Beginners guide to **bokashi**

recyclefoodwaste.org bokashi.nyc

Bokashi Research and Education
bokashiresearch.org

contact@downtoearthgarden.org — To get **hands-on experience** with bokashi at **Down to Earth Garden** (546 E 12th St, by Ave B, New York NY 10009), Tuesdays 1:30-4, Sundays 12-4 pm.

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- To have a bokashi workshop done at your community garden or for a group/students.
- Questions on bokashi and EM.

← This slide presentation can be found at bokashiresearch.org/bokashi-nybg-cfc-20250315

bokashi

Step 1. Ferment food waste

composting

Step 2. As greens

Step 2. Composting bokashi food waste (as greens)

youtu.be/hBSfmeBRCI4

Composting bins
12/22/2024
W4L 75°F
W4R 71°F

Weather overnight low 12°F

Worm composting bins 12/29/2024

Weather overnight low 46°F, high 58°F

W4L 60°F
W4R 65°F

Step 2. As soil amendment — (Composting? Not composting?)

Trenching/burying bokashi food waste

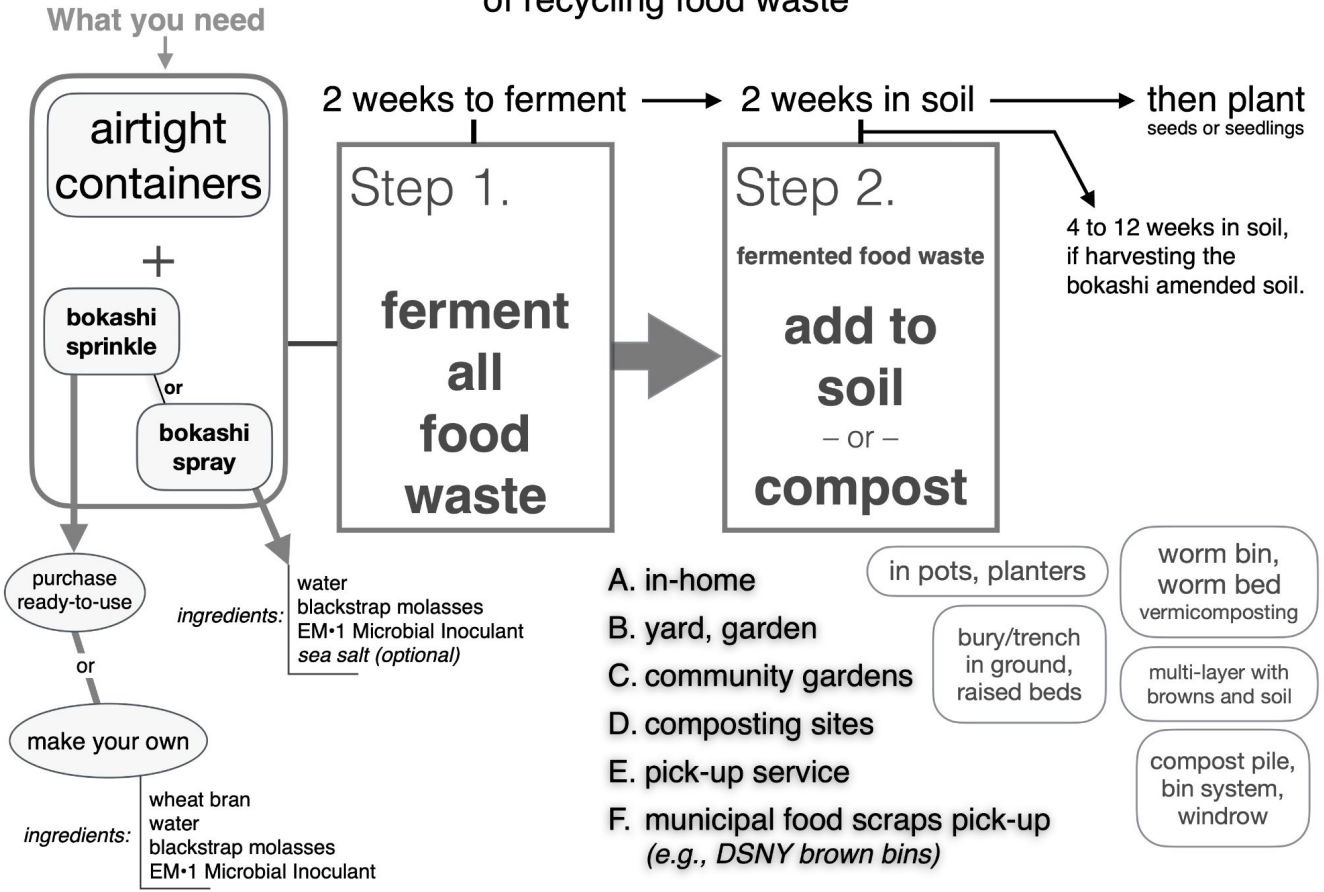
Growing various vegetables. Bokashi food waste fed soil is on the left side

Step 2. As a soil amendment in pots/planters

Sandwiching bokashi food waste in pots/planters

The bokashi method
of recycling food waste

recyclefoodwaste.org
3/29/2021



How to make bokashi sprinkle

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

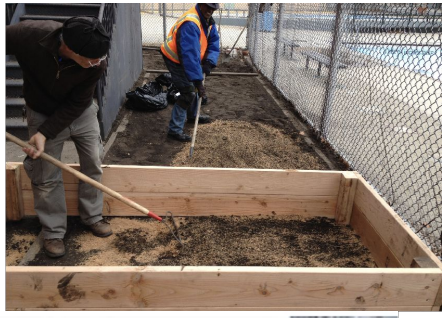
"wheat bran bokashi"

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

Bokashi Spray (Activated EM)

Airtight bottle		500 ml	16.9 fl oz
Water		450 ml	15.2 fl oz
Sea salt	~1% salinity	1 teaspoon	
Blackstrap molasses	5%	25 ml	0.8 fl oz
EM•1	5%	25 ml	0.8 fl oz

Bokashi is not just about food waste!



bokashi (wheat bran) and Activated EM applied directly to soil to treat for heavy metals 2012-2013 St. Mary's Urban Farm 521 W 126th St Harlem NY

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

soil amendment

bioremediate soil

animal feed additive

fermentation starter

antioxidants anti-rusting, anti-corrosion

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

odor control - replace odor-(gases)-producing microbes

What is bokashi?

- A fermented material (solid or liquid)

bokashi = fermented organic matter

- A **microbial** inoculant (added to soil or water)
  - A soil probiotic
  - A fermentation starter (to ferment food waste)
- A source of **nutrients**
- A soil **organic matter** additive
- A **biofertilizer** — contain living microbes that increase the availability of nutrients for plant growth
  - Its microbes are **biostimulants** — can stimulate the growth of plants

Different kinds of bokashi (**bokashi ferments**)

Used in different fields (farming, gardening, livestock, water, bioremediation)

Bokashi and **EM•1**

bokashi = **fermented organic matter**

*In essence, applying **microbes** + **organic matter***

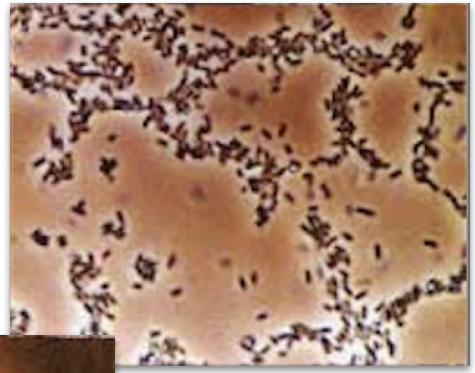
bokashi method = using **microbes** to ferment **organic matter**

***microbes** + molasses + water + **organic matter** => fermentation*

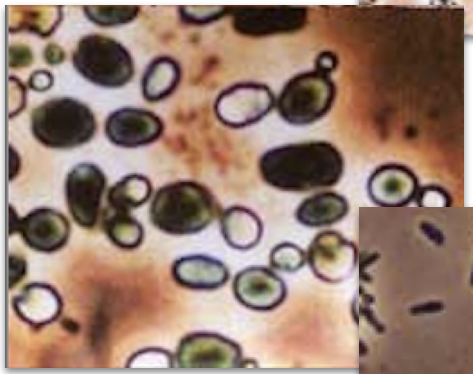
The microbes = EM•1

Effective Microorganisms, EM and EM•1

- Combination of 3 groups of microbes
- Microbes function differently when combined
- Naturally exists most everywhere but are usually not found together
- Not unique to any environment
- The discoverer (Teruo Higa) called them **Effective Microorganisms** or **EM**.
- **EM•1** is the liquid containing these 3 groups of microbes.



Lactic acid bacteria



Yeast

Photosynthetic bacteria

The Bokashi Ferments

1. **bokashi spray** or Activated EM
2. **bokashi sprinkle** or bokashi bran
3. **bokashi food waste** or fermented food waste
4. **bokashi mudballs** or EM mudballs
5. **bokashi silage**
6. **EM FPE** (fermented plant extract)
7. **EM•5**

Why bokashi

- Improves soil health
- Multiplies microbes
- Probiotic for the soil
- A biofertilizer
- A biostimulant
- Ambient to warm temperatures
- Microbes produce metabolites:
  - Feed other microbes
  - Pop. density & diversity
  - Protect plants from stresses
  - Bioavailability of nutrients

Microbial Metabolites

1. Amino acids
2. Bacteriocins
3. Coenzymes
4. Enzymes
5. Organic acids
6. Pigments
7. Fatty acids (short-chain, medium-chain, long-chain)
8. Vitamins

metabolite				
1 **amino acids**	basic constituents of protein	N-rich amino acids (*Rhizobia*>legumes)	anti-fungal protect plant roots	flavor enhancer
2 **bacteriocins**	proteins; inhibits the growth of similar bacterial strains		antibacterial, antimicrobial peptides	natural food preservatives
3 **coenzymes**	non-protein compounds; usually derived from vitamins; transport chem.groups enzymes–enzymes	necessary for enzymes to function, facilitate faster reactions of enzymes	involved in plant growth, stress resistance, fat storage (cell/plant/seed oils)	some are bioremediants
4 **enzymes**	proteins; 6 categories, 2 types, >5,000 biochemical reaction types	break down complex molecules	support natural cycles	bioremediants
5 **fatty acids**				
short-chain fatty acids (SCFA)	esters (e.g., lipids of animal fats, vegetable oils)	naturally occurring fats and essential oils	nematocide effects; gut barrier function	play a part in aromas of fruits and vegetables
medium-chain fatty acids (MCFA)	regulate metabolism		antibacterial, anticoccidial, antiviral	
long-chain fatty acids (LCFA)	signaling molecules; quorum-sensing between microbes	nutrients	role as microbial inhibitors	
6 **organic acids**	lactic acid, acetic acid (vinegar), propionic acid (suppresses molds)		encourage plant growth, protect from abiotic stress	
7 **pigments**	plays ecological roles—colors to most everything (soils, plants, flowers, birds, animals)	vitamins as pigments (e.g., riboflavin [B2] has a yellow-green fluorescence)	antibacterial, anti-fungal, antibiotic properties	
8 **vitamins**	majority produced by microbes	folate, riboflavin, biotin, B12	cyanobacteria > B12 > other microbes and plants require	
Also among the above metabolites	elements for plant growth, soil biology, and human nutrition	vitamins, minerals	macronutrients (C, H, N, O, P, K, Ca, S, and Mg)	micronutrients (B, Cl, Mn, Fe, Zn, Cu, Mo, and Ni)

microbes ⇄ metabolites

Each microbe ⇒ ~50 **different** metabolites

Quantities depend: *Escherichia coli* ~3,700 metabolites
Saccharomyces cerevisiae ~16,000 metabolites
(mean potential: ~9,850 metabolites)

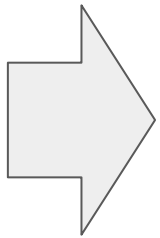
Amount of soil	Number of microbes	Est. number of different metabolites per microbe	Total minimum metabolites	Total potential metabolites
1 gram	10 billion	x 50	500 billion	98.5 trillion
1 teaspoon (5 grams)	50 billion	x 50	2.5 trillion	492.5 trillion
1 lbs (453 grams)	4.53 trillion	x 50	226.5 trillion	44.62 quadrillion
1 acre of soil (4 million pounds in the top 12 inches of soil)	18.12 quadrillion	x 50	906 quadrillion	178.48 quintillion

Nominal microbial cell counts per ml of surface sea water: >100,000/ml or 493,000/tsp x50: 24.65 million | x9,850: 4.86 billion

Purpose of bokashi

Primarily

1. Increase microbial pop. & diversity
2. Increase organic matter content
3. Make nutrients more bioavailable



Healthy living soil

By situation

- Good / not-so-bad soil => maintain / improve
- Poor soil => rebuild the soil
- Contaminated soil => bioremediate

How is bokashi used?

Direct application (one fermentation step)

- Using nutrient-rich organic matter
- Using specific plant/herb traits

As a fermentation starter (two fermentation steps)

- Organic matter as a carrier (or multiplier)
- Ferment other organic matter

What bokashi can mean

Living soil → self-sustaining & self-balancing

Foods grown in living soil → **probiotic foods**

More intense **flavors** and **aromas**

Difference between bokashi and composting

bokashi	composting
● Ferments organic matter (2 weeks) ● Without heat, turning, or air ● Fermented organic matter: ○ To soil (2 weeks and plant) ○ To worms (~6 weeks+) ○ Composted (4–6 weeks+) ● Organic matter*: ○ Microbe-dense ○ Metabolite-rich * *labile organic matter, labile carbon*	● Aerobic decomposition ● Heat (thermophilic composting) ● Turning (a few weeks – 14 weeks) ● Curing period (1 month – 1 year+) ● Produce “humus”** that contains microbes ** *recalcitrant organic matter, recalcitrant carbon*

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