

## **Indigenous Microorganisms:**

### *Grow Your Own*

Beneficial Indigenous Microorganisms and Bionutrients  
In Natural Farming

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*This was produced thanks to my mentor, Dr. Han Kyu Cho of the Korean Natural Farming Association and influence of the natural farmers of Japan I visited and apprenticed with.*

*“Farmers have lost their independent authority which they have in the farming techniques of the old days. Farmers became dependent in buying almost everything that they need in farming, and they just engaged in farming by role according to the program presented by the seller.”*

*“I insist to recover the spirit of farmers. To achieve it is impossible until the exhilarated farming that farmers can recover subjectivity in the farming technique is realized.”*

*“New vision of farming techniques is needed to recover the true nature of farming. There is a hidden possibility to realize a new vision in the ways that farmers make and apply which are necessary farming materials by making use of local materials actively.” –Dr. Han Kyu Cho*

“There is a need to invest on natural capital like the soil through the proliferation of beneficial indigenous microorganisms, sustaining their growth and population, creating *living soil*, and opening *mechanisms and bridges* to extract natural minerals to be taken by the plant and stored, broken down again to mineralized for future use as it completes the nutrient cycle. *Beneficial Indigenous Microorganism* is the start of this cycle, the ultimate digester, user and re-users.”

About a couple of months ago, while I was attending Apprenticeship in Ecological Horticulture at the University of California Santa Cruz, *Center for Agroecology and Sustainable Food Systems (CASFS)*, I had the opportunity to share my practical knowledge and experience on natural farming system of culturing beneficial indigenous microorganisms for use in agriculture with the apprentices of the program. We had started to raise free-range chickens at the UCSC Farm & Garden and had used this Asian natural farming technology not only in raising odor free, healthy chickens but also vegetables in our kitchen garden. Interesting enough, we had grown healthy chickens without the use of vaccines and antibiotics, and fed the chickens only once a day. We had raised some vegetables in our kitchen garden, bed inoculated with beneficial

indigenous microorganisms and occasionally sprayed with biological nutrients from local herbs and weeds. We had observed healthy plants with very minimal pests and nil plant diseases. We had mulched some beds and sprayed them with beneficial microorganisms and soil minimally tilled.

More than a year ago, I had given my mother some beneficial microorganisms which she gave away for Christmas. Specifically, I told her that these microbes will be good to arrest foul odors, as inoculant for composting and can be sprayed to plants to improve general health. One of the recipient of these microbes had used and sprayed them on orchids. Surprisingly, her orchid had grown well and healthy.

Some apprentices at the UCSC Farm & Garden had used these microbes for diarrhea and constipation, including canker sores. A concoction of our biological nutrient ginger-garlic extract had helped apprentices with their coughs, fever and flu. Even a Biodynamic farm in Covelo, California had used these beneficial microorganisms in their biotoilets eliminating foul odors and improving wastes decomposition.

In the Philippines where in the past two years, I had conducted seminar-workshop in the use and culture of these beneficial microorganisms and bionutrients in agriculture, it had empowered a lot of farmers in generating their own important organic inputs for their farms.

Today, organic agriculture like conventional agriculture is still very much dependent on purchased inputs. The goal of this workshop is to help farmers, specially small farmers take control of their farming – to be self-reliant and sustainable.

I would like to thank Mr. Thomas Wittman, one of the organizers of this ecological farming conference for giving me the opportunity to share this important natural farming technology. Starter cultures of beneficial microorganisms have been available here in the US but never have been under the control of the farmers themselves. They are agricultural inputs that farmers would need to purchase. Today, I will share with you the methods of culture for these beneficial indigenous microorganisms, including fermented extracts used as foliar fertilizers, pest and disease controls, and soil builders.

Nowadays, we had witnessed the rapid development of organic agriculture in this country only to see the degradation of sustainable organic practices. Several months ago, I visited a medium scale organic farm in Watsonville, California that do practice a more sustainable organic agriculture as contrasted to a nearby large, industrial organic farm that practice a lesser sustainable farming system. I had witnessed organic farming, yet system had encouraged soil erosion in their farming practices. Both farms purchased their organic agricultural inputs. They both practiced organic agriculture, but still quite unsustainable.

For organic farmers, the goal and direction is to sustain agricultural productivity. The task is not just to produce chemical free crops but sustainably produced crops. The emerging issue of *organic and beyond* needs to be addressed specifically through our

sustainable farming systems and true control of our resources like farm inputs. It is in this direction, that organic farmers of America can learn from natural farmers of Asia. It is the goal and direction of empowering farmers.

This empowering of the farmers is what excites Mr. Wittman and my collaborator in this workshop, Mr. Diver of ATTRA. Beneficial microorganisms have been available here in the US but for farmers to purchase and subculture. Today, I would like to share the methods of culturing not foreign or imported microbes, but local, indigenous microorganisms we can use in agriculture. I hope to talk about culture of probiotics like lactic acid bacteria, rhizobia and many other beneficial indigenous microorganisms. I also hope to talk about important foods for these beneficial indigenous microorganisms in the form of extracts, what we call biological nutrients (*bionutrients*). We shall also talk about natural antibiotics and how to make them. And not only shall we talk about these microbial workhorses for soil fertility and pest and disease controls, we shall also talk about conditions for their proliferations and activities. We shall talk about “*farming with air, water and sunlight*”. We shall talk about effective extraction of nutrients through fermentations and the creation of microbial biodiversity as an essential basis for balanced and harmonious macro and micro ecosystems we are dealing with in our agroecological farming systems.

I beg to speak of these other concerns to attain a more holistic agroecological farming system. Biodynamic and organic farmers of the West may focus on composts, nutrients, cover crops and rotations, and cosmic influences. Natural farmers of the East may focus on microbial farming. Natural farmers focus on microorganisms and enzymes, on energy *chi*, balance and harmony, of opposites, *yin* and *yang*.

Living soil is the basis of soil fertility. Soil, living soil is the *alpha* and *omega*, the beginning and end. And what makes a living soil is the existence of life forms like microorganisms. Without them, we cannot create and sustain soil fertility and health.

Sometime last year, a friend from California Organic Fertilizers came to my farm and saw how I grow my free-range chickens. He was surprised that there was no foul odors and the chickens are very healthy. He also noticed that there was no wastes created in my poultry system. First, it was litter-type on chicken housing. We had dug as deep as one yard and created a litter mixtures of soil, compost and lots of sawdust. I told him, we sprayed the litter substrate with beneficial indigenous microorganisms and bionutrients. I explained to him that the substrate served as a natural compost pile. As the chickens poohed, the sawdust (with compost and soil) absorbed the moisture. The dug got mixed naturally with the substrate through the chickens scratchings, which actually aerate the substrate. One of the major microbe of the beneficial indigenous microorganisms was lactic acid bacteria that arrest the foul odors and consequently help take off the toxins. In time, the chicken dung and the substrate had become good organic fertilizers. We also added bionutrients extracted from plants and herbs to feed the beneficial indigenous microorganisms, to encourage proliferation. There were no wastes created. The nutrient cycle was completed.

Let us go back to that story of the orchid. You may ask how come, the orchid has been healthy and vigorous when sprayed with beneficial indigenous microorganisms? After all, is it not nutrient that makes the plant grow healthy? Microorganism is not food *per se* to the plant. However, we have increased the population of these beneficial indigenous microorganisms on the leaf surface of the plant. It increases the activity of *phyllosphere* bacteria that help process food (like dust or organic matter) on the leaf surface, and consequently, making the nutrient available to the plant. We have also used the same method on seedlings that are quite stressed, almost dropping, and ready to be dominated by damping off. The beneficial indigenous microorganisms have arrested the systems of stress, dropping and damping off. These phenomena are observed and we may deduct the important role of the beneficial indigenous microorganisms.

A similar testimonial given to me by one of my students who was growing salad greens. One time, he approached me for he was having problems with his salad greens being attacked by pests and bacterial diseases. For a lengthy while, we talked about crop rotation, beneficial plant strips, application of calcium, a possible over nitrogen application, the issue of air movement, too much water and inadequate light penetration and basic nutrition. After addressing those concerns, I told him to use my botanical pesticide which also combined with bionutrient. He was able to control the persisting problem but only for a while. After a couple of days, the problem again came back. So I advised him this time to use beneficial indigenous microorganisms combined with concoction of herbal based bionutrients, spraying them not only to the plants but to the whole farm. After three days, he came back to me and said that the problem was controlled. Apparently, the pests and pathogens were controlled. I explained to him that the proliferation of beneficial indigenous microorganisms and the combined bionutrients had arrested the problem. Oriental medicine suggested that disease is a function of imbalance and disharmony. There was too much *yin* or *yang*, or less *yin* or *yang*. When there is balance and harmony of the *yin* and *yang*, we observed health and life.

I could probably talk more examples and experiences, for I would like you to understand and appreciate the functions of beneficial indigenous microorganisms and biological nutrients for plant and animal health. Remember when we have diarrhea? There is predominance of the bad bacteria over the good ones. And once we are able to increase the numbers of the good bacteria, and spell the balance of the digestive flora, diarrhea ceases.

With our understanding and appreciation of beneficials, nutrition, balance and harmony, we may now be ready to the culture of these beneficial indigenous microorganisms and preparation of bionutrients.

### ***Beneficial Indigenous Microorganism (BIM)***

#### **Lacto Bacilli**

One of the major workhorse beneficial indigenous microorganism used in natural farming is lacto bacilli. This particular beneficial microorganism is popularly used in composting that specifically arrest foul odors associated with anaerobic decomposition. Lactic acid

bacteria thrive and feed on the ammonia released in the decomposition normally associated with foul odors. So if you need to decompose or ferment wastes less foul odors, lactic acid bacteria is the specific bacteria to use. Its application in organic farming is enormous. Lactic acid bacteria is specially used in natural piggery. Pigs are allowed to roam their pens where the floors (substrate) are made of compost, soil and other organic matter like sawdust, sprayed with lactic acid bacteria serum. There is no need to clean up the pens of excretions and urines. The lactic acid bacteria do the "cleansing". They convert these wastes into unharmed ones through this natural way of decomposition. So there is no need to clean and no need to worry about foul odors. Another application is for raising organic chickens. The serum is diluted and added to water and feeds of the chickens. With the lactic acid bacteria intake of the chickens, it helps better assimilation of nutrients of feeds through better breakdown of food, thus, more nutritious food extraction. Likewise, in aquaculture, one of the problem is related to water quality. Poor water quality stresses the fish which in turn stunts their growth and affects their health. This is very evident specially on high density and tank aquaculture. The ammonia produced through fish excretions pollute the water and stress the fish. With regular addition of this beneficial microorganisms to the water, this ammonia problem is minimized, if not fully arrested. It helps hasten or complete the denitrification or converting wastes into forms not harmful to fish.

Spraying diluted solution of lactic acid bacteria serum to the plant and soil helps plant growth and makes them more healthy. As it is applied to the soil or the leaves, these beneficial bacteria aid in the decomposition process, thus allowing more food to be available and assimilated by the plant.

Lactic acid bacteria is also known to produce enzymes and natural antibiotics aiding effective digestion and has antibacterial properties, including control of salmonella and e. coli. To farmers, what are observed are the general health of the plants and animals, better nutrient assimilation, feed conversion and certain toxins eliminations.

Here's a simple method of collecting this type of microorganism. Lactic acid bacteria can be collected from the air. Pour rice wash (solution generated when you wash the rice with water) on a container like plastic pot with lid. Allow air gap at least 50-75% of the container. The key here is the air space. Cover the (not vacuum tight, allowing air still to move into the container) container with lid loosely. Put the container in a quiet area with no direct sunlight. Allow the rice was to ferment for at least 5-7 days. Lactic acid bacteria will gather in 5-7 days when temperature is 20-25 degrees C. Rice bran will be separated and float in the liquid, like a thin film, smelling sour. Strain and simply get the liquid. Put this liquid in a bigger container and pour ten parts milk. The original liquid has been infected with different type of microbes including lacto bacilli. And in order to get the pure lacto bacilli, saturation of milk will eliminate the other microorganisms and the pure lacto bacilli will be left. You may use skim or powdered milk, although fresh milk is best. In 5-7 days, carbohydrate, protein and fat will float leaving yellow liquid (serum), which contain the lactic acid bacteria. You can dispose the coagulated carbohydrate, protein and fat, add them to your compost pile or feed them to your animals. The pure lactic acid bacteria serum can be stored in the refrigerator or simply

add equal amount of crude sugar (dilute with 1/3 water) or molasses. Do not use refined sugar as they are chemically bleached and may affect the lactic acid bacteria. The sugar or molasses will keep the lactic acid bacteria alive at room temperature. One to one ratio is suggested although sugar, regardless of quantity is meant simply, serving as food for the bacteria to keep them alive. Now, these lactic acid bacteria serum with sugar or molasses will be your pure culture. To use, you can dilute this pure culture with 20 parts water. Make sure water is not chemically treated with, like chlorine. Remember, we are dealing with live microorganisms and chlorine can kill them. This diluted form 1:20 ratio will be your basic lactic acid bacteria concoction. Two to four tablespoons added to water of one gallon can be used as your basic spray and can be added to water and feeds of animals. For bigger animals, the 2-4 tablespoons of this diluted lactic acid bacteria serum should be used without diluting it further with water. Lactic acid bacteria serum can be applied to plant leaves to fortify phyllosphere microbes, to soil and compost. Of course, it will help improve digestion and nutrient assimilation for animals and other applications mentioned before. For any kind of imbalance, be it in the soil or digestive system, lacto bacilli can be of help.

One of the popular beneficial microorganism inoculant from Japan contains lactic acid bacteria as its major component, including photosynthetic bacteria, yeasts, actinomycetes and fermenting fungi. These are pure culture imported from Japan and can be subcultured through the use of sugar or molasses. These other microbes can be cultured in several ways by farmers themselves.

### **Forest Beneficial Microorganisms**

One technique in culturing other beneficial microorganism is getting them from your local aged forest. One way is finding a healthy old robust tree in your local forest. Check the humus litter around the tree. The tree should have accumulated real deep humus, litter, compost of at least 2 feet to 1 yard deep. In this area through observation, we can deduce that soil fertility and microbial biodiversity are high. Our goal is to trap and culture these diversified, aged beneficial indigenous microorganisms. The technique that we use in trapping these microorganisms is the use of carbohydrate like cooked rice. Microorganisms will be attracted to food. So generally, what we do is to put the cooked rice on a flatter container with lid. For example, you can use a plastic lunch box and add about an inch of cooked rice allowing air space in the container. What is important here is a larger area to trap those microorganisms. It is suggested that you cover this container with metal netting or equivalent protecting it from animals like rats that may undig your container once you bury it in the litter, humus of your local forest. In 2-10 days (relative to temperature), you may undig your container and will notice contamination of microorganisms like white and other color molds on the cooked rice. The cooked rice has been infected now with microorganisms of your local forest. The next step is to add 1/3 amount of crude sugar or molasses to the infected cooked rice. After a week, the concoction will look like sticky, liquidy rice. You may then add equal amount of crude sugar or molasses to keep it for storage, arresting microbial activities, in a cooler area. To use, you may dilute this serum with 20 parts water. This diluted form shall then serve as your basic forest microorganisms. You may strain it and put in a container.

Another version of trapping similar forest microorganisms is simply getting the litter, humus and spreading them sparingly to the top your cooked rice. Forest leaf molds can also be used. The same procedure will be followed as described in the culture of local forest microorganisms.

### **Bamboo Microorganisms**

Another method of gathering microorganism is through burying your container with cooked rice on bamboo plants litter. Apparently, bamboo through observation and experience in the East, attracts powerful beneficial microorganisms as the roots of the bamboo exude sugary substances that attract beneficial microorganisms. The same procedure is followed as described before in its culture.

### **Plant Specific Microorganisms**

An equal specific method is trapping beneficial microorganisms of specific plants you want to grow or growing. For example, if you want to trap and culture beneficial microorganisms from rice, you should then select healthy, vigorous rice plant, cut them and put inverted cooked rice container over the cut rice plant. Again, beneficial microorganisms specific to rice will be attracted to the cooked rice. You can use this technique to any other plant of choice and the same procedure of culture will be used as previously described.

### **Rhizobium Nitrogen-Fixing Bacteria**

One of the most popular nitrogen-fixing bacteria is rhizobium. It is amazing that when we coat our legumes with these specific bacteria, legumes grow well and more nitrogen is fixed on the soil. Amazingly enough, basic culture of these beneficial bacteria is simple. Once we have seen those nodules created by the bacteria fixing nitrogen on the roots of the legumes, we can assume that there are lots of these rhizobia and nitrogen fixed. Just pull out the legumes plants on a very specific stage, especially towards their flowering/fruited stage. A simple method of culture is simply get the soil with these leguminous bacteria and mix with crude sugar with equal ratio of crude sugar. Rhizobium bacteria will proliferate feeding on the sugar and thus can be mixed with your next batch of legume seeds for inoculation.

Our concoction or recipe of beneficial indigenous microorganism (BIM) is 50% lactic acid bacteria and the rest is 50% of the other microorganisms cultured. So you may use 1 part forest microorganism, 1 part bamboo microorganism and 1 part specific plant microorganism mixed with 3 parts or 50% lacto bacilli. The more diversified microbes, the better. However, we will still use 50% of the total beneficial indigenous microorganisms to be lactic acid bacteria. The rest you can experiment and make your own observations and formulations. I cannot really tell you specifically what microbes we get from the different sources we have mentioned. As a rule, I only use the above BIM for plants. For animals, I use just pure lacto bacilli for we have isolated this as described. We have used the bamboo microorganisms for fermenting feeds to be fed to animals.

Different type of microorganisms thrive on different type of foods. As you can see, we use principally carbohydrates and sugars. But it will be equally important that we

provide these beneficial indigenous microorganisms with other nutrients. In fact, we mix or add fermented plant extracts (fermented plant and fruit juices), ginger-garlic nutrients, brown rice vinegar and fish amino acid. That's why in most instances, we mix these beneficial indigenous microorganisms with bionutrients to make it more effective.

## **Bionutrients**

In the creation of biological nutrients, bionutrients, the basic process is the traditional fermentation. Fermentation process is a better system than simple extraction like boiling the plant materials, through infusion like making tea. In the United States, where compost tea is getting popular in organic agriculture, compost is made into tea, sugar or molasses are added, fermented to increase microbial population.

A simple general formula or recipe in fermentation can be done for plants. For example, seaweeds. If you simply infuse seaweeds (which are quite difficult to breakdown, therefore hard to extract active ingredients), you may not get a more potent extracted active ingredients. If you ferment the same materials by adding sugar or molasses, it is easily broken down (biologically) by microorganisms and thus making nutrient more available. Microorganisms get their energy from sugar in fermenting the materials. Most healthy foods are fermented foods. Through fermentation, food are easily broken down, enzymes created, nutrition improved. That's the reason why fermented foods like yogurt or *kimchi* (Korean pickles) are more nutritious than plain milk or vegetables.

In making bionutrients, the simple formula is to add 1/3 crude sugar or molasses and mixed with materials to be fermented and extracted. For example, let's take papaya fruit fermented extract. We chop as thinly as possible ripe papaya, unwashed and unpeeled. We then add 1/3 crude sugar or molasses to the total weight or approximate volume of the papaya materials. Put the materials with at least 50-75% air gap and cover loosely lid and let it ferment for at least a week. After a week, you will notice some molds and microbial infections and will start smelling sweet, sour and alcoholic. The materials are then strained and liquid generated will be your pure fruit papaya extract. You can dilute this with 20 parts water. This diluted form can be used as bionutrient, using 2-4 tablespoons per gallon of water. Again, this extract can be added to animal drinking water and feeds, to compost pile or sprayed/watered to plants leaves and roots. This will be a good source of nutrient for plants or animals, and also for our beneficial indigenous microorganisms. Papaya extract is good source of enzyme pappain, beta-carotene and Vitamin C for example. So extract any plant material and just try to find out what kind of nutrients they have you can use for animal and plant nutrition. Should the materials you intend to use for extraction do not have much moisture (as compared to our papaya fruit example), you may add water enough to the level that will moisten all the materials.

Specific bionutrients, fermented plant and other material extracts we have used to a great success and you can adopt for their specific use:

### ***Kangkong* (water spinach) Fermented Extract**

This is essentially used as growth promotant. *Kangkong* is sometimes called water spinach. It is a kind of vegetable that typically grows in fresh water. It can also grow in highly moist soil. Its basic characteristic is it grows very fast, similar to the rapid growth of kelp in the seas. To the natural farmers, this kind of plant or similar plant for that matter have natural growth promotant. In the scientific agricultural parlance, we speak of natural growth hormones like gibberellins, auxins and cytokinins. Plants that grow fast will have a better concentrations of these natural growth hormones. By observation, *kangkong* or kelp or even mugwort will fall on this category. Thus, axillary buds of *kangkong*, plants like cucumber, squash and watermelon will be good materials to ferment for this purpose. Once these are fermented, active ingredients extracted, you may use this to spray and/or water your plants. You will notice a great improvement in the growth of your plants.

### **Banana-Squash-Papaya (BSP) Fermented Extract**

One of the major fermented extract we use for plant flowering and fruiting, specially for vegetables, are extracts from banana, squash and papaya. Apparently, these materials have high level of potassium especially banana, and beta carotene. Although I have not tried a similar recipe using materials readily available here in the US, I will presume that materials substitute can be used. For your own experimentation, you can possibly use comfrey, squash and carrot. Let me know if they will work. In the Philippines, when we induce flowering of mangoes, conventional agriculture use potassium nitrate. We have tried with success natural materials high in nitrogen and potassium. Interesting enough, our local organic farmers have experimented using seaweed extract in inducing flowering of mangoes. Isn't it seaweed extract have lots of natural growth hormones and trace elements, and good source of nitrogen and potassium? Check out the kinds of materials you can ferment and use to induce growth, flowering and fruiting.

### **Fish Amino Acid**

As a general rule, the higher the protein of the materials, when composted or fermented, the higher the nitrogen. We use a lot of fish scraps to generate high nitrogen on our fish extracts. Here in the US, fish emulsion is pretty popular. Again, on basic fermentation of this material, we use crude sugar or molasses, third ratio of the fish scraps. I personally like using molasses than crude sugar not just for cost considerations, but molasses minimizes those fishy odors. I have added lactic acid bacteria in fermenting these fish scraps that arrest the foul odors very evident of fish emulsion foliar fertilizers.

### **Calcium Phosphate**

A lot of agriculture advisers have used calcium phosphate for better plant growth, health, pest and disease controls. Natural farmers use this bionutrient very specific. Under the theory of Nutrioperiodism developed by a Japanese horticulturist, Yasushi Inoue in the 1930's, plants and animals need a very specific nutrient relative to the stage of their development. In the plant, there is the essential vegetative growth, *changeover* and the reproductive periods. In animals, like humans, there is the infantile, juvenile and adulthood. It is not only critical to provide the right nutrient at the right stage of the development, but also critical to use or apply specific nutrient of calcium phosphate in the juvenile or *changeover* period. For the plant, for example, we know that nitrogen is

critical on the vegetative stage as potassium is critical in the flowering and fruiting stages. It is however, the *changeover* period that is most critical that will determine the quality of the final reproductive stage. At this stage, an additional nutrient is badly needed by the plant. And this is calcium phosphate. Calcium phosphate is good for plants' "morning sickness". It is the stage that additional baby needs to be fed or the process where flower/fruit is about to come. Ash made from soybean stems are excellent for this purpose.

Here is a simple, natural method of generating calcium phosphate. Get eggshells and roast them enough to generate some good ashes. Afterwhich, dip these roasted eggshells on about equal visual volume of vinegar. Allow it to sit for a couple of weeks until eggshells are practically broken down by the vinegar acids. You may use this diluted 20 parts water and can be sprayed or watered to the plants during the *changeover* period. When this is applied to that *changeover* period, it will improve plant health and productivity.

The use of calcium phosphate is important to natural farmers. This however, does not mean that we shall forget the nutrient timing application of other critical nutrients for plant growth both macro and micro nutrients, given at the right stages and combinations. We consider this very important bionutrient needed by the plants used by natural farmers.

### **Ginger-Garlic Extract**

The original recipe of the natural farmers of Korea use not only the ginger and garlic materials, but also Chinese herbs like *Angelica acutiloba*, *Glycyrrhiza uralensis* and *Cinnamomum loureirii*. These Chinese herbs have one basic common denominator, they are good for digestion. We have used simply equal amount of ginger and garlic, less these Chinese herbs. This is our natural antibiotics we use for plants and animals. Remember the high level of sulfur on garlic? It is a good fungicide. The ginger-garlic extract is quite different from the plant extracts we have discussed. We soak the chopped up ginger and garlic in beer or wine overnight or 12 hours. Then we add 1/3 crude sugar and let it ferment for a couple of days like 5-7 days. Then we add alcohol which stabilizes and arrests fermentation. The alcohol should be at least 40% proof. The active ingredients of the ginger and garlic is extracted in finale with the use of alcohol similar to herbal tincture we are familiar with in homeopathy. Remember that ginger and garlic are highly medicinal and highly nutritious. We have used them as natural antibiotics and in preventive medicine. We have used this concoction on chicks and chickens and have made them healthy throughout. Of course, we also use them when we see animal weakening and when they are sick. We have used them on fungal problems of plants. We have used them for rheumatism. The uses are enormous both for plants and animals.

The potency of your plant extracts are relative to active ingredients that are available from the plants you are extracting. Most importantly, the part of the plants. For example, the energy on the plant part is most concentrated on the seed, fruit, leaf and other parts of the plants, to that general order. Seed is where the plant procreate itself. By simply adding moisture and heat, seed will germinate and will derive its nutrient for growth from

its own seed. What natural farmers are saying is that the energy or nutrition is more potent on the seed, fruit will be second and on the leaf third. That's the reason why when we ferment seeds like grain, our dilution for use is 1:1000 instead of 1:500. This is just a guideline. Sometimes, you can use more diluted form but with more frequent applications. There is really no clear cut rule. Things have to be based on experimentations, experiences and observations.

### **Designer Compost**

Improved, more potent, otherwise know as *bokashi* in Japan is essentially naturally fortified with macro and micro nutrients, or bionutrients and biodiversed beneficial indigenous microorganisms.

Here is a typical recipe we use in the Philippines:

- |                  |          |
|------------------|----------|
| - Rice Bran      | 10 kilos |
| - Copra Meal     | 20 kilos |
| - Coco Peat      | 20 kilos |
| - Chicken Manure | 30 kilos |
| - Charcoal Dust  | 20 kilos |
| - BIM*           | 1 liter  |
| - Molasses       | 1 kilo   |
| - Bionutrient    | 1 liter  |
- Beneficial Indigenous Microorganism

Similar recipe can be adopted here in the US, replacing or substituting similar materials above. A basic formulation that I use is very similar to the general formulation I use for animal feeds. Basic formulation consists of 80% carbohydrate, 17% protein and 3% Vitamin/Mineral. When we apply this formulation to our designer compost, we likewise find 80% carbon source, 17% nitrogen and 3% trace elements, as a matter of rule.

For the rice bran, you can substitute wheat or any inexpensive grain bran. Our copra meal or the materials residue after extracting oil from coconut can be substituted with corn meal or inexpensive meal that has ample amount of protein. Soybean is a good substitute or any other legumes. Coco peat can be substituted with peat moss. I will probably use sawdust or any materials high in carbon and lignin. Any kind of grain hay can also be used. Any kind of animal manure can likewise be used. It is however ideal to use chicken manure because of its more potent ingredients as far as macro nutrients like nitrogen, phosphorous, potassium and calcium, not to mention its good source of micro nutrients. Charcoal dust is used for it is a basic carbon which natural farmers find a good media or substrate for proliferation of beneficial microorganisms. And of course, the use of molasses (as sugar source) that really improve the population of microorganisms since it is a basic food source for them. Bionutrient will be a concoction of high level of macro and micro nutrients. Depending on your goal, like higher level of potassium for example, we kind of emphasize our bionutrient with fermented extract high in potassium. Likewise, if your intention is to have a more potent level of nitrogen, our bionutrient shall emphasize high level of nitrogen source like fish emulsion or plant

leguminous extract. You can likewise add and ferment rock dusts. The general key however, in this designer compost formulation or *bokashi* is potent biodiversed beneficial indigenous microorganisms and bionutrients. You may adjust this basic recipe relative to your requirements and observations. When you try to analyze our Philippine basic recipe, you will notice that it is pretty much satisfying the general formulation I have mentioned as to carbohydrate-carbon, protein-nitrogen and vitamin/mineral-micronutrients ratios. The real key to this recipe is providing a greater population of biodiversed beneficial indigenous microorganisms and bionutrients, with lots of carbon and organic matter. I bet you, it will make also good compost tea.

I have deliberately included this *bokashi* in this presentation to show that we natural farmers consider beneficial indigenous microorganisms and bionutrients of great importance for soil fertility and animal health. As we establish a healthy fertile soil, we observe healthy plants, animals, community and planet. Living soil is dependent on biodiversed microbial populations and nutrients that create a stable, balance and harmonious soil that determines healthy plants and animals. As we “farm with air, water and sunlight”, and nutrient, we likewise farm with microorganisms vital to soil fertility. As sustainable agriculture is based on soil fertility to perpetually sustain production, so is soil fertility is determined by diversity and balance of microbial ecologies.

### ***“Farming with Air, Water and Sunlight”***

People who have attended my seminars on organic and natural farming system for free-range chicken probably noticed my emphasis in utilizing the natural elements in Nature. This I term loosely as “*farming with air, water and sunlight*”. In the biodynamic parlance, heat is the other element I have not specifically mentioned for the simple reason that I associate heat with sunlight. The other element is nutrient. In summary, it is harnessing and providing these vital elements crucial to plant and animal agrowth used in agriculture. Ninety-six percent of the plant and animal growth is attributed to air, water and sunlight. Four percent can be attributed to nutrients and other elements. As we look to vital plant growth, especially in our forests, plants grow without a deliberate application of nutrient (fertilizer). They grow well, balance and in harmony, as they utilize the powers of air, water and sunlight available in Nature. Nutrients are derived from natural soil fertility. As organic matters decay and are taken up or consumed by microorganisms as food, the resulting reaction brings out nutrients supplied to the plants to sustain them. But most importantly, plants are able to utilize air, water and sunlight. Without them, plants do not grow well. This also applies to animal growth. If animals were unable to effectively utilize these powerful elements in Nature, animal will not grow well and healthy.

I am very specific in utilizing these power elements in Nature. If we fail to recognize and apply them in agriculture, we are bound to fail. A lot of farmers have become myopic and de-emphasized the utilization of these power elements. Farmers, especially the conventional ones, have simply emphasized the Nitrogen-Phosphorous-Potassium (NPK) farming scheme. It is simply providing nutrients of nitrogen, phosphorous and potassium

in agriculture. In the same token, when pests and diseases occur, the way to eliminate them is by way of spraying synthetic pesticides. And when applied to livestock, the principal emphasis of conventional farmers on the role of feeds and antibiotics. They always speak of balanced fertilization, balanced diet but with the use of chemicals.

How do we harness these power elements in Nature? How do we apply the principle of *“farming with air, water and sunlight?”*

In Biointensive mini-farming, one of the basic requirement in the preparation of planting beds is the technique of double digging. In this method, the soil is loosened up to 24 inches compared to conventional agriculture of 8-10 inches only as they use plows or tractors. With 24 inches loosening up of soil, we are able to allow more air to pass through the soil. Air is vital to plant growth. We never ask ourselves why plants grow well on loosened soil, as compared to compacted soil. We simply assumed it is natural. The vital element of water is also taken for granted. Of course, if we do not water the plants, they do get enough moisture deliberately or naturally, plants do not grow well. In some, if not in most cases, they die.

This applies to sunlight. No sun, no life. No photosynthesis, no food production for plant's nourishment. Plant foliage is stimulated by sunlight. Heat plays a vital role for the plants. This is the reason why we emphasize the proper utilization of sunlight in Biointensive mini-farming. Why do we have to plant east-west orientation? In other instances, why plant north-south orientation? And why transplant a few days before the new moon? They all apply to the utilization of sunlight. The sun rises from the east and sets in the west. With this orientation, we get maximum exposure to sunlight. In my planting beds, however, with the north-south orientation, we apply the interplanting method or companion planting where shorter plants are planted towards the northern portion to maximize the use of sunlighting and shading. Although the sun rises in the east, and sets in the west, the sun inclines a little to the northern side. The moon is also the reflection of the sun. When we plant towards the new moon, or even full moon, we are effectively adding more or making available “sunlight” to the plant. Have you noticed the influence of the moon on plant growth? When there's full moon, we see more light.

This principle is also applied to livestock. I always emphasize on my seminars on natural farming system for free-range chicken how the *“farming with air, water and sunlight”* is applied. In the housing design for free-range chicken, the air movement, and ventilation is highly emphasized. It is mandatory that the housing have an exhaust ventilation. It is also emphasized that the substrate are loose with lots of sawdust, wood shavings and compost. In fact, I use substrate as deep as one yard. We try to allow better air movement not only through the housing but also the litter substrate. The housing of chicken is also oriented east-west to get maximum exposure to sunlight. In fact, we make sure that the portion of the roofing is transparent to allow the sunlight to come into the chicken housing. It is also emphasized that we provide water, clean water to the chicken all the time. If we do not provide good air movement and ventilation, sunlight and clean water, our chickens do not grow well and healthy. In the conventional way of growing

chickens, the use of antibiotics are imperative. High density, crowding, foul decomposing smells of manure and practically no sunlight penetration, all these cause diseases. This is the reason why these chickens are loaded with antibiotics. The natural way of growing chickens is the free-range method where chickens can properly access air, water and sunlight freely.

We never pay attention much to these factors that really or greatly influence our agriculture. The more we recognize and apply this principle in our agriculture, the more successful we will become. The best way is the natural way, harnessing the power elements in Nature. Allow ourselves to “speak” with the soil, with the plants and animals, and they will tell us what should be done to improve our agriculture. Nature is complete. As we relate to the ways of Nature, Nature starts to unfold its mysteries to us. As I always say, the answer to our questions in agriculture will not really come from us, but from Nature herself. I remember when a farm help asked me why his veggies do not seem to grow well in one of his plant beds., when he has already applied everything I have taught him about vegetable gardening. I ask him to look to the sky and pray to God and ask why his vegetables do not grow well. So he did exactly what I said. And as he prays and looks to the sky, he finds a shrub tree shading overshadowing his plant bed. And he said: “there is not much light coming to my vegetables”. No wonder , his plants do not grow well.

In as much as we need to feed our soils and consequently our plants, and creating a healthy environment both for our plants and animals with balance nutrition, let us not forget that the first and foremost, we have to effectively farm with “*air, water and sunlight*”.

I hope learning to grow and culture these vital beneficial indigenous microorganisms and harnessing the power elements in Nature and learning from Her, shall empower the farmers to self-determination, providing food to us all, sustaining life.

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