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Natural Farming: Lactic Acid Bacteria

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Introduction

Lactic acid bacteria (LAB) are ubiquitous microorganisms that can be beneficial in crop and livestock production. With their long history of use in food preservation by many world cultures (Nordqvist 2004), LAB are generally recognized as safe for human consumption. By producing lactic acid as a fermentation metabolite, these microorganisms prolong storage, preserve nutritive value, and enhance flavors of otherwise perishable foods. LAB are easy to collect and economical to culture, store, and use. This fact sheet addresses frequently asked questions concerning LAB collection, culture, storage, and use in Natural Farming.

What Are Lactic Acid Bacteria?

"Lactic acid bacteria" (LAB) refers to a large group of bacteria, rather than a single species or strain, that produce lactic acid as a by-product of digesting their food source (usually carbohydrates). The lactic acid accumulates to ferment or "pickle" the food, and LAB are capable of surviving in acidic (low-pH) environments. LAB are widespread in nature and are beneficial probiotics in our digestive systems. They are among the most important groups of microorganisms used in food fermentation, contributing to the taste and texture of fermented products and inhibiting food spoilage caused by other microorganisms. LAB are responsible for the production of yogurt, cheese, cultured butter, sour cream, sausage, kimchee, olives, and sauerkraut (Nordqvist 2004).

How Are LAB Cultured?

Step-by-step instructions are given below. Rice grains are readily available, economical sources of LAB. When washing rice with clean water in preparation for cooking, colonies of LAB can be collected in the rinse water. Microorganisms other than LAB are also present, but allowing the rice rinse water to sit for 3 to 5 days will cause LAB to become the predominant species. Since the rinse water is low in nutrients, milk is then added as a food source for the LAB. Fresh cow's or goat's milk, which is high in lactose (milk sugar), is an ideal food source for LAB proliferation, or culture. It is best, for obvious reasons, if the milk is unpasteurized and does not contain any antibiotics. After an additional 3 to 5 days, the LAB culture separates into solid and liquid fractions (similar to curds and whey). The liquid fraction is the LAB culture, which can be used immediately, stored under refrigeration, or kept in a cool, dark place with the addition of brown sugar. This edible culture is used in Natural Farming for both plant and livestock production. The solid fraction is edible as a soft cheese and can also be fed to livestock or composted.

LAB Culture Instructions

1. Wash rice grains and collect the first two rinses of cloudy water.
2. Fill a clean glass jar about $^{2}/_{3}$ full with rice rinse-water. Label the jar with date and contents (Figure 1).
3. Cover the mouth of the jar with breathable cloth (such as muslin) or paper (not plastic) and secure with rubber bands or ties to keep out pests. Store at room temperature away from direct light. Be careful not to shake or move the jar while it ferments.
4. After 3 to 5 days, LAB will multiply and give off a slightly sour odor. There will be a mat of semi-solid material floating on the top of the cloudy liquid in the jar. Collect only the cloudy liquid (fermented rinse-water) by pouring off and discarding the mat layer.
5. Depending on the size of your glass jar, measure one part of fermented rinse-water and add 10 parts of milk to fill your jar $^{2}/_{3}$ full.
6. As in step 3, cover the mouth of the jar with cloth or paper and secure with rubber bands or ties to keep out pests. Store at room temperature away from direct light. Be careful not to shake or move the jar while it ferments.
7. After 3 to 5 days, the contents of the jar will separate into a floating solid fraction and a yellow liquid fraction (Figure 2). It may take longer in cooler climates. **The yellow liquid is the LAB culture, which must be kept alive.**
8. Pour off the liquid fraction, being careful not to mix any solids back into the LAB culture (Figure

Figure 1: Fill a clean glass jar $^{2}/_{3}$ full with cloudy water from rinsing rice. Cover with breathable cloth or paper to keep pests out; label with contents ("Rice Rinse-Water") and date.

Figure 2: Approximately 3 to 5 days after adding 10 parts milk to 1 part fermented rice rinse-water, the contents of the jar will separate into a floating solid mass and a yellow liquid. The yellow liquid is the LAB culture, which must be kept alive.

3). Store LAB culture in a **loosely capped** plastic or glass bottle labeled with the date and contents.

9. Any LAB culture not used within a week should be refrigerated, or if it must be kept at room temperature, add an equal amount (by weight) of brown sugar. In either case, keep the bottle loosely capped to release gases formed by fermentation, or the container may burst.

Figure 3: Strain the LAB culture (yellow liquid fraction) into a clean bottle. Keep refrigerated and loosely capped to allow gases formed during fermentation to escape. If refrigeration is not possible, add an equal amount (by weight) of brown sugar to the LAB culture and keep loosely capped to allow ferment.

10. LAB culture may be kept refrigerated for 6 months. Continue to keep the bottle loosely capped to release gases.

11. LAB culture should have a sweet odor; if the odor becomes unpleasant (rotten) after it has been stored, discard it and make a new batch.

How Is LAB Culture Used for Plant Production?

LAB culture is diluted at a 1:1,000 ratio with water (Table 1), mixed with a plant nutrient solution such as fermented plant juice (FPJ) (Miller et al., in press), and applied as a foliar spray to leaf surfaces of leaf or fruit crops. Note: Over-application of LAB culture to fruit crops may result in the loss of sweetness (lowered brix) of fruits. Apply sparingly in the latter stages of the fruiting season.

LAB culture can also be used in conjunction with other nutrient solutions to treat seeds before planting. This improves seed germination, inoculates the seed with beneficial microbes, and deters fungal problems, such as “damping off” (Hamed et al. 2011).

LAB is used with IMO (indigenous microorganisms) in Natural Farming in making composts or compost teas for soil preparation prior to planting (Park and DuPonte 2008). Application of LAB culture can accelerate the decomposition of organic amendments in soils and enhance the release of plant nutrients for absorption (Higa and Kinjo 1989).

Table 1: Preparation of 1:1,000 LAB Solutions

Water volume	Amount of LAB (select ONE column only)		
	Kitchen measuring utensils	Fluid ounces (fl oz)	Milliliters (ml)
½ gallon	⅓ tsp	0.06	2
1 gallon	¾ tsp	0.13	4
5 gallons	1¼ Tbsp	0.64	19
10 gallons	2½ Tbsp	1.28	38
25 gallons	little less than ½ c	3.2	95

How Is LAB Culture Used in Livestock Production?

LAB culture can transform a malodorous, anaerobic livestock pen, for example, into an odorless system when used in conjunction with an IMO-inoculated deep litter system (Chantsavang et al. 1993; DuPonte and Fischer 2012).

LAB culture can also be given to most livestock species to consume through their feed and/or water as a probiotic to help foster a healthy gut flora, enhance their immune systems, and aid in digestion (Corcionivoschi et al. 2010, Farjardo et al. 2012).

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