Indigenous Microorganisms: Grow Your Own Beneficial Indigenous Microorganism

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 wcys 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 reusers."

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 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 and Garden and had used this Asian natural farming technology not only in raising foul odor free, healthy chickens and vegetables in our kitchen garden. Interesting enough, we had grown healthy chickens without the use of vaccines and antibiotics, fed the chickens only once a day. We had raised some vegetables in our kitchen garden, bed inoculated with beneficial 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 orchids had grown well and healthy.

Some apprentices at the UCSC Farm and Garden had used these microbes for diarrhea and constipation, including canker sores. A concoction of our biological nutrient ginger-garlic extract had helped apprentices and 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 improve wastes decomposition.

In the Philippines where in the past two years, I had conducted seminar-workshop in the use of these beneficial indigenous 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 Whittman, 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 they 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 had the opportunity to visit 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 to 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. Whittman 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 plant 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 agrecological 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 enery *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 vard 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 dung got mixed naturally with the substrate through the chickens scratchings, which actually aerate the substrate. One of the major microbe of the beneficial microorganisms was lactic acid bacteria that arrest the foul odors and consequently help takes 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? Afterall, is it not nutrient that makes the plan 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 plants. 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 that the important role of the beneficial indigenous microorganisms.

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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 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 what I advised him this time was 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. Definitely, there were microbial and nutritional imbalance. 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 probably speak a lot of examples and experiences for I would like for 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 we 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 strain of beneficial microorganism is popularly used

in composting that specifically help 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. It's application in organic farming is enormous. Lactic acid bacteria is specially used in natural piggery. Pigs are allowed to roam they 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 converts these wastes into unharmful 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 quality of water stresses the fish which in turn stunt 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 microorganism 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 help 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 know to produce enzymes and natural antibiotics aiding effective digestion and 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 any 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 moveinto the container) container with lid loosely. Put the container in a quiet area with no direct sunlight. Allow the rice wash to ferment for at least 5-7 days. Lactic acid bacteria will gather in 5-7 days when temperature is 20-25 degree 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 AT . N. T.

simply add equal amount of crude sugar (dilute sugar 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 is 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 from Japan contain 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 microorganisms 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 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 diversed, aged beneficial indigenous microorganism. 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 one 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 you 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. 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 of 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 materials 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. 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 on the a very specific stage, especially during their flowering/fruiting 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 (B.I.M.) 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 diversed 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..

Different types of microorganisms thrive on different types of food. 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. And as you will notice on attached illustrations, we kind of mix these beneficial indigenous microorganisms with fermented plant extracts (fermented plant and fruit juices), Oriental herbal 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 yougurt 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 a 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 tablespoon 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 used 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 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 lettuce0 Fermented Extract

This is essentially used as growth promotant. Kangkong is sometimes called water lettuce. It is a kind of vegetable that typically grow 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 of 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. One 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 the 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 that seaweed extract have lots on 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 Extract

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 scientist 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 period, *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 stage. It is however, the *changeoven* 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". Ash made from soybean stems is excellent for this purpose. You may refer to the illustration on *changeover*.

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, 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 a 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, Glycurrhiza 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. When you refer to the illustration on Oriental Herbal Nutrients, you will notice the use of wine or beer for 12 hours, the use of 1/3 crude sugar and eventual addition of distilled liquor. The essential difference from our regular fermentation is the use of alcohol which stabilizes and arrests fermentation. The active ingredients of the ginger and garlic are 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 on 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 plant, 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 that the energy or nutrition is more potent on the seed, fruit will be second and on the leaves 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 compost, otherwise known 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	*Beneficial
Molasses	1 kilo	Indigenous
Bionutrient	1 liter	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 general 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 original has ample amount of protein. Soybean is a good substitute or any 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 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 micronutrients. 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. 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 have deliberately include 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. It is intended for their application to our sustainable agriculture – the vital function of beneficial microorganisms after we have cultured them.

We natural farmers of the East pay special attention to these beneficial indigenous microorganisms and bionutrients in our farming practices. We however, still use a holistic approach with ever considerations of other elements affecting plant and animal growth and 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. And beyond the terrestrial influence in agriculture, lies the celestial forces that affect plants and animals. As we "farmwith 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 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 growth used in agriculture. Ninety-six percent of 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, balanced 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, animals 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 deemphasized 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 farmer 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 not get enough moisture deliberately or naturally so that plants do not grow well. In some, if not in most instances, 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 have to plant east-west orientation? In other instances, why plant northsouth 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 the 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 a 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 thie "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 meter. We try to allow better air movement not only through the housing but 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 freerange 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 to 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 his 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 environmental both for our plants and animals with balance nutrition, let us not forget that first and foremost, we have to effectively farm with "air, water and sunlight".

I hope learning to grow and culture these vital beneficial indigenous microorganism 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.

References:

S: Korean Natural Farming, Indigenous Microorganism Vital Power for Crop and Livestock, Han Kyu Cho and Atsushi Kouama, Korean Natural Farming Publisher.

Organic Corner, Gil Carandang. Organic Matters magazine Vol. 2 Issue 3, No. 4 and Vol. 3 Issue 2, No. 7.





(from rice straw) Indigenous Microorganisms 2



(through mixing leaf mold with rice bran) Indigenous Microorganisms 3







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N MARY SALES

· Put attractants in places in the fields



Rain water is no problem.

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- -standing →lying →when standing again
- fruit crop such as tomato and cucumber
 when the first flower comes out

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Ingredients and Instructions for Microbe Brew

- 1. Bacillus Spaericus
- 2. Bacillus Licheniformis
- 3. Bacillus Sublilis
- 4. Bacillus Cereus
- 5. Bacillus Megaterium
- 6. Azotobacter Vinelandi
- 7. Lactobacillus Acidophilus
- 8. Rhizobium Japonicum
- 9. Aspergillus Oryzae
- 10. Pseridomonos Putida

Additional Microbes:

- 1. Wild forest microbes (rice bags under big Trees, 12" deep)
- 2. Meadow microbes (rice bags 6" deep)

Note: The above two groups contain the disease resistance that keep the area healthy.

- 1. Bamboo microbes for their strong growth promoting hormones
- 2. Plant specific microbes from the base a a similar plant that did well and grew to maturity.

Plant steamed rice bags. One nylon cut in half and tied to make two rice bags. Put two or three cups of cooked rice in each bag. Then plant a bag of rice at the base of three of your biggest healthiest trees (different varieties). Plant 12" deep.

Also plant one bag of rice 6" deep in a meadow (there are different microbes in each location) Plant one bag of rice 6" deep in the healthiest bamboo patch you can find.

Leave the rice bags buried for 2 to 3 weeks. The microbes will colonize on the starch. Dig up the rice bags after 2-3 weeks and put them into 5 gallon buckets. Now add 2 to 3 gal. of blackstrap molasses (cattle grade from local feed store) to each 5 gal. bucket with the bag of rice (opened up) and fill with water to 2/ 3 full. Mix well, cover and leave in a warm area (not direct sunlight) ferment for about 3 weeks. Than batch all-buckets into a 50 gallon plastic drum.

Spray soil with microbe mixture and water throughly into soil in planting area. Dilute 4 or 5 qt's for this before planting and also at planting. Later I add a gallon of liquid kelp to each 5 gallon of mixed microbes and use as a foliar spray. I dilute my finished mix to about a oz (1cup) to 1 gallon of water. Be sure and strain mixture through a 5 gallon paint strainer bay (purple) at any paint store) just before you put it in your sprayer.

I recharge my microbe mixture with a gal. or two of black stran molasses every few months throughout the season. Foliar spray once a week in the morning.

- Ectomycorriza:

 - 1. Pisolithus tinctorius
 - 2. Rhizopogon villosuli
 - 3. Rhizopogon luteolus
 - 4. Rhizopogon amylopogon
 - 5. Rhizopogon fulvigleba

Endomycorriza:

- 1. Glomus intraradices
 - 2. Glomus mosseae
 - 3. Glomus aggregatum
 - 4. Gomus clarum
 - 5. Glomus monosporus
 - 6. Gigaspora margarita
 - 7. Paraglomus brasilianum

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