



## BENEFICIAL MICROORGANISMS

This resource will cover the process of cultivating beneficial microorganisms for use in bokashi composting. This process uses Korean Natural Farming practices to culture Lactic Acid Bacteria (LAB) and Indigenous Microorganisms (IMO). There are two stages of IMO to culture in this process, IMO#1 and IMO#2. In this resource you will learn the steps to cultivate both IMOs. Propagating indigenous beneficial microorganisms such as LAB and IMO improves plant and soil health by increasing microbial activity of naturally occurring soil microbes. If you are familiar with using EM-1®, this resource will guide you through making bokashi with LAB and IMO#2 in place of EM-1® and molasses. In this process, LAB and IMO will be cultivated simultaneously, therefore begin by gathering all LAB and IMO supplies.

### SAFETY PRECAUTIONS

It is important to take safety precautions when touching fungi and other organisms. If you have cuts or wounds on your hands, be sure to use gloves. If you have respiratory issues or sensitivity to fungal spores, use a respiratory mask. Do not touch your eyes, nose, or mouth when you are culturing, collecting, and applying beneficial microorganisms. Thoroughly wash your hands with soap and water before and after handling organisms.

### Lactic Acid Bacteria (LAB) Supplies:

- 2 cups of white rice to make rice water
- 1 gallon whole milk (raw milk if available)
- Brown sugar
- 2 1-quart jars\*
- 2 half-gallon jars\*
- 3 large rubber bands
- Cheesecloth or other breathable material
- Wooden spoon

### Indigenous Microorganisms (IMO#1 and IMO#2) Supplies:

- All of the rice and remaining water from rinsing the rice for LAB
- Brown sugar
- Rice cooker
- Breathable box (i.e. lauhala basket, cedar box)
- 2 wide-mouth jars\*
- 2 large rubber bands
- Cheesecloth or other breathable material
- Bowl & wooden spoon

*\*Glass jars are preferred but reused plastic containers of the same size can be used.*

### Bokashi Supplies:

- Wheat Mill Run
- Water
- IMO#2
- LAB
- 5-gallon bucket with an air tight lid



# How to... Cultivate Beneficial Microorganisms

## HOW TO MAKE LACTIC ACID BACTERIA (LAB):

1. Place 2 cups white rice in the rice pot and add 5 cups of water, wash rice until cloudy. Do not dump out the cloudy water, this rice water is full of necessary starches to cultivate LAB.
2. Pour about 3 cups of the rice wash water into a quart jar leaving approximately 2 cups (or 1/4 inch of water above rice) in the rice pot. Set rice aside for making IMO.
3. Cover jar with cheesecloth and secure with a rubber band. Place outside in an undisturbed, covered area for 3-4 days until the rice wash water separates into a solid mass at the top, a clear liquid in the middle, and cloudy liquid at the bottom of the jar.

**\*At this stage, start making your IMO. (See directions on page 3.)**

4. After 3-4 days, the rice wash water will separate. Pour gently into a quart jar to collect the clear liquid in the middle. Avoid pouring any milk solids into the jar.
5. In a half-gallon jar, at a ratio of 10:1, pour 1 part clear rice water into jar. Add 10 parts milk leaving the jar 1/3 empty.
6. Cover jar with cheesecloth and secure with a rubber band. Place outside in an undisturbed, covered area for 3-4 more days.
7. After 3-4 days, check to make sure the liquid separated into a thin solid mass at the top, cloudy liquid in the middle, and a white sediment on the bottom.
8. Fill a half-gallon jar with 1/2 brown sugar. At a ratio of 1:1, pour cloudy liquid into the jar with the brown sugar and mix well with a wooden spoon.
9. Clean any residue off the surface of the bottle to avoid attracting pests. Cover with a loose fitting lid and label jar "LAB" with the date and location. Set aside and store LAB in a cool shaded area for up to 2 weeks.



1) Rice water



2) Pour into the jar



3) Collecting microbes



4) Cloudy mid-liquid



5) 10 parts milk to 1 part rice water



6) Milk & rice water collecting microbes



7) LAB ready to harvest



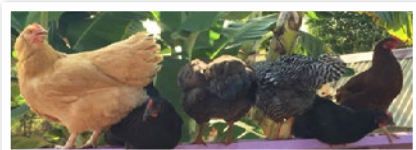
8) LAB & brown sugar



9) Completed LAB

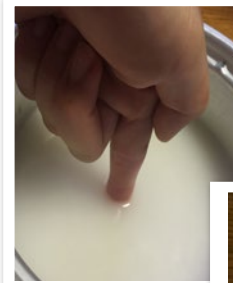
### OTHER USES:

LAB may also be used to neutralize strong odors such as chicken coops or pig pens. At a ratio of 1:1000, mix 1 part LAB with 1000 parts water and spray.



## HOW TO MAKE INDIGENOUS MICROORGANISMS (IMO#1 AND IMO#2):

- Using the rice that was used to make rice wash water for LAB, place your pointer finger on the surface of the rice. The amount of water should measure just above the rice, about 1/4 to the first line on your finger. Do not dump out the cloudy water, this rice water is full of necessary starches to cultivate IMO. Cook rice and let cool to room temperature. Steamed rice should be firm.
- Place the steamed rice in a breathable container such as a lauhala basket or cedar box. Rice should fill the breathable container 2/3 full, leaving 1/3 empty. Cover with a breathable lid. For a more robust culture, split cooked rice into two containers and position them at multiple sites around your 'āina to collect microorganisms from the environment.
- Place breathable container under trees in an undisturbed vegetative area for 3-4 days. 3 days for humid/dry areas, 4 days for wet/cool areas. Cover with chicken wire or hardware cloth to keep pest out. If it is a rainy season, shelter the container from the elements.
- After 3-4 days there should be white mold growth covering the rice that resembles cotton candy. The rice and mold are called IMO#1. #1 represents the first stage in the IMO process. Other colors of mold may appear and are okay, but if black mold appears, throw out and begin process again.
- Weigh IMO#1. Weigh the same weight of brown sugar in a bowl. At a ratio of 1:1, add your IMO#1 to the brown sugar and incorporate with hands until the texture is sticky like molasses. This stage is IMO#2.
- Transfer to a jar and label "IMO#2", date and location. Cover IMO#2 with a breathable lid to ferment for 1 week before use. Cover with a loose fitting lid and store in a cool shaded area. IMO#2 can last indefinitely if kept moist.



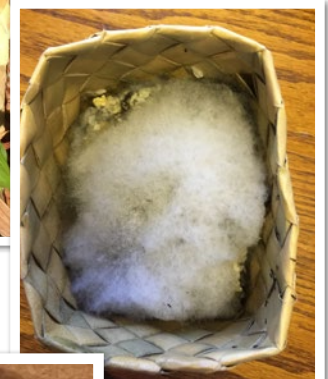
1) Rice and rice wash water



2) Steamed rice



3) Rice in lauhala collecting IMOs



4) Completed IMO#1



5) IMO#1 & brown sugar



6) Completed IMO#2

### OTHER USES:

**IMO#2 may be applied to compost piles to speed up the decomposition process. At ratio of 1:500, mix 1 part IMO to 500 parts water and spray.**

# How to... Cultivate Beneficial Microorganisms

## HOW TO MIX LAB AND IMO#2 FOR BOKASHI:

This recipe will yield enough bokashi to layer with food scraps in one 5-gallon bucket.

Wheat Mill Run	Water	IMO#2	LAB
2.5 lbs	2.5 cups	1 Tbs	1 Tbs

1. In a shaded area, place wheat mill run in an open container and mix in water, IMO#2, and LAB.
2. Once mixed, grab a handful of the mixture and squeeze it into a ball. The bokashi ball should keep its shape but crumble slowly to the touch. If it is too wet, add more wheat mill run.
3. Place the mixture inside a plastic airtight container such as 5-gallon storage bucket or reusable plastic sealable bag. Remove as much air as possible and seal. Allow the mixture to ferment for about two weeks.
4. After two weeks, the mixture should have a sweet fermented smell (like pickles) and will be ready to use. Unused bokashi should be air or sun dried. One method of drying is to spread out the mixture on a tarp on a sunny day. Once mixture is dry, store in an airtight container for up to one month.

**For instruction on how to use bokashi with a two bucket system, please refer to the KHF Resource Sheet: How To Bokashi at [www.kokuahawaiifoundation.org/aina](http://www.kokuahawaiifoundation.org/aina).**

Wheat mill run can be purchased at Waimanalo Feed Supply, 41-1521 Lukanela St, Waimanalo, HI 96795 ph. 808-259-5344. If wheat mill run is not available, experiment with alternative host mediums such as newspaper, shredded office paper, or sawdust from untreated lumber. All other supplies can be found at most supermarkets and hardware/garden supply stores.

**Mahalo to Hawai'i Natural Farming for guidance and instruction on Korean Natural Farming practices adapted to Hawai'i's climate and culture. For further resources and trainings pertaining to Korean Natural Farming in Hawai'i, contact [hawaiinaturalfarming@gmail.com](mailto:hawaiinaturalfarming@gmail.com).**



1) Mixing in IMO#2 & LAB



2) Sandball test



3) Fermenting bokashi



4) Drying bokashi for storage