Organic Farming in the Tropics Using Microorganisms: The Philippine Experience

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Organic farming is still a marginal growing method in the Philippines since agriculture remains generally dependent on massive use of agro-chemicals for the popular belief that these could deliver increased productivity and profitability.

There are about 13 big agrochemical companies in the country, today: nine are foreign companies that control 85% of the market. Five of which also lead the transgenic seed business that produces so-called high-yielding, high-quality seed varieties. These new varieties are starting to take on farmers' preferences especially given much government promotions.

However, a growing number of people in the country are already convinced that organic farming could be a better alternative to the present's destructive chemical-intensive farming. Nobody could dispute that fact, but local agriculture still faces a lot of other huge problems at present.

Reality check on Philippine agriculture

Most farms in the country are very small, only about 5 acres on the average. And so, harvest area and yield capacity are also limited. Landlessness is still a major concern since seven out of ten farmers do not own the land they till, according to IBON Data Bank. These landless farmers eventually become farm workers, and they keep growing in numbers now. They are employed seasonally and paid on daily basis by independent farmers or big commercial farms.

The rise and growth of the farm workers sector have made farming manual labor intensive, in general. This is despite the advance in modern technology and agricultural science worldwide. Local farmers as well as commercial farms resort to employing seasonal farm workers to do planting and harvesting for them because it is also cheaper than acquiring and maintaining farm technologies.

Also, the country does not have basic industries that manufacture farm implements, thus, most farm inputs, tools and machineries need to be sourced from other countries. Most independent farmers use only simple tractor or draught animal like *carabao* (water buffalo) since high-priced farm implements are beyond their means.

Access to modern farm machineries, processing services and post-harvest facilities is often limited to big commercial farms, agribusiness corporations, contract growers and multinational companies.

There are rural merchants and farmers, however, who make a living by leasing their farm implements to other farmers on hourly or daily basis. Some government-owned corporations also lease low-priced farm equipment and machineries to farmers and cooperatives.

Erratic weather conditions as well as insufficient irrigation and water supply are significant factors that also influence the country's agriculture performance. Since there is not enough and effective irrigation system in the countryside, farmers rely heavily on unpredictable rain.

The continued and increasing importation of major crops such as rice, corn and sugar likewise make agriculture less self-reliant in terms of food production for domestic consumption. The country could not produce enough of what it needs, affordably; that's why it relies heavily on foreign trading.

But despite such inadequacies, the local agriculture could still make some significant growth in performance. In 2004, agriculture performance grew by 5.06% putting the gross value of agricultural output amounted to $14 billion (P784B) at current prices, which is 18.40% more than last year's level according to the records of the Agriculture Department.

In terms of employment, the agriculture, fishery and forestry sector also employ the second biggest chunk at 11.2 million of the country's 35.4 million total labor force in 2004, according to the Bureau of Labor and Employment and Statistics (BLES).

Efforts to Promote Organic Farming

Based on common definition, the system of organic farming raises and processes plants and animals that are used as food sources without using toxic chemicals, which include synthetic fertilizers, pesticides, herbicides, antibiotics, irradiation, and additives such as artificial colors, flavors and preservatives. It also does not involve the genetic modification of crops.

Organic farming was first introduced in the Philippines during the mid of 1980s. It was an offshoot of environmental advocacy movement rather than agriculture development.

Today, efforts are continuously building up to push large-scale organic farming locally. There are four bills in the House of Representatives seeking to promote organic farming in the country. House Bills 413, 959 and 1637, respectively; propose the establishment of a comprehensive bio-organic farming program in the country.

The program is designed to develop and propagate bio-organic cultivation and production methods. It also aims to educate farmers and provide extension services to individuals or groups who are practicing bio-organic farming.

Meanwhile, House Bill 559 seeks to establish an organic farming training and production facility in every agricultural barangay in the country.

A grant of special rates on loans intended for organic farming is also being raised in the Lower House as well as an increase in the proposed P50 million fund for the supply of organic fertilizers, nationwide.

However, since these bills still await Lower House approval, the Agriculture Department came up with two palliative programs, *Tipid Abono* Fertilizer Saving Program and Balanced Fertilizer Program.

The first one encourages use of organic fertilizers as substitute to expensive inorganic fertilizers while the second one utilizes a combination of chemical and organic fertilizers.

The private sector and non-government organizations, on the other hand, are more aggressive with their advocacy for organic farming. There are five (5) Philippine-based institutions, for instance, that are actively involved in an international movement for the advance of organic agriculture in the developing countries, particularly.

These institutions: the Alter Trade Corporation (ATC), Farmer-Scientist Partnership for Development (MASIPAG), Organic Certification Center of the Philippines (OCCP), Organic Producers Trade Association (OPTA), and the Sustainable Agriculture Center (SAC) at Xavier University are members of the Germany-based International Federation of Organic Agriculture Movements (IFOAM), which tries to unite 750 member organizations in 108 countries for such a cause.

Organic Rice Production Started

Meanwhile, the organic rice industry is already showing potential for large-scale production. An Agriculture Department agency, the Philippine Development Assistance Program (PDAP) claimed that organic rice production per hectare is now comparable to the yield of hybrid rice varieties. And there are already organic rice varieties being sold in Metro Manila supermarkets.

Another large-scale effort for organic rice production is being started by the Ecotech-Masipag Foundation in its satellite farms in Zambales. Reports said that its method of organic farming that grows native and traditional rice varieties respond well to organic fertilizers, and pest resistant.

Other efforts to advance organic farming are also making headway through the individual advocacy and commitment of independent organic farmers and growers in the country; one of which is Gil Carandang of Herbana Farms.

Organic Farming Using Microorganisms

Herbana Farms is located in Calamba, Laguna which is 30 miles south of Manila. This farm is known for its use of indigenous microorganisms (IMOs) in its organic farming method. IMOs, based on definition, are microbes cultured from plants and native materials found in the farm locality.

The farm is a 10 acre ecological organic demonstration farm that produces herbs, salad greens, specialty vegetables, cut flowers and free-range chickens. It offers training and apprenticeship programs for different organic and natural farming technologies. It accommodates local and international participants as well.

The farm is owned and run by full-time farmer and Fulbright scholar Gil Carandang, known to have brought the technology, which he named Beneficial Indigenous Microorganisms or BIM, in the Philippines. He is also involved in organic certification and organic farm development.

Carandang acquired his organic farming exposures from varied influences. He studied Sustainable Biointensive Mini-Farming under John Jeavons of the Ecology Action in California and the Natural Farming Systems for Crops and Livestocks under Dr. Han Kyu Cho of the Korean Natural Farming Association. He was an apprentice with the Natural Farmers of Japan as well as at the Center for Agroecology and Sustainable Food Systems of the University of California, Sta. Cruz on Ecological Horticulture. He attended workshops on Biodynamic Preparations and Permaculture Design Course with the Biodynamics Association of Northern California and the Biodynamics Association of Northern California, respectively.

Organic farming, for Carandang, is a way of life rather than a means to improve production for agricultural efficiency. He promotes organic farming as a passion because he believes farming needs to be humanized and farmers need to achieve certain level of commitment for organic farming, both economic and ecological. He believes farmers must be able to decipher that farming is all about growing or healing the soil, creating food and harnessing life. Otherwise, they can always get tempted to go back to hazardous agro-chemical use.

"I'm trying to elevate farming as a very noble profession and correct the misconception especially among our farmers whose reason for sending their children to school is to prevent them from becoming farmers like them," he says.

How is it different to do organic farming in the tropics?

(GC): It is not much different. The only limiting factor in the tropics is too much rain. The nutrient is trapped with the biomass of the plant while in temperate areas it is with the soil. And a lot of nutrients volatize quickly in the tropics.

What is the technology behind BIM?

(GC): BIM are microbial inoculants, cultured from bio-diverse forest and grassland microorganisms used for composting, soil building and control of pests and diseases.

The general principle behind BIM is basic: growing or healing the soil by building up its life and biodiversity through the cultivation of beneficial indigenous microorganisms. The microbes break down the nutrients and make them accessible to the plants as food. The BIM can be gathered through the use of cheap and accessible everyday ingredients such as vodka, generic brown sugar, milk, garlic, mango, rice and local soil.

The preparation is quite simple. Set up a carbohydrate food such as rice to attract microbes from a place through its air, soil, plants or animals. In case of *Lactobacilli*, they are collected by using milk while forest microbes are collected by using cooked white rice. Feed the microbes with sugar so they can multiply. Dilute solution and apply it to compost pile or directly to soil or plants.

The cultivation of BIM is a technology initiated by the Koreans. They empower their farmers by teaching them to grow the microbes that they use for farming rather than rely on purchase of crop nutrients and growth boosters. I started sharing this technology two years ago when I held several workshops in the Ecofarm Conference in Monterey, California and New Mexico.

Now, if biodynamic relies on the influences of everything above ground, BIM counts on the influences of the microbes because the real workers that make soil fertile are the beneficial microbes. Microbe is a food in itself, when it dies; whatever is inside the microbe is released as nutrient in the form of microbe protein. When protein decomposed, it becomes nitrogen. As I grow the soil, I also grow the life forms in the soil including earthworms, bacteria and fungi. The use of BIM, however, is only necessary if a farm could not maintain enough biodiversity. This condition is especially common among agricultural and mono-cropping lands.

How did you realize that BIM could be an important technology for organic farming?

(CG): This technology is not new. It has always been utilized by farmers. But, they never pay close attention when they use earthworm casting or manure compost for fertilizer. If you analyze it, the microbes are the ones that process them into foods for the plants. Some farmers even put certain herbs or concoctions to compost pile to stimulate the microbial activity that creates the food. This is biodynamic at work; our local farmers just do not realize it.

How do you think BIM can solve soil toxicity and nutrient deficiencies in soil?

(GC): This is a problem now in most agricultural lands because tons of chemicals are feed directly into the plants and pollute the soil and water sources. In fact, Jaime Tadeo of PARAGOS PILIPINAS revealed that the country's farm lands are now experiencing fertilizer fatigue or multiple nutrient deficiencies in soil. And this could be attributed to the excessive use of agrochemicals. He explained that the acceptable rice toxicity content, as prescribed by the United Nations, is only 0.015 parts per million, which is far in comparison to the Philippines' rice toxicity value of 0.83 parts per million.

With the BIM system, the focus is in completing and sustaining the farming cycle without creating pollution.

When there is nutrient deficiency in soil; one can get the needed nutrients mainly from the plants because certain type of plant accumulates certain type of nutrient. Banana, for instance, is a great accumulator of potassium because it is 43% potassium. In a banana plantation, if there is potash deficiency in soil and you need to get a good source of potash necessary in growing banana – you can extract it directly from the banana biologically using microbial extraction; and add the extract to the compost pile.

I have created a compost pile especially for BIM. I call it 'Bukasi,' a Japanese term. It elevates the nutritional value of the compost since I also add other ingredients such as sugar, plant extracts, charcoal, and the BIM.

Now, if there is one type of plant that accumulates the most types of nutrients, these are the seaweeds. Seaweeds are known to be the greatest trace element accumulator. As what geology taught us, the top soil and mineral from the mountains get washed out to the sea shore; and the seaweeds accumulate all the minerals down below.

Another good example is phosphorous, which could be sourced directly from the root crops. If there is phosphorous deficiency in soil I could extract from cassava, then I have phosphorus. If I want nitrogen, I could extract from nitrogen fixing legumes.

But again, plants cannot absorb these organic extracts, so I have to change them into inorganic form. And the way to do it is through the use of microorganisms. I focus on beneficial and indigenous because they have to be gathered from the locality.

Lactobacilli are strains of bacteria I used to spray on orchids. People thought I was spraying fertilizer, but I told them I was spraying bacteria. On the leaves of the orchids are some organic matters in the form of dusts, which are food technically. The lactic acid bacteria feed on these dusts. Then, it becomes food for the plants to be absorbed by the stomata.

If a farm had been using chemicals for quite a time, how long does it take to heal the soil before it can go organic?

(GC): Actually, you can heal the soil very quickly. But if you talk to some organic farmers, they will say it takes generally five to seven years. I agree with them, but I have proven that through the use of BIM, you can get back soil fertility in a year's time.

I have helped a farmer with his 100 acres sugarcane farm. He could not afford Urea

(chemical fertilizer) anymore because the cost went up from $14.29 to $19.64 per bag. He is already spending about $13,750 for Urea alone, last season. I helped him make his own organic fertilizer using my microbial inoculants. After a year, he was able to convert his sugarcane land to organic 100% and he got about the same tonnage that he was getting before he went organic.

So technically, there is not much change in terms of yields but he was able to save on fertilizer cost. If he used the standard organic fertilizer, he has to use 60 bags of conventional organic fertilizer, which is $4.46 per bag. But, with the use of BIM, he had only used 25 bags of standard organic. Plus, he got a better grade because the sugar content went a little bit higher.

He is not an organic man. He is mainly concerned about his cost, which is what most farmers worry about. The secret is the microbial count – I increased the level of microorganisms in his compost.

How can BIM protect an organic farm from pests and diseases as well as from GMO contamination?

(GC): When we do pest control, we also use microbial techniques. If there are open pathways in the soil, the beneficial microbes could go in and occupy the pathways or it could be the pathogenic microbes. If the beneficial microbes got in first, then, there would be no rooms for the pathogens anymore. If the pathogens got in first, then you can release microbes that will prey on these pathogenic microbes. It's a prey and predator relationship. The technique is to spray the plants with beneficial microbes so there's no room for the pathogenic microbes to come in.

At Herbana Farms, we have specific solution for specific kind of crop disease. I am using *Neem* pesticide extract, which is a broad spectrum botanical pesticide. I also use Benpest or short for beneficial pest, which is also a botanical plant extract. This is a natural pesticide plant extract derived from *Neem* and *Gliricidia Sepium* plus the BIM. Another one is *Calphos* or natural calcium-phosphate extract. It improves plant resistant to diseases as well as the general health of the plants through better access and strengthening of plant cell walls.

When you have specific disease in your farm, what you need to do is create diversity or do rotation and less on mono-cropping. This could be another technique. You create a mini-ecosystem that creates balance and harmony within a particular ecosystem.

Mostly, the problem of crop pests and diseases is a problem of imbalance and disharmony. You cannot create balance and harmony if you do not have biodiversity. If I cannot create biodiversity because I do not have enough plants around the farm, then I create it through microbial diversity.

I design certain types of microbes for certain types of crops and soil. Right now, I am helping a local commercial farm based in Lanao, Mindanao that grows cassava or tapioca. This farm company controls about 50% of cassava starch supply in the Philippines. It has 10,000 acres of cassava plantation and it wants to go organic to achieve higher starch content.

This farm used to rely heavily on chemicals. But with chemicals, come too much water and it could not get enough starch. I am studying the different species of the plant right now in order to design an organic fertilizer strictly for cassava plantation. I already got some materials from Lanao and I am culturing microbes from the cassava as well as from the local forest in Lanao.

Now, when it comes to protecting the farm from GMO contamination, the BIM technology can doing nothing about it, yet. You see, I do not have a problem with my corn here because there is no Bt corn hybrid around. But I know this will become a big political issue in the future.