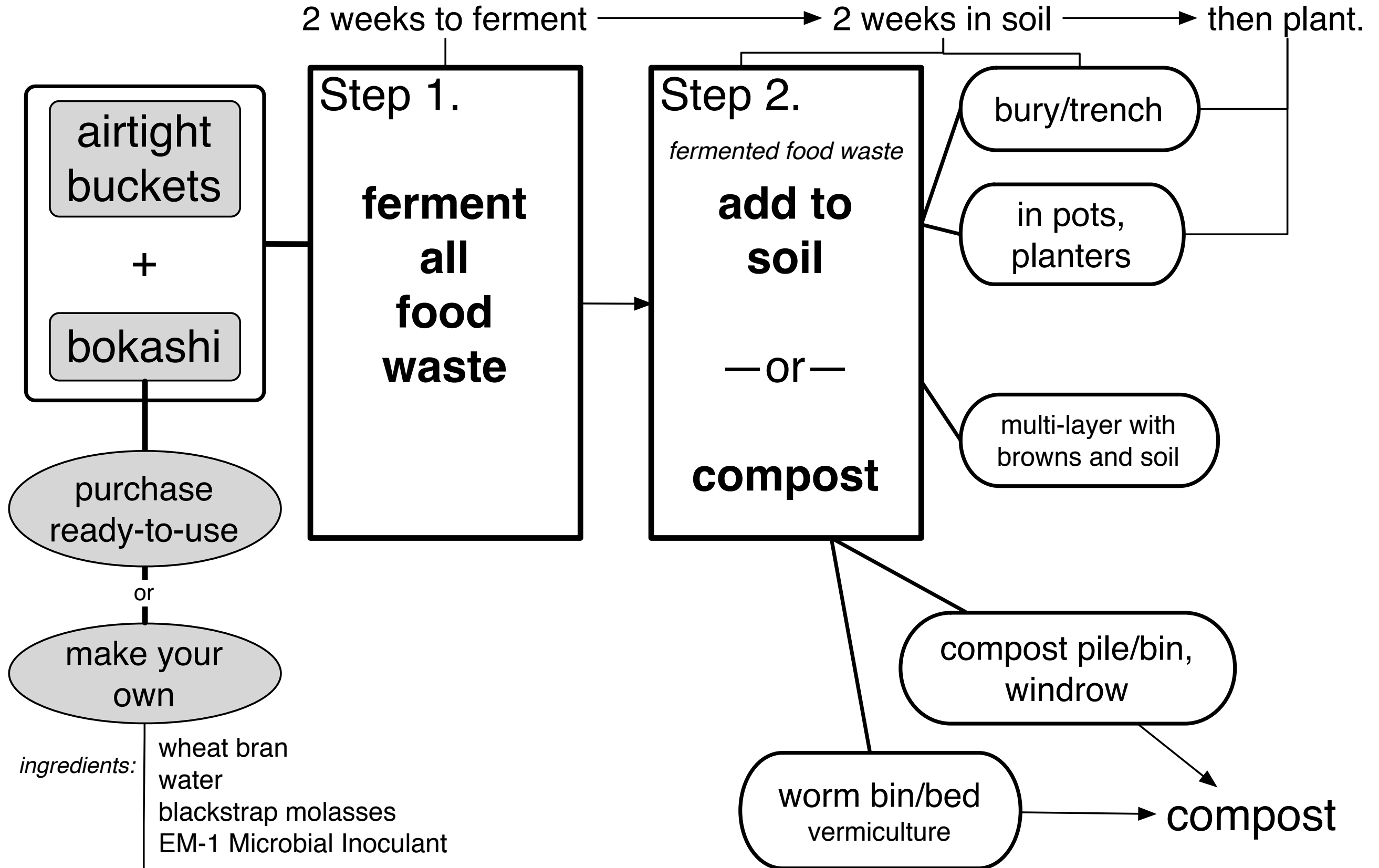
Originally, bokashi farming

The bokashi method of recycling food waste

2 weeks to ferment

2 weeks in soil

then plant.



Fermentation

where microbes break down complex molecules into simpler ones

sauerkraut

kimchee

yogurt

kefir

cheese

dark chocolate

vanilla extract

bread

hard salami

mead

wine

beer

Different kinds of fermentation

lactic-yeast fermentation (*incl. bokashi*)

methane fermentation (*anaerobic digesters*)

bokashi ≠ methane fermentation

We've been **fermenting foods** and **beverages** since ancient times.

How were each discovered?

Did farmers ferment plant/crop waste in the past to feed their soil and plants?

fermentation

Importance of fermentation:

1. Preservation (“bio-alignment”)
2. Nutrient bioavailability

Fermentation Farming

- Bokashi = fermentation + microbial inoculation
fermentation => with existing microbes
bokashi => **adding microbes**
- Bokashi farming => culturing, adding, maintaining microbes
bokashi gardening
- Originally, not bokashi food waste composting
- Silage (fermented grasses/post-harvest plant residue)
- Why fermentation farming or bokashi farming may have existed in farming cultures throughout the ancient world

Microbes

(general)

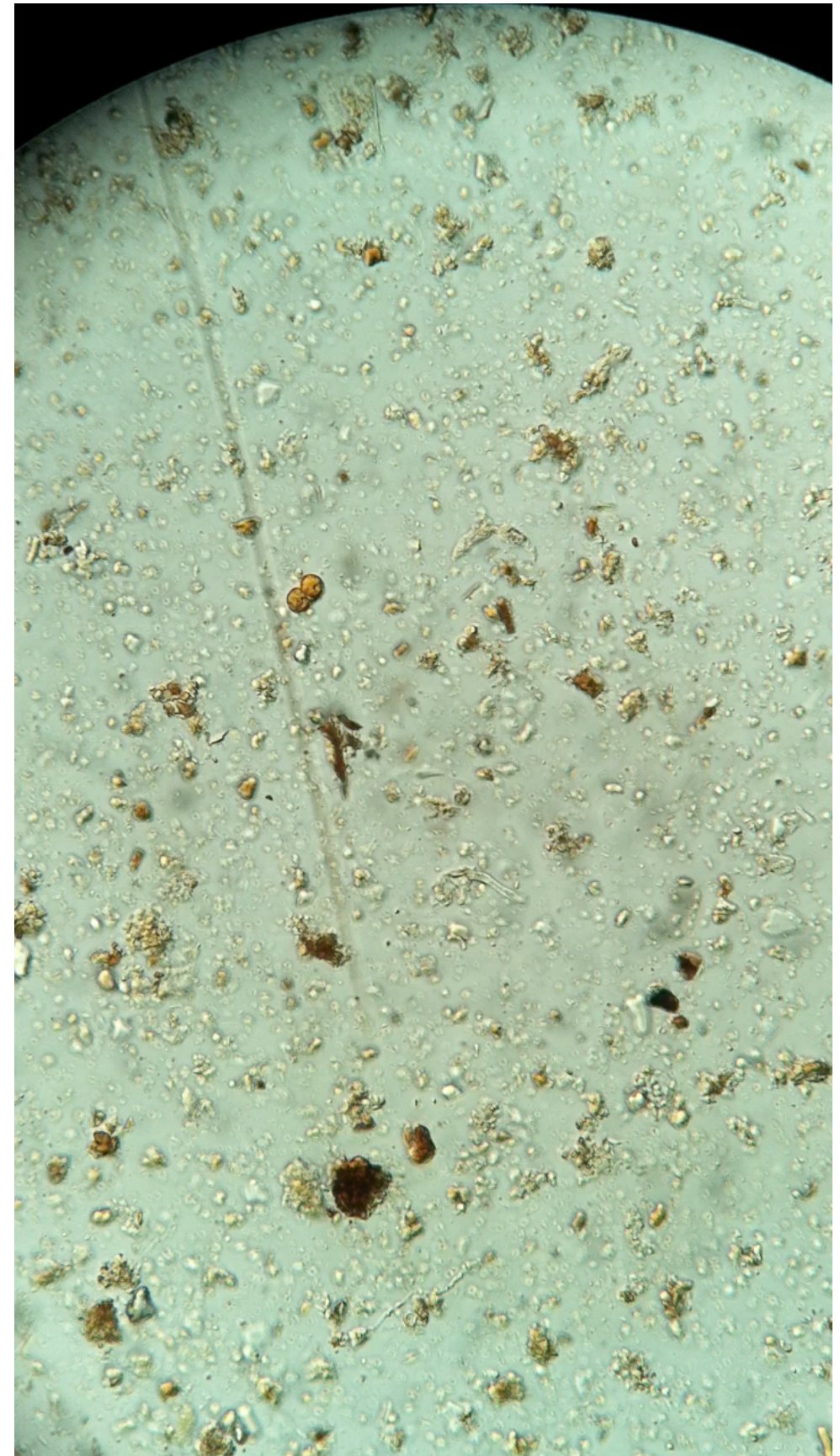
microbes = microorganisms
= microscopic organisms

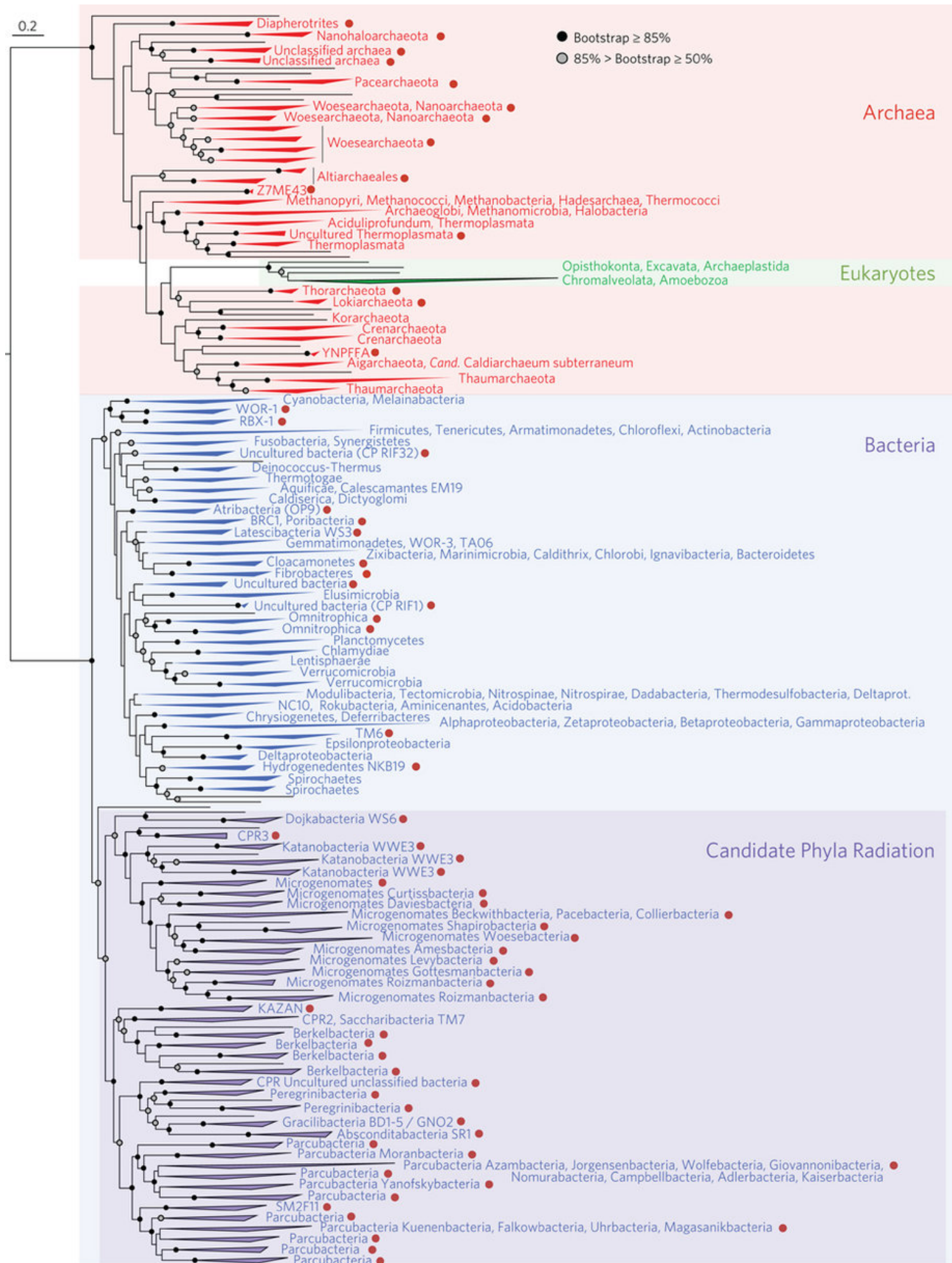
archaea, bacteria, fungi, algae, protozoa,
microscopic plants, microscopic animals

pathogens – disease causing by toxins or cell damage
bacterial, fungal, viral, parasitic, prionic (protein)
— a fraction of 1% of all microbes

Probiotic — probiotic farming

Prebiotic — prebiotic farming





“A new view of the tree of life” [biology]

from *Nature Microbiology*

<https://www.nature.com/articles/nmicrobiol201648>
May 2016

Past tree of life diagrams had animals represent about half of all the species.

Now, all of the visible life (from fungi to plants to animals to humans) are on that one thick line under Eukaryotes.

The bottom third, “Candidate Phyla Radiation” (a temporary name) have all been recently discovered (ca. 2015).

How little we still know about the microbial world.

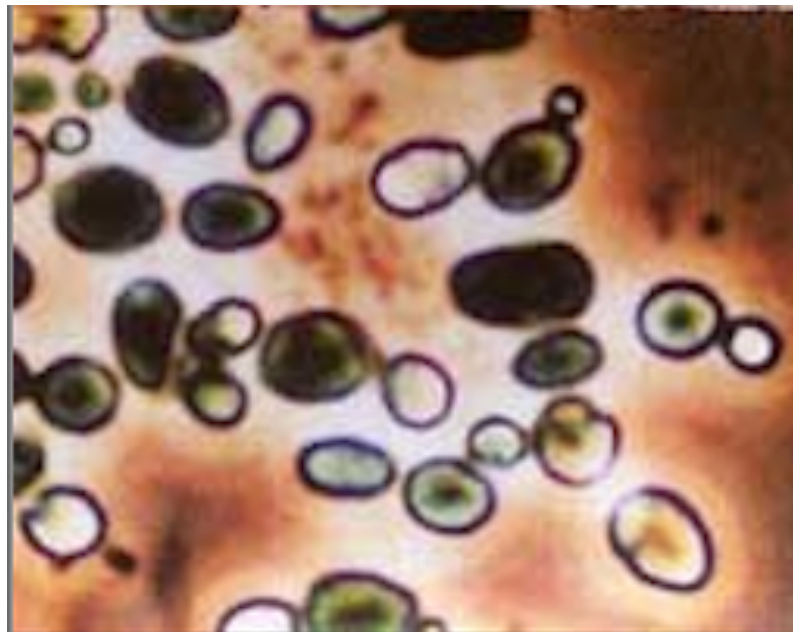
Bokashi History

- Since mid-1700s (?)
- bokashi (fermented plant matter) made with pristine forest/mountain valley soils as fermentation starter
- with EM (Effective Microorganisms), 1982 (Teruo Higa), easier to make bokashi
- bokashi revived and developed with EM

Effective Microorganisms

EM, EM-1

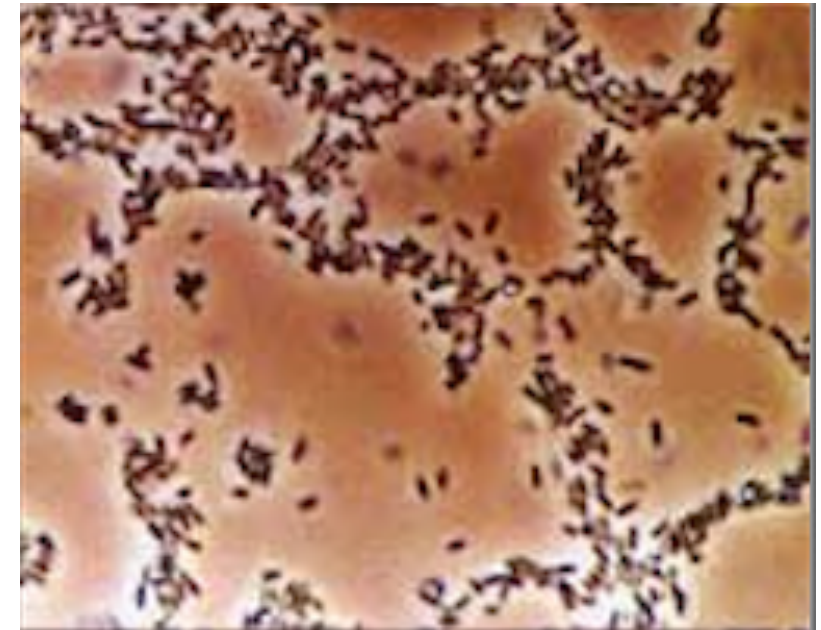
Combination of
3 groups of
microbes



yeast

When Higa needed to refer this grouping by a name, he called them Effective Microorganisms or EM. And EM-1 is the actual liquid containing these 3 groups of microbes.

Microbes function differently
when combined



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

<http://recyclefoodwaste.org/files/Microbes%20in%20EM1.pdf>

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]

Activated EM



blackstrap molasses

1% to water



EM-1

1% to water

after 2 weeks, ready to use

EM-5

1. water
2. blackstrap molasses 5%
3. EM-1 Microbial Inoculant
4. apple cider vinegar 5%
5. 40% alcohol (vodka) 5%
6. garlic cloves
7. hot peppers (cayenne or hotter)

Bokashi with EM

ideal world, no need for EM

but we keep polluting and damaging life/microbial world

soil care without chemicals

animal care without pharmaceuticals

environmental remediation: water, soil, waste

industrial applications

health applications

bokashi methods

bokashi farming

bokashi gardening

bokashi composting

bokashi bioremediation

bokashi personal care

bokashi types

by ingredients

fermentation starter

microbial inoculant [+ nutrients + organic matter]

bokashi mudballs / EM mudballs

probiotic feed

prebiotic starter

uses of bokashi

*bokashi (wheat bran)
applied directly to soil
to treat for heavy metals
St. Mary's Urban Farm
521 W 126th St Harlem NY*



soil amendment

bioremediate soil

animal feed additive

fermentation starter



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

uses of EM

bioremediation

break down of pollutants, chemicals, toxins—they eat our waste and secrete beneficial substances

antioxidants

anti-rusting,
anti-corrosion

odor control

replace odor (gases) producing microbes



St. Mary's Urban Farm, West Harlem, NYC



Washington Square Park Dog Run, New York NY

Step 1. 'pickling'

fermenting food waste

pretreats (safer =>)

microbial pop. increase

release nutrients

metabolites:

organic acids (pH≈3.9)

amino acids (protein building block)

enzymes (breaks down materials)

coenzymes, bacteriocins (anti-pathogens)

antioxidants (naturally preserve)

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

2 weeks - room temp.

4 weeks - <50°F (if enough mass)

all food waste

(microbial and nutrient diversity)

Step 2. 'break down'

adding to soil or compost

as a soil amendment

microbial inoculant

organic matter content

bioavailability of more nutrients:

diversity (fat, proteins, carbohydrates, vitamins, minerals)

macronutrients (i.e., NPK, Mg, Ca, S)

micronutrients (e.g., I, Fe, B, Mn, Zn)

2 weeks - warmer seasons

4 weeks - winter (successive)

90%~99% broken down

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/Lower East Side
New York, NY*

