BENEFICIAL MICROBES

Organic microbial solutions for enhanced soil health, crop vitality, and regenerative farming

Martin Costello

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ABOUT THE AUTHOR

Martin Costello is a social entrepreneur based in the East Midlands, whose career has spanned participatory arts, community activism, and education, most recently focusing on agriculture and the environment. He founded a thriving special school for trauma-impacted young people, built from the ground up on the principles described by E.F. Schumacher in *Small Is Beautiful*. Martin later brought this same philosophy to his work with renowned vermiculturist Anna de la Vega at The Urban Worm, where he was inspired by the cyclical 'alchemy' of decay, decomposition, and regeneration to become a skilled composter. His hands-on experience with vermiculture and fermentation processes directly led to this Fellowship undertaking.

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My thanks go to everyone I met and worked alongside in The Philippines who hosted me, gave their knowledge with unstinting generosity, and extended their kindness in other ways whenever I needed a lift – whether a physical lift to the buko pie shop or the emotional lift of cheering me up when it rained or when the mosquitoes were unreasonably aggressive. But especially and in particular, I must credit and thank Mr. Michael Cagas for taking so much time to consider my project and make sure that I got in front of the right people at the right times, as well as sharing his tireless passion for the social, economic and environmental wellbeing of Filipino farmers. It was Michael who planted the seed about beneficial microbes back in 2018, and was there in 2023 when I needed his expertise for this Fellowship. Thanks also to Marvin Cagas for driving us both – Michael and myself – wherever we needed to go and whenever we needed to get there.

EXECUTIVE SUMMARY

This report details the findings of a Churchill Fellowship undertaken in the Philippines, investigating innovative low-cost organic farming practices to enhance farmer self-sufficiency and soil health. Confronted by mounting pressures from escalating input costs, environmental degradation, and the urgent need to address soil depletion in the UK, the Fellowship explored a farmer-led movement focused on self-produced biological inputs. The central inquiry: how the Filipino model of cultivating and applying Enhanced Microorganisms (EM) and other diverse ferments, alongside its supporting ecosystem, could offer transferable solutions for more resilient and sustainable UK agriculture.

Major Findings:

- Indigenous Microorganisms (IMOs) underpin self-reliance: The Fellowship demonstrated how IMOs form the foundation for converting organic waste into fertile soil amendments, significantly enhancing carbon sequestration and reducing reliance on external, costly fertility inputs.

- Diverse microbial ferments offer targeted solutions: Beyond IMOs, specific ferments like Fermented Plant and Fruit Juices, and particularly scalable Enhanced Microorganism (EM) solutions, provide versatile, cost-effective tools for varied agricultural applications, potentially adaptable for large-scale UK use.

- Policy, ethos, and ground-up empowerment drive adoption: Success in the Philippines is fostered by explicit government support (from national legislative acts to local technical committees), a pragmatic farmer ethos driven by economic benefits, and an effective, peer-led training infrastructure. While generally robust, a potential vulnerability exists in the significant authority vested in local leaders.

Recommendations:

- Develop a UK-Specific Microbial Ferment Resource Manual: Create an accessible guide for farmers on identifying, collecting, and cultivating local microbial sources and producing on-farm ferments to reduce reliance on commercial inputs.

- Strengthen Farmer-Led Demonstration and Data Collection: Expand existing UK initiatives to support farmers in rigorously trialing and documenting the efficacy of these specific microbial ferment applications under UK conditions.

- Amplify Ground-Up Farmer Networks and Lived-Experience Training Models: Systematically enhance and fund peer-led farmer-to-farmer learning networks, mirroring the successful, practical training models observed in the Philippines.

- Government Review of International Policy Instruments: Defra should undertake a comprehensive review of foreign policy frameworks that actively promote and scale organic agriculture through state backing, to inform future UK agricultural strategies.

INTRODUCTION

Background to the Project

The pursuit of sustainable and resilient agricultural systems is a global imperative, particularly as conventional farming faces mounting pressures from escalating input costs, environmental degradation, and the impacts of climate change. In the UK, challenges of declining soil health, reliance on synthetic chemical inputs, food security, and farmer profitability are at the forefront of the agricultural agenda. Concerns around soil degradation are particularly urgent, with stark warnings from various sources highlighting the accelerated rate at which vital topsoil is being lost, underscoring an emergency for our land.

My interest in these challenges, and a potential solution, first emerged during an unrelated tour of organic farms in the Philippines in 2018, where I was introduced to the concept of Enhanced Microorganisms (EM) used in combination with vermiculture, a field I was already involved with and the reason I was in the Philippines at that time. This initial interest led to further remote research, though much of the readily available information focused on the proprietary product '*EM-1*' and its associated '*Effective Microorganisms*' brand. Through online conversations with Michael Cagas, a leading figure in Philippine organic farming, I learned about a grassroots movement of farmers who were successfully making their *own* varieties of these beneficial microbial solutions under the generic term 'Enhanced Microorganisms'. This proved to be the pivotal insight that shaped my Churchill Fellowship.

Awarded a travel bursary in February 2020, my Fellowship was designed to delve deeply into these farmer-led practices. My travel was delayed until late 2023. This report documents my on-the-ground investigation into these self-made microbial solutions and the broader support systems that enable Filipino farmers to achieve a significant level of self-reliance in how they manage soil and animal health. It explores key concepts central to this approach, including organic ferments, microbial farming, self-reliance, and farmer empowerment, providing a tangible roadmap for their potential application in the UK context.

Aims and Objectives of the Project

This Churchill Fellowship aimed to explore and identify transferable models of sustainable, low-input organic agriculture from the Philippines, with a view to enhancing farmer self-reliance and environmental resilience in the UK.

Specifically, the objectives of this Fellowship were to:

- **Learn Practical Production Techniques:** To gain hands-on experience and master the practical techniques for cultivating and applying indigenous microorganisms (IMOs), alongside other on-farm ferments such as Fermented Plant Juices (FPJs), Fermented Fruit Juices (FFJs), and Enhanced Microorganism (EM) solutions. A core objective was to understand how farmers produce these solutions independently, thereby reducing their reliance on costly, proprietary, and often imported agricultural inputs.

- **Understand Underlying Ethos and Drivers:** To investigate the philosophical underpinnings and pragmatic motivations that encourage the widespread adoption of these organic practices among Filipino farming communities, including the economic and social incentives.

- **Examine Support Structures and Policy:** To identify and analyse the formal and informal support structures, including government policies, local community initiatives, and training methodologies, that facilitate the widespread dissemination and implementation of these methods.

- **Observe Ground-Level Application:** To work directly with producers and farmers in their own settings, observing real-world application of these techniques and understanding the practicalities and benefits in diverse farming contexts.

- **Assess UK Applicability:** To critically evaluate the potential for adapting and transferring these low-cost, biologically-driven practices, along with their associated support models, to the UK agricultural landscape.

Purpose of the Report

This report aims to inform and inspire stakeholders across the UK agricultural sector about the potential of indigenous and 'enhanced' microbial solutions, drawing upon the highly effective practices observed in the Philippines. It seeks to initiate discussion on how these low-cost, biologically-driven farming methods, alongside enabling policy and community structures, could be adapted to enhance the resilience, profitability, and environmental sustainability of UK farms. While offering insights and practical observations, this document serves as a starter for further exploration and collaborative action, acknowledging that the full realisation of these approaches in the UK will require dedicated research, practical experimentation, and broad engagement.

Approach/Methods




My Fellowship was characterised by an immersive and participatory approach to data collection and learning. Guided throughout by the mentorship of Michael Cagas, a leading figure in Philippine organic farming, my research extended beyond simple observation. I engaged directly in hands-on learning, participating in the practical production of various microbial ferments. This included making Indigenous Microorganisms (IMOs), Fermented Plant Juices (FPJs), Fermented Fruit Juices (FFJs), and the production of Enhanced Microorganism (EM) solutions - '*concoctions*', colloquially - in diverse settings.

My learning journey was enriched by attending formal training sessions and informal farmer meetings, often held at local '*barangay*' community halls or dedicated on-farm training facilities. Michael Cagas facilitated introductions to a wide spectrum of stakeholders across the country, including academics, scientists, agricultural consultants, working farmers, government officials, commercial EM producers, and end-users. This allowed for extensive direct observation and qualitative insight into the practical application, underlying philosophies, and enabling structures of organic agriculture. The experience was tooted in practical and at times labour-intensive, training alongside Filipino farmers. This provided a 'lived' understanding to augment my theoretical overview of the subject.

FINDINGS

My Churchill Fellowship to the Philippines yielded three core findings, each offering valuable insights into effective and sustainable organic farming practices and their enabling environments:

- Indigenous Microorganisms (IMOs) as a Foundation for Self-Reliance
- Microbial Ferments for Targeted Outcomes
- Policy, Ethos, and Ground-Up Empowerment

These findings demonstrate a holistic approach to regenerative agriculture that fosters both environmental stewardship and farmer resilience.

1. Indigenous Microorganisms (IMOs) as a Foundation for Self-Reliance

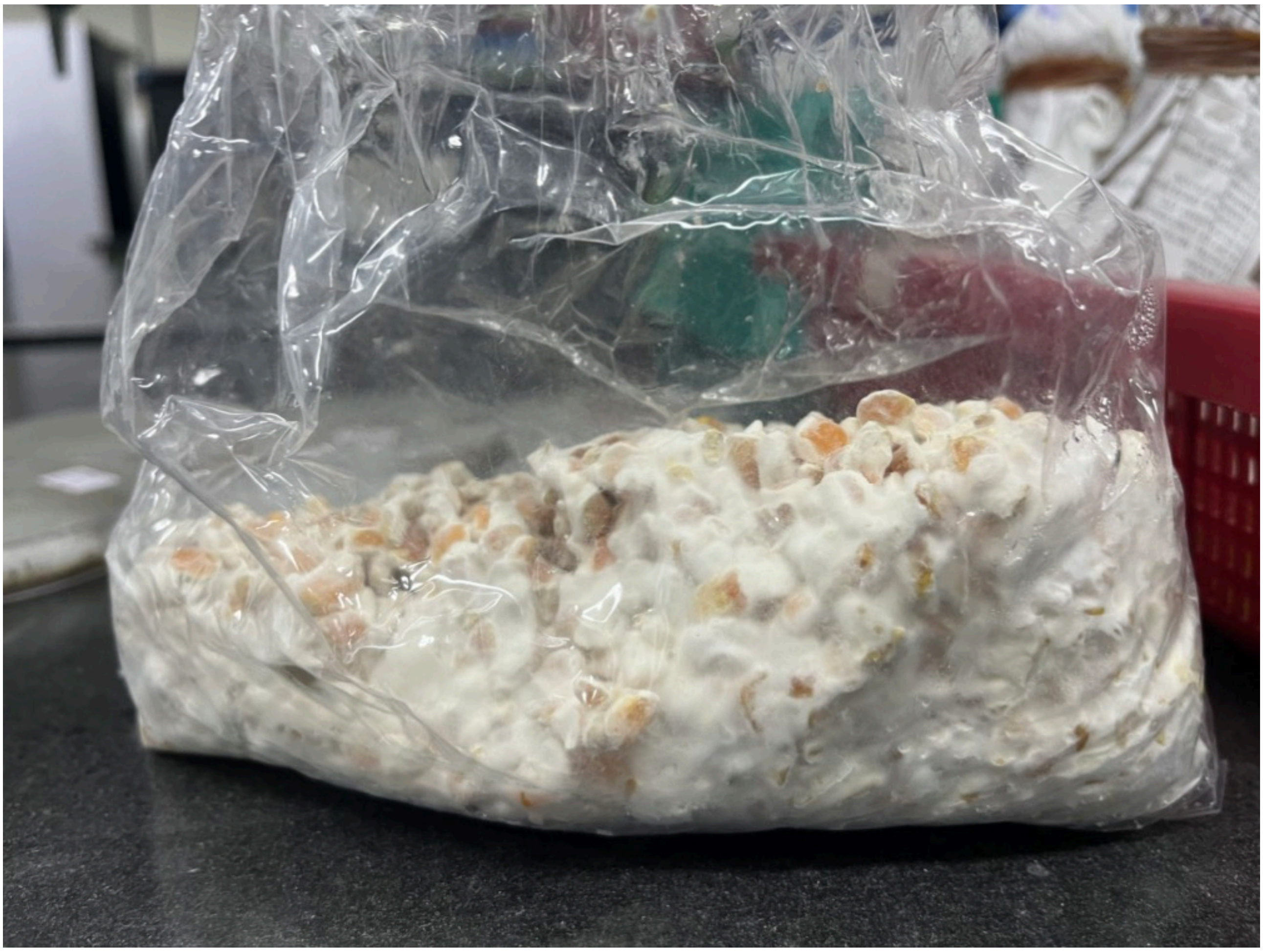
During my field visits in the Philippines, particularly in areas around Puypuy, Bay Municipality, Mount Makiling, Laguna, and Piddig, Illocos Norte, I had the invaluable opportunity to observe and participate in the entire process of cultivating IMOs, working with organic educator Michael Cagas.

Indigenous Microorganisms (IMOs) refer to a diverse group of beneficial microbes, unique to a specific local environment, that can be cultivated and multiplied to enhance soil fertility, plant health, and overall ecosystem resilience. Unlike commercial microbial products, IMOs are collected directly from natural, undisturbed local ecosystems, embodying a principle of working with nature's inherent biodiversity.

Underpinning the benefits of IMO use is self-reliance and resourcefulness. This approach shifts farmers away from reliance on expensive, often imported, and not necessarily long-term beneficial synthetic inputs towards harnessing the power of their immediate natural surroundings. This fosters a deeper understanding of ecological processes and empowers farmers to create their own biologically active inputs, promoting a sustainable and regenerative agricultural system. My Fellowship experience highlighted IMOs as a cornerstone of organic farming in the Philippines, a concept with significant potential for application in agricultural practices in the UK.

IMO production unfolds in four distinct stages, each carefully designed to capture, expand, stabilise, and integrate beneficial microbial communities from local environments. This progressive four-step activation ensures the initial wild microbial populations are both preserved and significantly multiplied, ultimately creating a stable inoculant (IMO-4) ready for a range of agricultural applications, notably as an activator for composting in my personal work.

- **IMO-1 (Initial Capture):** The process begins with creating an ideal substrate for microbial capture. Cooked rice, approximately 8cm deep, is placed in open containers (usually cardboard or bamboo) and strategically positioned in microbially rich environments – often under a bamboo clump in an isolated, undisturbed area. Over 2 to 3 days, naturally occurring airborne and waterborne microbes colonise the rice. Successful capture is indicated by mould growth, varying in colour depending on the microbial species. This initial collection is referred to as IMO-1.



- **IMO-2 (Fermentation for Stability):** The collected IMO-1 is then carefully mixed with an equal ratio (1:1) of molasses or brown sugar. This sugar acts as a food source for the microbes and, more importantly, initiates a fermentation process. This mixture, now called IMO-2, is left to ferment for approximately five days. The fermentation stabilises the microbial populations, making them dormant and preserving their viability for future use.

- **IMO-3 (Bulk Expansion on Rice Bran):** To expand the microbial population for practical agricultural application, a small quantity of IMO-2 (approximately 1 gram per 100 millilitres) is introduced into a larger volume of rice bran – typically 10 kilograms. This mixture is then moistened to about 65% moisture using rice wash water (the water obtained from rinsing rice). The rice bran provides an abundant substrate for the microbes to multiply, and the rice water offers additional starchy nutrients. This new solution, IMO-3, is subsequently fermented for three to five days.

- **IMO-4 (Integration with Soil):** The final stage involves integrating the microbial solution with local soil. One part of IMO-3 is mixed with one part of representative local soil, and this combination is further fermented for three to five days. The resulting product, IMO-4, is a highly fertile microbial inoculum.

- **Storage and Application:** IMO-4 is typically covered with mulch to maintain its optimal 65% moisture content, making it ready for a wide variety of applications. Crucially, IMO-4 serves as an excellent inoculum for high-quality composting, significantly accelerating decomposition and nutrient cycling.

This step-by-step cultivation of IMOs highlights a fundamental principle of regenerative agriculture: leveraging existing natural resources to create powerful biological inputs. The system is low cost, accessible, and empowers farmers to produce their own solutions rather than relying on external, often expensive, commercial products.

While the specific environment of the Philippines offers a distinct microbial profile, the underlying principles of IMO cultivation are universally applicable. The primary challenge for implementation in the UK lies in identifying suitable analogous environments to source indigenous microorganisms. The tropical rainforest environment of Luzon, with its rich biodiversity, provides an ideal microbial 'soup'. For the UK, potential sources would need to mimic this microbial density and diversity within a temperate climate. Promising UK environments based on current understanding of microbial ecology include ancient woodlands (recognised for their unique and stable soil microbial communities despite historical management); the edges of healthy wetlands and peat bogs; and coastal areas providing nutrient-rich seaweeds, which are increasingly being studied for their biostimulant properties and ability to enhance soil microbial diversity. Furthermore, specific sugar-rich plant materials such as squashes and pumpkins can serve as initial substrates for capturing and cultivating beneficial microbes without using rice, mirroring the initial IMO-1 collection in the Philippines but with local materials.

IMO cultivation experiments in the East Midlands - Birklands Ancient Forest

My long-term goal for applying this learning in the UK is precisely to develop localised systems for creating high-quality, microbially rich composting inputs. By harnessing the power of UK indigenous microorganisms, we can transform organic waste into soil amendments, enhance carbon sequestration in soils, reduce reliance on external fertility inputs, and contribute to a more resilient and sustainable agricultural landscape. This directly supports the principles of a circular economy in farming.

2. Microbial Ferments for Targeted Outcomes

While Indigenous Microorganisms (IMOs) form the cornerstone for building general soil health and microbial diversity, my Fellowship revealed that Filipino organic farmers employ a broader spectrum of specialised microbial ferments, each tailored to achieve specific outcomes for crops, animal husbandry, and soil vitality. These additional solutions demonstrate a sophisticated understanding of plant and animal nutritional needs, addressing them with highly targeted, biologically active solutions. Among the most widely used of these are Fermented Plant Juices (FPJs) and Fermented Fruit Juices (FFJs), both of which I had the opportunity to produce firsthand, alongside a comprehensive system for Enhanced Microorganisms (EM).

Fermented Plant Juice (FPJ): Harnessing Plant Vigour for Growth


FPJ under fermentation, Puypuy Farm

FPJ is an organic solution for enhancing nutrient absorption and growth throughout various stages of a plant's life cycle. Its efficacy stems from culturing the inherent vitality of fast-growing plants, which are a rich source of hormones, enzymes, and beneficial microbes. A key principle in its production, which I learned and practiced, is the precise timing of material collection.

Materials and Collection: FPJ is made from the freshly picked growing tips of vigorous, fast-growing plants, readily available within the local environment. Common sources include vines from riverbanks (rich in iron and manganese), sweet potato, malunggay, banana flower, alugbati, acacia and madre de cacao leaves, and bamboo shoots. These materials must be collected very early in the morning, just before dawn, while the morning dew is still present. This specific timing is vital because plants undergo significant growth during the night, concentrating growth hormones in their actively developing tips. Only these growing tips, typically 3 to 6 inches in length, are collected, and it is imperative to use only one plant species at a time to maintain the specific properties of the ferment. The collected materials are then gently shaken to remove dirt but never washed, to preserve their natural microbial load.

Procedure: Once collected, the plant materials are weighed, and an equal amount of molasses or crude sugar is prepared. The materials are then chopped and thoroughly mixed with the molasses. This mixture is placed into fishnets or similar porous bags to keep the plant matter intact within a plastic container, which is then covered with a breathable fabric or fine net, secured with a rubber band, to prevent contamination from flies and other insects. It is then stored in a room with a stable temperature. Over the next 7 to 20 days, a rich, brown syrupy liquid accumulates. This liquid, the completed FPJ, is carefully poured off into a plastic or glass container and stored in a cool, dark place to maintain its potency.

Application: FPJ is primarily used as a foliar spray or soil drench and is highly versatile. It is generally diluted with water at a ratio of 1:100 and is usually applied twice a week. Its role extends beyond simple fertilisation; it actively promotes nutrient absorption, adds vibrant colour to plants and fruits, and increases overall plant resilience. It is commonly used in conjunction with other organic solutions, forming part of a holistic plant health strategy.

Fermented Fruit Juice (FFJ): Boosting Fruiting and Animal Vitality

Preparing pomelo fruit for a ferment by combining with molasses

Complementing FPJ, Fermented Fruit Juice (FFJ) supports the flowering and fruiting stages of plants and enhances the palatability of animal feed. This ferment capitalises on the nutrient density and enzymatic activity of ripe fruits.

Materials and Collection: FFJ production typically uses 1 part ripe fruit to 1 part molasses. My hands-on experience included making FFJ using various common Filipino fruits like banana, papaya, and mango. I produced a batch with Michael Cagas utilising only pomelo, highlighting the flexibility of the method based on local availability. The fruits are cleaned, washed, and drained for five minutes to remove surface contaminants, then sliced into approximately one-inch pieces to facilitate the fermentation process.

Procedure: All sliced fruits are thoroughly mixed with the molasses in a plastic pail (typically 20-litre capacity). A nylon screen is placed on top of the mixture, weighted down with 5 to 8 stones (each weighing 25-50 grams) to keep the fruit submerged. The mouth of the pail is wiped clean, and the container is covered with brown paper to allow for gas exchange while preventing contamination. The mixture is then left to ferment for seven days. After fermentation, the nutrient-rich liquid is extracted and stored in a plastic container in a cool, dark place.

8th day FFJ with pomelo, ready for separation - the fruit will be used to feed worm beds

Application: FFJ is versatile in its application. For plants, it serves as an excellent source of potassium, directly supporting flower and fruit development. Like FPJ, it is applied via spray or drench, typically diluted at 2 tablespoons per litre of water, twice a week. FFJ also has applications in animal husbandry where a small amount mixed into drinking water acts as a taste enhancer, encouraging consumption and potentially providing probiotic benefits to livestock. FFJ can be effectively utilised as a topical insect repellent, demonstrating its broad utility within the farm ecosystem.

Analytical Conclusion for FPJ and FFJ:

The widespread use of FPJs and FFJs across Filipino organic farms highlights a commonplace commitment to sustainable, circular agricultural practices. These ferments harness the abundant natural resources available within the immediate environment, transforming readily available plant and fruit matter into targeted, biologically active inputs. This abundance of biomass, characteristic of the rainforest setting, undeniably facilitates the ease and scale of production observed. This approach stands in contrast to the reliance on external, often costly, synthetic products, offering farmers a pathway to enhanced self-reliance and significant economic savings. By promoting nutrient cycling and reducing the need for chemical interventions, these practices contribute directly to improved soil health, biodiversity, and overall ecological resilience within the farm system.

While the principle of utilising local biological resources for these ferments is universally valuable, the context of resource availability differs significantly. In contrast to the tropical rainforest environment's high abundance of rapidly growing plant matter and diverse fruits, the UK agricultural landscape, while generating its own substantial organic waste streams (such as fibrous crop residues), may not possess the same year-round, readily forage-able abundance of fresh, high-sugar plant tips and diverse fruits ideal for continuous small-scale FPJ and FFJ production directly on every farm. My personal experience since returning has involved successfully fermenting fruits for home water kefir production and compost inoculation. While some UK seasonal fruits like strawberries, blackberries, and redcurrants have proven effective, a significant portion of the material I've used, such as citrus, dried fruits, and ginger root, highlights the current reliance on non-native or commercially available produce for consistent supply in a temperate climate.

Enhanced Microorganisms (EM) - Stock and Activated Solutions

Beyond specific plant and fruit ferments, a foundational element of organic farming in the Philippines revolves around Enhanced Microorganisms (EM). It's important to clarify that while *'Effective Microorganisms'* is a registered brand, the term 'Enhanced Microorganisms' (EM), as used in this report and broadly understood and applied in the Philippines, refers to a synergetic combination of beneficial, naturally occurring, and non-manipulated microorganisms. These diverse microbes are compatible and coexist in liquid culture, encompassing both predominantly anaerobic and aerobic organisms. The typical composition of EM includes significant populations of lactic acid bacteria and yeasts, alongside smaller numbers of photosynthetic bacteria, actinomycetes, and other beneficial microbial types.

When correctly applied, EM offers a wide array of benefits across various aspects of farming and environmental management, significantly contributing to the holistic health of the farm ecosystem:

- **Livestock and Poultry Production:** EM promotes faster and more uniform growth rates, improves the immune system to prevent diseases, minimises mortality rates and stress, boosts the quality of animal produce, expels foul odours from animal pens and ponds, and facilitates the easy conversion of animal waste into valuable organic fertilisers.

Above: Greenland chicken processing plant, Lipa City; the waste slurry pits are treated with an EM solution - there is no smell. The slurry is then fed into nearby worm windrows, where the worms turn the waste into nutrient-rich vermicompost.

Left: Livestock at Sunflower Farm, Piddig benefit from EM mixed into feeds and water, as well as for treating the manure

- **Agricultural and Horticultural Production:** In plant cultivation, EM facilitates high germination, flowering, fruiting, and ripening rates. It increases microbial diversity in the soil, effectively suppressing soil-borne disease pathogens. Furthermore, EM enhances the photosynthetic capacity of plants and improves mycorrhizal fungus performance, increases the efficacy of organic matter as fertilisers, prolongs the freshness of cut-foliage and cut-flowers, and serves as a potent root growth stimulant. The anaerobic microorganisms within EM multiply in the soil, creating a suitable fermentable environment that supports robust plant growth, reduces soil deterioration from repeated cultivation, and minimises the growth of harmful bacteria and injurious insects.

- **Solid Waste Management:** EM plays a crucial role in waste management by enhancing the decomposition rate of mixed market wastes and other organic materials, while also suppressing and eliminating foul odour caused by high levels of ammonia, hydrogen sulphide, and methane gases.

- **Other Uses:** Beyond agriculture, EM is utilised to stop the growth of algae and facilitate faster breakdown of sludge in water bodies, helping to improve river water quality. It also contributes to the good performance of septic tank facilities.

EM Stock Solution Production

Fermenting for activated EM at scale, Pangasinan Farm.

The foundation of on-farm EM application is the production of a concentrated EM Stock Solution. I learned to prepare this solution using readily available local ingredients, some of which are themselves probiotic preparations:

Preparing a banana plant stump for collection of growth hormone, Mount Makiling

Ingredients: The recipe called for 200ml of banana growth hormone (BGH), combined with 2 litres of Lactic Acid Bacteria Serum (LABS), 200 litres of water, and 15 kilograms of molasses.

Banana Growth Hormone (BGH): This highly potent liquid is directly sourced from mature banana plants. It's collected by carefully hollowing out a 'cup' in the stump of a freshly cut banana plant, which then naturally leaches out this powerful growth stimulant overnight. For UK application, it's important to note that with mature banana plants not readily available for such harvesting, an analogue will be required. The key active component of banana growth hormone is gibberellic acid, which can be purchased as a synthesised substance. While not a controlled substance in the UK, its commercial formulations are regulated under Plant Protection Product guidelines for specific agricultural and horticultural uses.

Lactic Acid Bacteria Serum (LABS): LABS is a vital component, cultivated by harnessing naturally occurring lactic acid bacteria from the air using a simple fermentation process involving rice wash water and milk. This method yields a purified serum rich in beneficial lactic acid bacteria, crucial for various microbial applications. (The full recipe for LABS can be found in the Appendix.)

Procedure: All ingredients (BGH, LABS, water, and molasses) are then thoroughly mixed and sealed in a container equipped with air holes to allow for gas exchange while maintaining anaerobic conditions for the primary fermentation. This mixture is left to ferment for 23 days, with stirring performed every 7 days to ensure even distribution and activation of the microbes.

Shelf Life: Once fermentation is complete, this stock solution can be bottled. When sealed, it has a useful shelf life of fourteen months. Once opened, it should ideally be used within two months to maintain optimal potency.

Above - LABS preparation as an ingredient of EM stock solution; below - the harvested banana growth hormone will feed 200l. of stock; bottom - the stock solution two weeks into ferment, bubbling with life

Activated EM Solution Production

To create the ready-to-use form, an Activated EM Solution is prepared from the stock. This activation process multiplies the dormant microbes and prepares them for immediate application:

Ingredients: The recipe involves combining 1 litre of the EM Stock Solution with 1 litre of molasses (serving as the microbial food source) and 200 litres of water.

Procedure: The mixture is stirred twice a week. On the fifth day of fermentation, 1-2 kilograms of fortified milk are incorporated. This addition is designed to significantly boost the population of lactic acid bacteria, further enhancing the solution's potency. Based on common practices, this activation period typically continues for a total of 7 to 10 days, or until the pH of the solution drops to around 3.5-4.0, indicating optimal microbial activity.

Shelf Life: Unlike the stock solution, Activated EM has a much shorter shelf life of approximately 10 days.

Application Scale: This 200-litre batch of Activated EM, when diluted further (commonly at ratios from 1:1000 to 1:5000 with water), yields a substantial volume. At a typical application rate of 1 litre of diluted solution per square meter, a single 200-litre batch of activated EM could effectively treat between 20 and 100 hectares of agricultural land, depending on the specific dilution used and soil conditions. This demonstrates the high leverage and scalability of these microbial solutions from relatively small inputs – the initial 200l of stock solution, when activated to its full extent, will provide for up to 20,000 hectares of single application.

Aerating the EM Stock Solution during a 23-day ferment

Analysis and UK Context (for EM Stock and Activated Solutions):

The simple processes for producing EM stock and activated solutions underscore the accessibility of on-farm biotechnology in the Philippines. This model provides farmers with powerful, self-made tools for enhancing productivity, managing waste, and improving animal welfare, all while reducing reliance on external inputs. For the UK, the adoption of such a comprehensive EM system represents a significant opportunity. While the initial acquisition of a foundational EM culture might be commercial, the subsequent on-farm expansion and activation using molasses and water offer a cost-effective and empowering pathway to widespread biological enhancement. The versatility of EM, from soil and crop health to waste management and livestock care, demonstrates its potential as a core component of a genuinely regenerative and low-input agricultural future in the UK.

3. Policy, Ethos, and Ground-Up Empowerment

A significant factor contributing to the robust adoption of organic farming methods in the Philippines is the explicit, multi-tiered government support, coupled with a pragmatic farmer ethos and a highly effective system of ground-up knowledge dissemination. My Fellowship revealed how these interwoven elements create a fertile environment for sustainable agricultural practices.

Puypuy Farmers Association meet with local agricultural officials at the 'Barangay' or district hall to discuss future equipment investments

Government and Policy Support: A Framework for Organic Growth

Unlike many contexts where organic agriculture operates at the fringes, the Philippines has established a clear national policy, demonstrating a top-down commitment that cascades to local implementation.

Republic Act No. 10068, otherwise known as the "Organic Agriculture Act of 2010," serves as the cornerstone of this commitment. This Act explicitly declares the State's policy to "*promote, propagate, develop further and implement the practice of organic agriculture in the Philippines*" with clear objectives: to enrich soil fertility, increase farm productivity, reduce environmental pollution, prevent natural resource depletion, and protect the health of farmers, consumers, and the general public.

To achieve these ambitious goals, the Act mandated the establishment of a National Organic Agricultural Program. This program focuses on promoting and commercialising organic farming practices through various mechanisms, including the cultivation and adoption of developed methods, continuous research, capacity building for farmers, consumer education, and extending assistance to Local Government Units, People's Organisations, Non-Government Organisations, and other stakeholders.

My fieldwork directly experienced this commitment in action at the local level. For instance, a local ordinance from the Municipality of Bay, Laguna, explicitly adopted the "Organic Agriculture Act of 2010." This ordinance highlighted Section 14 of the national act, which requires every municipal mayor, "*insofar as practicable, [to] form a municipal technical committee for purposes of implementing activities in line with the National Organic Agricultural Program within each municipality.*" I had the opportunity to sit in on local committee training sessions and farmers' meetings, witnessing firsthand how these national mandates translate into local committees providing guidance, expertise, and coordination for promoting and developing organic agriculture initiatives. This tiered approach, from national legislation to municipal technical committees, provides a critical framework for supporting and scaling organic farming practices across the archipelago.

Ethos and Farmer Engagement: Pragmatism Over Ideology

Beyond the top-down policy support, a critical element observed in the widespread adoption of organic farming practices in the Philippines was the prevailing ethos among local farmers. My direct engagement in local committee training sessions and farmers' meetings revealed that the primary driver for their embrace of these organic methods was not rooted in a purely theoretical or principled stance on environmentalism or a return to nature. Instead, their engagement was overwhelmingly pragmatic and incentive-driven.

Farmers actively participated and were committed to learning and implementing these techniques because they offered tangible, immediate benefits. The promise of cheaper methods for fertilising their land, coupled with the potential for increased yields, provided compelling economic incentives. This practical advantage was underscored and facilitated by the free training and ongoing support provided by the local technical committees. This accessibility to knowledge and resources removed significant barriers to entry, empowering farmers to improve their livelihoods using methods that were both economically sound and environmentally beneficial, rather than solely philosophically aligned. This pragmatic ethos, focused on demonstrable results and cost-effectiveness, appears to be a powerful engine for the ground-up adoption and sustained practice of organic agriculture within these communities.

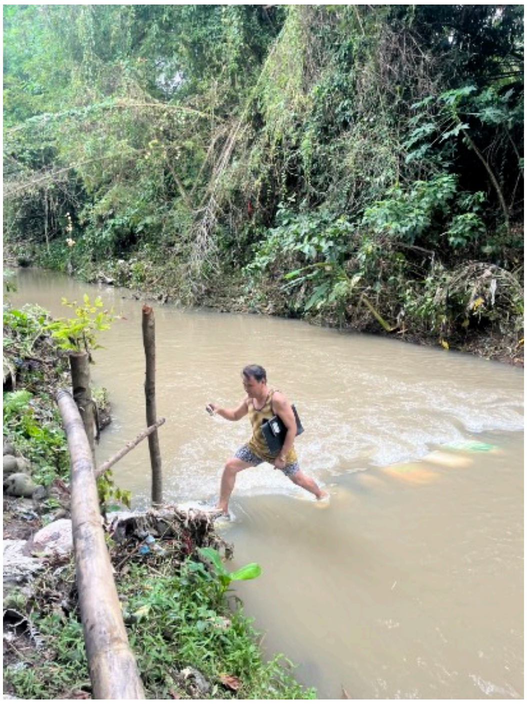
Ground-Up Empowerment and Dissemination: Building Community Capacity

Farmers training in IMO cultivation at Piddig training farm, Ilocos Norte

The top-down policy framework and pragmatic ethos are effectively translated into action through a robust system of ground-up empowerment and knowledge dissemination. This multi-faceted approach ensures that organic farming practices are not just mandated, but genuinely adopted and sustained by local farming communities.

A key element of this system is the decentralised, peer-led training infrastructure. Municipal and regional governments designate experienced farms with what I observed to be a 'training status.' These farms receive funding to develop dedicated training facilities, ranging from classrooms to, in some remote locations, accommodation for trainees. This allows for immersive learning directly in environments where real farming practices are demonstrated firsthand. Beyond these dedicated training farms, sessions, meetings, and consultation events are also regularly held at local '*barangay*' halls, which are local government hubs and serve as vital community centres. This blend of central and hyper-local training venues ensures broad accessibility and practical relevance.

I gained insights into this process by attending a number of training courses for small farmers across different parts of the country, even earning a certificate of participation in Batangas! These sessions consistently fostered a sense of community, bringing farmers together to share experiences and learn collaboratively. The learning environment was inclusive and supportive, accommodating various languages, literacy levels, genders, and ages. Tutors, many of whom were experienced farmers themselves, were not only thorough but genuinely enthusiastic, making the learning relatable and engaging.



Tutor Michael Cagas on his way to a training session in Bay, Luzon, undeterred - the bridge had washed away the previous month

The teaching methodology blended formal learning with practical application. Sessions incorporated structured teaching with clear targets and outcomes, but critically, these were mixed with lively discussions and hands-on practicals. A key aspect was the assessment process, which prioritised discussion over written tests. This approach sensitively addressed varying literacy levels among farmers, allowing them to demonstrate their competency through verbal engagement and practical understanding, ultimately leading to the presentation of well-earned certificates. This emphasis on lived experience was commonplace; there were always real, practising farmers among the trainers, not just theorists. This ensured trainees could converse with relatable individuals who genuinely understood their daily routines and challenges, creating a conduit for knowledge transfer and sustained engagement.

Challenges and Potential Vulnerabilities: The Role of Local Governance

While the overall picture observed was one of strong support and successful implementation, it is important to consider potential underlying vulnerabilities. Direct experience, including witnessing well-supported facilities and community engagement, showed financial and organisational support flowing from local authorities to farmers for re-equipping and adopting new organic practices. This support extended to organising small local collectives to maximise equipment sharing, facilitating effective resource management.

However, a significant aspect of the local governance structure also became apparent: the considerable authority vested in local mayors or '*barangay Captains*' regarding the allocation of local authority funding and the endorsement of initiatives. My experiences, which included having to arrange preparatory meetings with these *Captains* in certain areas before being granted access to their supported farms or training sessions—almost a 'vetting process'—highlighted this centralised power. While in the contexts I witnessed this power was clearly used to positive effect, bringing small organic farmers together and fostering excellent facilities, it presents a potential concern: the continued propagation and success of these organic farming communities could be intrinsically linked to the consistent support and goodwill of individual governors.

This reliance on individual decision-makers introduces a potential risk. If a local authority or *Captain* were less supportive, or if a particular farm or organisation were to fall out of favour with these governing individuals, it might significantly impede access to crucial funding, training, or official recognition. This dependence, while currently leveraged for positive impact, could constitute a systemic vulnerability to the long-term equitable propagation of these valuable organic farming initiatives if local leadership priorities were to shift.

CONCLUSION

My Churchill Fellowship to the Philippines offered an immersive exploration into a highly effective, locally driven model of organic agriculture, revealing valuable lessons applicable to the UK's pursuit of sustainable farming. The core findings highlight the transformative power of biological inputs, accessible knowledge transfer, and a supportive enabling environment.

First, the research into **Indigenous Microorganisms (IMOs)** revealed their important role in achieving self-reliance for Filipino farmers. By harnessing the power of local microbial biodiversity, these practices demonstrate a pathway for transforming farm and organic waste into rich soil amendments. This not only enhances soil health and its capacity for carbon sequestration, but reduces reliance on external fertility inputs, fostering a more resilient and sustainable agricultural landscape.

Second, the Fellowship demonstrated the widespread and effective use of **Microbial Ferments for Targeted Outcomes**. While Fermented Plant Juices (FPJs) and Fermented Fruit Juices (FFJs) show remarkable benefits in the Philippines by utilising abundant local biomass, their direct scalability in the UK using similar raw materials presents a challenge due to differing resource availability. However, the system for Enhanced Microorganisms (EM), from stock solution to activated application, seems to be a versatile and easily scalable model. This capacity for at-volume, low-cost organic farm applications makes EM a compelling and readily adaptable tool for UK farmers.

Finally, the success of organic farming in the Philippines is underpinned by a robust framework of **Policy, Ethos, and Ground-Up Empowerment**. I witnessed a clear commitment to organic agriculture, flowing from national legislation to the establishment of local technical committees. This policy support converges with a pragmatic farmer ethos, where engagement is driven by tangible economic benefits like reduced input costs and increased yields, rather than solely ideological motivations. Crucially, knowledge is disseminated through well-organised, widespread, and easily accessible training programmes – from central government initiatives to local collectives – that effectively cater to diverse farmers. While this ground-up approach is highly empowering, a potential vulnerability lies in the significant authority vested in local district mayors or *barangay* captains, whose individual support can, should it waver, be a pinch-point for the flow of funding and continued progress.

In essence, the Filipino experience underscores that a shift towards sustainable agriculture requires not only effective biological tools but also a supportive policy environment that champions ground-up capacity building and pragmatic farmer engagement.

RECOMMENDATIONS

Following my Churchill Fellowship to the Philippines, I propose the following recommendations to foster the adoption and scaling of sustainable, low-input organic farming practices in the UK, drawing directly from the models observed:

Develop a UK-Specific Microbial Ferment Resource Manual

Recommendation: Inspired by the comprehensive 'EM Manual' and various training documents encountered in the Philippines, there is a clear need to develop a dedicated reference or resource focusing on UK-specific microbial sources, habitats, and collection/cultivation methods for on-farm ferments. This manual would serve as a practical guide for farmers, detailing how to identify, collect, and propagate indigenous microorganisms (IMOs), and how to produce probiotic ferments such as activated EM using readily available UK materials. While some general resources on composting and broader microbial applications do exist in the UK, a consolidated, accessible guide specifically for context-appropriate, farm-made microbial ferments using local UK resources remains a significant gap.

Collaborations: This initiative would ideally involve collaboration between agricultural research institutions (e.g., Organic Research Centre, James Hutton Institute), agricultural colleges, organic farming NGOs (e.g., Soil Association, Organic Farmers & Growers), and experienced UK organic farmers. Citizen science groups could also play a role in identifying local microbial hotspots.

What is Needed: Funding for applied research into UK microbial ecology and plant/fruit suitability, development of clear, accessible instructional materials (digital and print), and the establishment of a centralised, accessible platform for sharing this knowledge.

Benefits: This would significantly open the process for UK farmers, providing context-appropriate solutions that reduce reliance on imported or commercially purchased inputs. It would empower farmers to harness local biodiversity, lower their input costs, and foster a sense of self-reliance and innovation tailored to the UK's unique climate and agricultural landscape.

Strengthen Farmer-Led Demonstration and Data Collection for On-Farm Ferments

Recommendation: To build a robust evidence base and foster wider adoption, existing UK initiatives should be strengthened and expanded to support organic farmers in producing and rigorously documenting the results of using at-volume activated Enhanced Microorganisms (EM) and other farm-made ferments (like adapted FPJs and FFJs). Building on successful models like the Organic Research Centre's Participatory Research Network and Innovative Farmers' field labs, this would involve selected pioneering farms actively integrating these specific microbial practices into their operations, meticulously measuring outcomes, and openly sharing their findings with peers and researchers.

Collaborations: Individual organic farmers and farmer networks would be central. Agricultural universities and research bodies (e.g., those involved in Living Labs or agroecological research) could provide methodological guidance and support for data collection and analysis. Organic certification bodies might help integrate best practices into standards. Defra and other agricultural grant providers could offer targeted funding.

What is Needed: Enhanced grants or incentives for participating farms to cover materials and dedicated time for application and meticulous record-keeping, specifically for microbial ferments. Development of simple, standardised methodologies for documenting yields, soil health parameters, pest/disease incidence, and input cost savings. Stronger platforms for regular farmer workshops and field days to facilitate peer-to-peer learning and showcase successful examples of these specific ferment applications.

Benefits: Generates invaluable real-world, UK-specific data on the efficacy and economic benefits of these practices, moving beyond anecdotal evidence for these novel applications. This evidence base would be critical for convincing a broader audience of farmers and policymakers, fostering peer learning, accelerating the transition to regenerative practices, and ultimately enhancing the resilience and profitability of UK farms.

Amplify Ground-Up Farmer Networks and Lived-Experience Training Models

Recommendation: Building on the highly effective, inclusive, and peer-led training infrastructure observed in the Philippines, existing UK farmer networks and training initiatives should be amplified and intentionally structured. The goal is to maximise the 'lived-experience' model of knowledge transfer, where experienced organic farmers with proven success are empowered and funded to train and mentor their peers, ideally utilising their own farms or local community hubs as practical learning sites. This approach would complement existing valuable efforts by organisations like the Nature Friendly Farming Network, FarmED, and the work of Nuffield Scholars in knowledge exchange.

Collaborations: Existing farmer networks and co-operatives (e.g., Organic Farmers & Growers, FarmED, Landworkers' Alliance, NFFN), agricultural colleges looking to expand practical curricula, grant-making foundations (e.g., Nuffield Farming Scholarships Trust, other agricultural charities), and potentially local authorities.

What is Needed: Increased and targeted funding for network coordinators, grants for developing on-farm training infrastructure (e.g., basic classrooms, demonstration plots), and systematic support for the development of flexible and inclusive curricula that blend practicals with discussion. Robust mentorship programmes should be funded, along with incentives for experienced farmers to become recognised trainers and mentors.

Benefits: Builds practical capacity and confidence directly within farming communities, creating a more resilient and adaptable agricultural sector. It decentralises knowledge, making learning accessible and relevant to diverse farmers regardless of literacy level or background. This amplified ground-up approach also maximises the impact of philanthropic and public funding by directly empowering farmers to solve their own challenges and share their successes broadly.

Government Review of International Policy Instruments for Organic Agriculture Propagation

Recommendation: The UK Government, specifically the Department for Environment, Food & Rural Affairs (Defra), should undertake a comprehensive review of policy instruments and legislation from countries (such as the Philippines, and potentially others like South Korea, and parts of the EU) that have successfully used explicit state backing to promote and scale organic agriculture. While the UK is currently developing new agricultural policies like the Environmental Land Management Schemes (ELMs), this review should go beyond general environmental incentives. It should specifically examine the concrete legislative frameworks, dedicated funding mechanisms, and robust institutional structures that have driven widespread, state-backed propagation and adoption of organic farming practices in these nations.

Collaborations: UK Government (Defra), policy makers, agricultural strategy units within relevant departments, parliamentary committees, and collaborating academic researchers specialising in agricultural policy and international development.

What is Needed: Political will and a dedicated policy research budget to commission detailed comparative studies. This would require active engagement with international counterparts, in-depth analysis of long-term impacts of diverse policy approaches, and robust stakeholder consultation within the UK to assess applicability and potential for adaptation.

Benefits: Provides a blueprint for developing a more robust, proactive, and directly enabling policy environment for UK organic and regenerative agriculture. Learning from successful international models could unlock significant public and private investment, streamline regulatory processes, and accelerate the transition towards a genuinely sustainable, resilient, and environmentally positive food system at a national level. This would also significantly enhance the UK's global leadership in environmental stewardship and food security.

NEXT STEPS

My Churchill Fellowship to the Philippines has provided invaluable knowledge and a clear direction for contributing to the advancement of sustainable agriculture in the UK. My immediate next steps focus on building practical capacity, fostering collaboration, and disseminating these techniques:

Practical Application and Enterprise Development



Since returning from the Philippines, I've already begun the practical application of my learning, producing Lactic Acid Bacteria Serum (LABS), Fermented Fruit Juices (FFJs), and Indigenous Microorganisms (IMOs). These are primarily used as inputs for enhancing on-farm composts and in partnership with the vermiculture business to inoculate commercial-scale worm farms. This collaboration aims to optimise vermicompost production and improve organic waste management. The immediate next stage involves perfecting the production of Enhanced Microorganism (EM) stock solution, which I haven't yet made. Following this, I'll trial the activation and application of EM on a larger scale. This progression is vital before developing a commercial product, which represents my medium- to long-term business potential for providing low-cost organic solutions to horticulturists and farmers.

Knowledge Dissemination and Advocacy

Once my practical application and product development are further established, I intend to transition into more widespread knowledge dissemination. This will involve developing and leading practical workshops, creating electronic media resources, and writing articles to share detailed insights and experiences. My goal is to support and empower other farmers and organisations to adopt these accessible and effective biological methods.

Networking and Collaboration

Being based at a community farm provides an excellent foundation and extensive connections, particularly within the Nuffield Farming Scholarships Trust. I plan to leverage this proximity to engage more actively with the Nuffield organisation and its scholars. As my practical skills and enterprise develop, I aim to share my findings and experiences with relevant UK agencies, including those identified in the Recommendations section. This includes connecting with agricultural research institutions (such as the Organic Research Centre and James Hutton Institute), organic farming NGOs (like the Soil Association and Organic Farmers & Growers), and agricultural colleges to explore collaborative research, training, and development opportunities.


DEPARTMENT OF AGRICULTURE
The
Department of Agriculture
bestows this
Certificate of Participation
to
MARTIN COSTELLO
for actively participating in the two-day Strategic Planning Workshop for the members of Puypuy Farmers Association, Inc. in relation to the implementation of the Organic Agriculture Livelihood Project in Bay, Laguna.
Given this 7th day of December 2023 at Zillion Pavilion, Lipa City, Batangas.
EDA F. DIMAPILIS
Regional Organic Agriculture Focal Person
MASAGANANG AGRIKULTURA
MAUNLAD NA EKONOMIYA

APPENDIX

Beneficial Microbes Recipe Book

ASIAN EM RECIPES

In this appendix I have provided a range of farm & compost recipes collected on my travels for the Fellowship, some of which I worked on myself in different farm settings whilst in the Philippines, and others which I noted down during training sessions I attended or from notes which were handed out. Even with some of the ferments I mixed, I did not always get to see the end results as I had moved on before they were complete, and most of these recipes I have not tried at all but they are tried and tested solutions throughout the Philippines and further afield. As noted in my *Next Steps* section, it will be for myself and others to identify analogues from indigenous micro-organisms and from local feedstocks which will go to make up the ferments, as most of these recipes rely on inputs which are not freely available in the UK. Nevertheless I feel these are a valuable resource worth including. Some contain detailed instructions while others are very basic indicators of a process.

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A number of these recipes call for EM-1 stock or activated solution, by which they are usually referring to the *Effective Microorganisms* proprietary ferment, but these can be replaced by the EM solution discussed in this report. It is worth noting that another straightforward EM alternative is a 50/50 mix of vermicast tea and LABS, filtered to remove residue.

Indigenous micro-organisms (IMO)

Beneficial indigenous micro-organisms (IMO) occur naturally and are deliberately captured and cultured in the environment. The presence of IMO in ecosystems are proof of active life and are present almost anywhere in the plant and animal kingdom as well as in our bodies. IMO can be found in the soil, on the surface of the soil, on branches, leaves, and other plant parts. The collection of IMO can be done from fields, forest floors, rice paddies, hedges, shrubs, and bamboo trees. IMO for organic farm input production are usually gathered from places with high IMO presence, with established forests providing the best 'foraging' sites.

IMO can act as a soil conditioner by enhancing the microbiological activity in the soil, particularly in soils where compost has been applied, and as a soil sterilizer by outnumbering pathogens with 'beneficial' bacteria. It is a growth and health promoter through the presence of diversified micro-organisms in the soil, which strengthen the plants and makes them more resistant to pests and diseases and give better yields. Its use enhances soil fertility and plant nutrient uptake through the introduction and proliferation of beneficial soil microbes or mycorrhizae. These microbes have a wide range of uses and applications - IMO serves as a microbial inoculant which will help in fortified soil preparation, organic fertiliser production, crop production and animal husbandry.

IMO is used to make the composting process more effective and efficient, and thus faster, in fertiliser production. Micro-organisms consume molasses and other organic matter which will compost faster due to the abundant presence of beneficial microbes. In vermiculture, the feed for worms (eg. cow manure) is decomposed before being consumed by the worms. During this process, IMO can be sprayed onto the feed to make the decomposition process faster.

In animal farming, the bedding of pig pens are also made with organic matter like rice hulls, sawdust and coir dust. To remove the foul odor from the manure and to decompose the beddings faster, it is drenched with an IMO solution. When the pigs removed at around 5 months, the pens will be left with tons of organic fertilizer that has been decomposed by the microorganisms.

IMO in animal feed mix improves immuno-digestive responses. Microbes consumed and inside the stomach of the animal will improve its immune system and aid in nutrient absorption. IMO can also be mixed in the drinking water of farm animals like goats, pigs, chickens, & ducks to improve the immune system of the animal and help in the absorption of nutrients from feeds.

In crop production IMO is used in the land preparation stage to colonize the soil with beneficial micro-organisms, providing the soil with more readily absorbable form of nutrients for plants and to suppress harmful disease-causing micro-organisms. IMO can be applied as a root and leaf spray for more availability and better uptake of nutrients, aiding growth and improving resilience to environmental pressures.

IMO is categorized into IMO-1, IMO-2, IMO-3 and IMO-4 according to their stages of fermentation and effectiveness as inoculants for various applications.

IMO-1 is obtained by placing cooked rice in a container of about 8cm deep which is then left under a bamboo clump in an isolated area for 2 – 3 days for natural inoculation by water and air-borne microbes. The inoculated rice is then mixed with molasses or brown sugar at the ratio of 1:1. The resultant mixture called IMO-2, is then fermented for 5 days. Then 1g/100ml of IMO-2 is added to 10kg of rice bran and added with rice water (i.e. water obtained from the washing of rice) until the mixture is 65% moist. The new concoction, IMO-3, is subsequently left to ferment for 3 – 5 days. Then 1 part of IMO-3 is added to 1 part of soil and further fermented for 3 – 5 days to create IMO-4.

IMO-4 is covered with mulch to maintain the moisture of 65% to be used later, for a wide variety of applications including as the inoculants for compost.

Preparation of Indigenous Micro-organisms (IMO-4)

Initial Preparation: Cook rice. Place under bamboo clump, bury in forest floor mulch or beneath vermicomposting site for 2 – 3 days until the rice becomes mouldy; separate black and white moulds, keeping only the white mould.

IMO-1 : then add brown sugar or molasses to IMO-1 at 1:1 ratio; ferment for 2 -3 days

IMO-2 : then add rice bran and rice water to IMO-2 at 10,000:1 ratio; ferment for 3 – 5 days at 65% moisture

IMO-3 : add IMO-3 to soil at 1:1 ratio; ferment for 3 – 5 days at 65% moisture

Final result is IMO-4

USAGE

Plants – stronger immune systems

Animals - stronger immune systems. Removes foul odor. mix with drinking water

DOSAGE

2tbsp./L of water

spray or drench 2x a week

Total fermentation days: 8-13 days

Forest Micro-organisms

Beneficial IMOs can be collected from Rain or Aged Forests, using more or less the same process as the standard IMO collection process.

1. Cooked rice on a platter container with 1 inch thickness and cover it such as a plastic lunch box, allowing air space in the container.

2. Cover this container to protect it from animals that may dig the container once it is bury under an old tree in the forest.

3. Within 2-10 days (with a relative temperature), dig the container and evidently the contamination of microorganisms like white and other color molds is on the cooked rice. (forests' microorganisms)

4. Add 1:3 parts of crude sugar or molasses on the infected cooked rice and mixed it well.

5. Wait for another 7 days and the concoction will look like sticky, liquidy rice.

6. Suggested to add a 1:1 amount of crude sugar or molasses to this sticky, liquidy rice and keep it for storage in a cooler area.

7. To use, suggested dilution of this serum 1:10 parts water.

Forest micro-organisms can also be collected by getting ample amount of litter materials in forests' ground, humus or forest leaf molds and then spreading them proportionately at the top of cooked rice.

Bamboo Micro-organisms

Gathering micro-organisms through burying a container of cooked rice underneath the bamboo plants or underneath bamboo litters near to the bamboo plant will collect specific bamboo micro-organisms. Bamboo attracts very potent Effective Micro-organism (EM) as its roots exude sugary substances that attract beneficial micro-organisms. The same procedure is followed in collecting forest microorganisms.

Plant Specific Microorganisms

Collection of EM from specific plants is possible. Or example to trap and culture the EM from rice plant, select healthy and vigorous rice plants in the field, cut, uproot and chop (do not wash it) and placed it at the top of the cooked rice container.

Rhizobium Nitrogen-Fixing Bacteria

Rhizobium is one of the most popular nitrogen-fixing bacteria. Collect and prepare a basic culture of these beneficial bacteria as follows:

1. Collect some soil, roots, root crops from leguminous plants where this bacteria proliferates

2. Chop or pound, and mix materials with an equal ratio of crude sugar or molasses

3. Place in a container

4. Wait for 7-20 days for Rhizobium bacteria to feed on the sugar and become dominant

5. Suggested application of 1:10 parts of water.

Lactic Acid Bacteria Serum (LABS)

This particular concoction of beneficial micro-organisms is popularly and widely used in composting and solid waste management specifically to arrest foul odours associated with anaerobic decomposition. It thrives and feeds on ammonia released in the decomposition of organic matter which is associated with foul odours.

The lactobacillus is one of the most important - if not the most – beneficial microorganism in eco-farming. Lactic acid bacteria are beneficial microbes responsible for decomposing organic matter by means of fermentation, forming an enzymic barrier to prevent growth of harmful bacteria like Salmonella and E. coli. In serum form - LABS - it can be applied both in crop and animal production.

In crop production, it helps in promoting the health of the plant by increasing microbiological activity in the soil, improving the immune system and repelling harmful bacteria in the soil that may cause sickness and diseases to plants. This is done by either spraying, drenching or watering into the plants.

Lactic acid bacteria acts as sanitizer of soil and beddings in poultry and livestock production, and produces enzymes and natural antibiotics aiding effective digestion, keeping digestive systems of animals free of pathogens and promoting strong and healthy digestion.

Collection & Fermentation Procedure

1. Pour rice wash into a container. It is a solution generated when you wash the rice with water into a container with lid. Allow presence of air in the container of at least 50-75%.

2. Cover the container loosely (not vacuum tight to allow air flow into the container). Place the container with rice wash solution in a shaded area away from direct sunlight.

3. Ferment for at least 5-7 days. Lactic acid bacteria will gather in 5-7 days when temperature is 25-30°C.

4. Rice bran is evidently floating and separated in the liquid, like a thin film, it has a sour smell. Strain the solution get the liquid (Lactic Acid Serum) and placed it in a new container.

5. Pour ten parts of fresh milk

6. The collected liquid has been infected with different types of micro-organism including Lacto bacilli. To facilitate getting the pure Lacto bacilli, the addition of milk will eliminate other micro-organisms, leaving pure Lacto bacilli culture. You may use skimmed or powdered milk, although fresh organic milk is best.

7. In 5-7 days, carbohydrates, protein and fat will separate in the solution leaving yellow or whey liquid (serum), which contains lactic acid bacteria. The curds which float to the top are discarded, but are edible and can be used in cheese-making.

8. Lactic acid bacteria serum can be stored in the refrigerator or add equal amount of crude sugar (dilute with 1/3 water) or molasses. It will keep the lactic acid bacteria alive at room temperature. 1 part molasses to 1 part Lactic Acid Bacteria is recommended as food for the bacteria to keep them.

9. Dilute pure culture of lactic acid bacteria with 20 parts water.

10.1:100 dilution to water is suggested as basic spray or liquid feeds for animals.

11. For individual farm animals 20ml of lactic acid bacteria serum is recommended undilutied.

12. LABS is applied to plant leaves and branches to fortify phyllosphere microbes, or to soil and compost to fortify the rhizosphere.

LABS alternative formulations

(1) Beer ferment

1. Ferment 100g of ground rice to 1l. of water for 1 week (or you can use 1l. of Rice wash) in a pail

2. After 1 week, add 1l. of Milk

3. After 1 week, add 1l. of Molasses

4. After 1 week, add 10l. of water, 1.5l. of Molasses and 1 bottle of beer

5. Ferment for another week before it is ready for use

Total fermentation days: 28 days

(2) Fortified milk quick-ferment

1. Ferment 2l. spring water with 66g/l. of fortified powdered milk, 40g/l. of cornstarch and 98ml./l. of Dutch Mill (food grade probiotic) for 1 week; the LABS is ready for use

Fermented fruit juice (FFJ)

Fermented fruit juice is made from various fruits that are rich in potassium like banana, unripe papaya and squash. Potassium is responsible for sweetening fruits, fruit setting and flower setting; it is extracted by a process of fermentation and mixed with water in application. The fermented juice is used in both animal and crop production. In crop production, FFJ is used as a natural potassium source which boosts flowering, fruiting and reproduction. It strengthens plant tissues, increases size of fruits, increases crop resistance against diseases and protects from insects

This is usually either drenched or sprayed onto the plants during their reproductive stage or at the time when the plant starts to bear flowers. In animal production, this is used as a natural taste enhancer when mixed into the feeds, increasing appetite and growth in feed animals like native pigs, chickens and ducks.

FFJ production formula

Materials – (1 fruit : 1 molasses)1 kg Banana fruit;
1 kg Papaya;
1 kg Squash/pumpkin/watermelon
3 kg molasses

Procedure:

1. Clean and wash fruits;
2. Drain for 5 min;
3. Slice to an inch size;
4. Mix all fruits & molasses thoroughly in a plastic pail (20 liter capacity)
5. Put nylon screen on top of the mixture;
6. Put 5-8 pieces 25-50 grams stone on top of the nylon screen;
7. Wipe the mouth of the plastic pail
8. Cover with manila paper and add label. Ferment for 7 days
9. Extract the liquid and keep it in a plastic container

Total fermentation days: 7 days

Note: Citrus juice cannot be used with other plants because of its high acid content. Use citrus juice for citrus crops only, i.e., calamansi juice to a calamansi tree or pomelo juice to a pomelo tree.

Fermented Plant Juice (FPJ)

Fermented Plant Juice (FPJ) is made from freshly picked leaves that can easily be sourced out within the local surroundings very early in the morning around sunrise. FPJ is commonly made from fast-growing, vigorous plants such as vines near the river banks, which is high in iron and manganese; sweet potato, malunggay, banana flower, alugbati, acacia and madre de cacao leaves, bamboo shoots, lettuces, cucumber, and tomato plant. These materials contain high levels of natural growth hormones which will be extracted through fermentation. It can be used in both crop and animal production.

In animal production, FPJ is used as a source of supplemental nutrient, provides potassium and can be used during entire growth period as supplement. It improves the digestion of animals and strengthens the immune system.

FPJ is used as a spray in almost all stages of a plant's growth cycle as natural growth hormone and a source of nitrogen. It helps in nutrient absorption and adds vitality and color to plants and fruits. It is recommended diluted with water at 1:100 and is commonly used in conjunction with other organic concoctions. For example it can be used as an additive when making IMO3 and IMO4 and in EM preparations.

FPJ Preparation

1. Materials are picked before dawn while the morning dew is still present in the leaves of the plant. Since plants grow during the night, pre-dawn is when the most growth hormones are concentrated in the growing tips. Those growing tips should be collected and used. The size and length of the tips varies accordingly due plant's size and rate of growth. As a rule of thumb, it is generally cut at 6-12cm in length. Only one plant species is used at a time they are not mixed with other plants.

2. Shake off the dirt from the picked plant materials but never wash with water.

3. Weigh materials and prepare an equal amount of molasses or crude sugar.

4. Chop plant materials and mix the molasses evenly.

5. Place the mixed materials in fishnets or anything that will keep the plant materials intact before placing it in a container.

6. Cover the container with fabric or with fine net and secure with a rubber band to keep off flies and other flying insects. Place in a room with stable temperature.

7. Wait from 7-20 days until brown syrupy liquid accumulates.

8. Pour off the liquid fermented plant juice in a plastic or glass container and store in a container or in a cool, darker place.

Note: Not used in greenhouses or nurseries if there is an existing fungal problems.

Korean Farming System alternative FPJ Recipe

Materials - (2 plants : 1 molasses)

1 kg Kangkong

1 kg Kamote tops/leguminous plants

1 kg Banana stalks

1.5 kg molasses

Put nylon screen on top of the mixture; then 5-8 pieces 25-50 grams stone on top of the nylon screen.

Cover with manila paper and ferment for 7 days. Extract the liquid and keep it in a plastic container.

DOSAGE

2tbsp./liter of water

spray or drench 1 to 2 times a week

Total fermentation days: 7 days

Kangkong (water spinach) Fermented Extract

Kangkong Fermented Extract, widely known as water spinach, is essentially used as plant growth promotant and stimulant. It typically grows in fresh water and is very fast growing in highly moist soil similar to the rapid growth of kelp.

In organic agricultural practices, natural growth hormones like gibberellins, auxins and cytokinins are critical components of natural bio-nutrients extracted from fermentation processes. Those plants with a very fast growing character will have a higher concentration of natural growth hormones and stimulants. Kangkong, kelp, alugabati, the middle portion of banana all fall into this category. Axillary buds of kangkong, plants like cucumber, squash, patola and upo will be efficient materials for fermenting purposes. Once fermented, all active ingredients are extracted.

EM-1 (stock solution) is added at a proportion of 1:100 parts water and 1:10 parts molasses. The duration of fermentation and extraction is 20-30 days. Suggested usage for plant application is dilution of serum at 1:10 parts water.

Farmers' EM

Farmers' EM is a small-holders recipe for producing an activated (live) EM solution from limited but widely available local materials, usually having purchased or traded a small amount of EM-1 stock solution from a larger producer.

Materials

3kg. squash
3kg. unripe Papaya
3kg. banana (middle portion of the trunk)
3kg. brown Sugar or Molasses
3pcs. egg
10l. water
100ml. EM-1 (stock solution)

Procedure

1. Chop squash, unripe papaya and middle portion of banana trunk.
2. Add all the materials in a container sealed with lid.
3. Open the lid after 10 days carefully. Fungi is evident on the surface, if no presence of fungi, add 1 kg. of molasses and cover it again.
4. Aerate the mixture once every 10 days.
5. After 30 days stir the mixture at least once a day through 45-60 days. The mixture is ready to use.
6. Filter the mixture to get the liquid.
7. Recommended 1:10 parts of water if applying to plants.

Swamp Fertiliser

A simple ferment of 50/50 plant waste to water, using only sugar and salt.

Use a 200l. drum, add 100l. water and 100l. plant and leaves, with 250g each of sugar and salt.

Aerate by compressing every day,

23 day ferment.

Fish Amino Acid (FAA)

In the fermentation process, a general rule thumb is that the higher the protein content of the materials used in fermentation or in composting, the higher the nitrogen. Fish amino acid has this high protein coefficient and therefore provides an excellent source of nitrogen.

FAA is the liquid from the fermented fish entrails, gut, and gills or from the golden apple snail ('kuhol' - the ferment therefore sometimes referred to as KAA). As well as nitrogen it contains an abundant amount of secondary and trace nutrients. It can be added to the fertilisation program where the application of solid organic fertiliser is not providing sufficient nitrogen, particularly in operations during conversion periods from conventional to organic farming or at the onset of an organic system where soil is poor to start with. In well-established systems, there may be no more need to apply FAA, except if the farmer wishes to speed up the growth of green leafy vegetables such as pechay, pakchoi, lettuce, or if the crops are stressed during the hot season.

This very rich plant food is a sticky concentrate made from the blend of saltwater fish, or snail (KAA) and blood (BAA). It contains about 5% nitrogen (in the form of amino acids, ammonia and nitrate), and it has a small but significant amount of trace elements and plenty of fish (or snail/blood) oil.

FAA is interchangeable with seaweed-based foliar fertiliser in places where it is difficult to get fresh fish entrails, or if farmers prefer to avoid the production of this odorous farm input.

Procedure in Fish Amino Acid Extraction

1. Cut or ground fish if necessary and mix with an equal amount of brown sugar or molasses in a clay pot or any container.

2. Add EM-1 (EM stock solution), IMO-3 or IMO-4 to help in the fermentation process. It will eliminate the smell of rotting fish during fermentation and when used as foliar fertiliser. The mix consists of anearated and aerated processes, with lactic acid bacteria proliferating in the anaerobic condition and IMO active in the aerobic portion of the process.

3. Place covering over materials to keep off flies and anything that is attracted to the fermented materials.

4. Wait 3-4 weeks and extend up to 60 days.

5. Separate all liquids and place in a plastic or bottle container.

6. Suggested dilution of 1:1000 since it is high in nitrogen and amino acids to boost vegetative growth.

7. Leftover bones are mixed with vinegar for 2 weeks for calcium phosphate extraction.

Using golden apple snail (kuhol) for KAA solution

1. Wash, clean, and soak snail for 1 hour. Crush & grind the shell, and pour molasses immediately in 1:1 ratio. Preparation must be done at night to prevent flies.

2. Place in plastic container. Seal container with Manila paper and ferment for 10 days, protected from direct sunlight.

3. Strain and transfer to a clean container, ready for use.

Application

Dilute 1:100 to 2:100 with water. Spray as foliar soil treatment for crops, and as compost activator or add to animal feeds.

Oriental Herb Nutrient

OHN is made from plants and herbs such as garlic, ginger, chili ('siling labuyo'), and neem seeds. For crop production, garlic and ginger have anti-fungal and anti-bacterial properties. Neem controls insects.

In animals, garlic acts as antibiotic and parasite control. Ginger is good for the upper respiratory system. Chili enhances blood circulation. Neem seeds are effective in insect control. OHN is an important farm input for the development of the immune system of plant and animals and the control of crawling pests.

Benefits:

• Source of phytochemicals

• Improves plant and animal health

• Strengthens immune system

• Insect repellent

Materials:

OHN 1

1kg garlic

1kg ginger

400 g muscovado sugar

2.4 L of coco vinegar

OHN2

200 g chili

100 g makabuhay

Procedure : (OHN1)

1. Peel the garlic and ginger

2. Cut the garlic into halves and slice the ginger into quarter of an inch

3. Mix garlic and ginger with muscovado sugar/molasses in a pail

4. Wipe the mouth of pail and seal the it tightly. Put markings or label when it was made to know if it is ready to extract.

5. After 3 days, mix the vinegar and wipe the mouth of the pail and seal it tightly.

6. Ferment for 10 days. (1st extraction)

7. Filter the liquid in a plastic container, seal and put markings.

8. Ready to use for animals

Procedure: (OHN2)

9. Put 2.4L of vinegar, 200g chili and 100g makabuhay

10. Ferment for 10 days (2nd extraction)

11. Filter the liquid in a plastic container, seal and put markings

12. Put 2.4L of vinegar, 200g chili and 100g makabuhay for (3rd extraction.)

13. Filter the liquid in a plastic container, seal and put markings.

USAGE

Plants – Pest repellant.

Animals – Immune booster. mix with drinking water and feeds

DOSAGE

2tbsp./L of water

spray or drench 3x a week

Total fermentation days: 13 days (OHN1) 23 days (OHN2)

NFI Liquor ferment

First extraction

1. Chop ginger and/or garlic, place in a 2-gal container. Put about 2.5 kg ginger and/or garlic (2/3 portion of the container must be filled), add 2.5 L of beer. Cover the container and ferment for 12 hours.

2. After 12 hours, add half litre of molasses and ferment for 5 days, protected from direct sunlight. Strain and place in clean container.

3. This is the mother liquor to which 1/3 gin or 'lambanog' measuring about 4l. are added to ferment for another 10 days.

4. Harvest about 4 L of this fermented mixture for second extraction.

Second extraction

1. Take about 4 L of the liquid from the first extraction; add a handful of crushed finger chili ('siling labuyo'), 'makabuhay' and neem tree fruits for stronger potency. Add 4l. gin and ferment for another 10 days.

Third extraction

1. Repeat steps of second extraction by adding again 4l. of gin.

2. Store finished product in a cool place protected from direct sunlight.

Application:

Dilute 1:100 to 2:100 in water and spray on leaves and soil for crop production. Add to feeds or drinking water. Use in bedding of poultry/livestock production.

Water-Soluble Calcium Phosphate (CalPhos)

One important input in organic farming especially during rainy season that is used in fruiting plants and trees is the Water-Soluble Calcium Phosphate. Many organic practitioners use calcium phosphate for better plant growth, healthy plant condition, barrier from pest and diseases. This bio-nutrient is used very timely and very specific.

Plants need a very specific nutrient that is relative to the stage of their growth and development.

1. Seedling Establishment

2. Vegetative Growth

3. Changeover Stage

4. Reproductive Stage.

Note: Provision of the right nutrient at the right stage of the development is not only critical, but also, it is critical to apply specific nutrient of calcium phosphate in the juvenile or changeover period and also during changing weather condition with high volume of water fall.

a. nitrogen is critical on the vegetative stage

b. potassium is critical in the flowering and fruiting stages

c. however, the changeover period that is most critical and crucial that will determine the quality of reproductive stages. During this stage, one additional nutrient is needed by the plants. Calcium Phosphate or CalPhos. Calcium phosphate is good for plants' "morning sickness", a stage when additional baby feed needs to be fed, in the process where flower/fruit is about to come (e.g rice panicle development).

CalPhos from Bones, Eggshells, Shells and other source of organic calcium

This is made from calcium base materials soaked in natural vinegar. Simple equipment like, charcoal grill, long handled tongs, charcoal and clean calcium base materials (bones, eggshells, shells etc.) are needed.

Procedure

1. Get the charcoal hot and then place the materials directly in the grill. Turn materials in a few times for proportionate color. It will take about 30 minutes in low heat. When materials are ready, gray color that is even on every surface should be the objective. Black color is overdone, whereas white is underdone.

2. Cool materials and weigh. Add 9 parts of natural vinegar for every 1 part of charred materials.

3. Place mixture in a glass container and placed net over to keep off unnecessary things during the process. Evidence of bubbling where phosphoric acid is being released during process that takes for 10-15 days.

4. Collect all liquid materials and store in a dark cool place where temperature is stable.

5. For effective use, dilute 15 ml of the collected solution to 1 liter of water. Spray on leaves during vegetative and flowering stage. Apply also during rainy season to balance nitrogen intake and when growth is poor. It is use also to improve root growth, assist in fruit ripening and balance nutrient uptake.

Korean Farming System Calphos recipe

Materials – (1:9)

1kgs. Bones (ruminants)/ shells

(chicken, ducks, ostrich, sea shells)

9L of coco vinegar

Procedure:

1. Clean and wash bones/shell properly then grill it

2. Wait until the remaining fats are drained

3. Remove the bones/shell when it becomes brownish in color (not over cooked)

4. Cool down and wash again

5. Drain excess water

6. Put the bones/shell inside plastic pail

7. Add 9 liters of coco vinegar

8. Wipe the mouth of the pail then cover it with manila paper and tie with rubber band

9.Ferment for 30 days

10. Filter and put it in another plastic container. Loosen cap for 1 week

11. Ready to use

USAGE

Plants – Calcium and phosphorous source

Animals – Calcium source for bones. mix with drinking water

DOSAGE

2tbsp./L of water

spray or drench 2x a week

Total fermentation days: 30 days

Foliar Calcium from Eggshells

Calcium is one of the nutrients required by fruit-bearing plants. This element must be present to induce flowering and during flowering stage of the plant.

Benefits:

- Source of calcium
- Helps induce flowering
- Prevents blossom-end rot in tomatoes
- Prevents premature falling of blossom, improves fruit setting

Procedure:

1. Collect 2 kg eggshells and take out the inside peel.

2. Pan-fry or toast until eggshell turns brown. Use swift hand movement when burning eggshells. Allow it to cool down.

3. In a clean container, mix with 5 gal coconut vinegar. Ferment for 20 days, protected from direct sunlight.

4. Strain and place in a clean container, ready for use.

Application:

Dilute 1:100 to 2:200 in water. Apply as foliar spray on crops just before flowering and during flowering stage.

Korean Farming System Vermi-Tea

Materials:

3kg Vermicast

2kg Molasses

250ml each IMO, LABS, FAA, FPJ, FFJ

60L drum

50L water

1 aerator

Procedure:

Aerate the water for 30minutes

Add the concoctions and vermicast

Aerate for 24 hours

Ready to use

USAGE

Plants – Complete foliar fertilizer

DOSAGE

1:1 with water

spray or drench 2x a week

Bokashi

Improved, more potent liquid fertilizer, otherwise known as bokashi or "fermented manure" is essentially a naturally fortified bio-liquid fertilizer with macro and micro nutrients (bio-nutrients).

Typical Materials Needed:

1. 10 kilograms	Rice Bran (alternate Starch)
2. 20 kilograms	Vermicasts
3. 20 kilograms	Chicken Manure
4. 1 litre	EM-1
5. 20 kilograms	Molasses
6. 100 litres	Water
7. 200 litres capacity	Drum Container

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.

Procedure

1. Mix all materials in the container,

2. Stir to make a homogenous mixture after adding the water,

3. Cover the container to keep off flies and other unnecessary things in the

mixture,

4. Wait for about 2 weeks or until bubbling subside,

5. Strain and collect all liquids in a container, place in cool and stable

temperature place,

6. Suggested usage of 1:10 parts of water for plant application.

Bokashi is a bio-nutrient concoction with a high level of macro and micro nutrients. For farmer's goal, if needed a higher level of potassium, materials that should be extracted are those that with high potassium level. Or, if the farmer's objective is to have high level of nitrogen, the bio-nutrient source should have high level of nitrogen like fish emulsion or plant leguminous extract.

Note: General key in the formulation of bokashi is between the diversity of available enhanced microorganism and bio-nutrients with high carbon and organic matter.

Korean Aerobic Bokashi

Mainly used for agriculture as organic fertilizer

Easily produced on a large scale compared to the anaerobic type

Materials for aerobic Bokashi

As main materials (more than 50% by volume):
Rice bran (darak),
Rice husk (ipa),
Chopped rice straw (dayami)
Shredded Corn Stalks (katawan ng mais)
Shredded Sugar cane Stalks (Bagas)
Sawdust
Soybean meal,
Copra meal,
Bean husk,
Fish meal,
Bone meal,
Duckweed /Azolla,
Leaves of Ipil-ipil or Kakawate,
Animal manure (except dog & cats)
Coffee grounds
IMO and Molasses

1-5 % to the water volume

Clean water
About 30-40% of Materials by weight
(30L-40L for 100kg materials)

Sample Mix for Aerobic Bokashi

20 kg D3 (Gaspang)
20 kg CRH (Carbonized Rice Hull)
10 kg dried rabbit or chicken manure
400 ml IMO
400 ml molasses
20 litres water

Procedure:

Step 1. Dilute IMO and Molasses in water
Step 2. Mix all the solid ingredients and diluted IMO solution
Step 3. Check for 30-40% Moisture content
Step 4. Cover the bokashi with gunny bags/plastic cover
Step 5. Ferment for 1 week in a covered area without rain and direct sunlight

Management during fermentation

Turn over the mixture if its temperature exceeds 50oC

1 week

Aerobic Bokashi is ready for use when
- it has a sweet-sour fermented smell.
- its temperature is stable

Storage of Aerobic Bokashi

1. Dry without direct sunlight
2. Pack

Aerobic EM Bokashi can be kept for 6 months under good storage condition

Usage of Aerobic Bokashi

Soil fertilizer
Composting agent
Treatment of kitchen garbage
Key ingredient for mud balls for the treatment of pond, lakes, rivers, sewage systems
Treatment of manures

Korean Fortified Compost Fertiliser

Mix 1 - 300kg

Materials:

1. 100kg shredded farm wastes (dried leaves, rice straw, vegetable trimmings, twigs, etc.)
2. 30L IMO solution (1L IMO: 29L water)
3. 100kg Soil
4. 15L FAA solution (500ml FAA:14.5L water)
5. 100kg decomposed animal manure
6. 15L FAA/Calphos/FFJ solution (300ml FAA/100ml CalP/100ml F FJ:14.5L of water) x2

Procedure:

1. Pile 100kg of shredded farm wastes and water with 30L IMO solution
2. Wait for 3 days
3. Add 100kg soil into the pile and water with 15L FAA solution
4. Wait for 3 days
5. Add 100kg of decomposed animal manure and water with 15L FAA, CalPhos ,FFJ solution
6. Wait for 3 days
7. Repeat step 5 (liquid only) everyday for 12 days
8. If it is not hot anymore or the temperature lowered down, it is ready to use

Total weight: approximately 300kg

Total days of preparation: 21 days

MC: 30-40%

Mix 2 - 600kg

Materials:

1. 100kg D2 rice bran
2. 30L IMO solution (1L IMO:29L water)
3. 200kg decomposed animal manure
4. 30L FAA solution (1L FAA:29L of water) x2
5. 100kg Soil
6. 30L FAA/FFJ/CalPhos solution (200ml FAA/200ml FFJ/100ml CalPhos: 29.5L water)
7. 15L FAA/FFJ solution (250ml FAA/250ml FFJ:14.5L water) x5
8. 100kg CRH
9. 100kg vermicast
10. 30L IMO/FAA solution (500ml IMO/500ml FAA:29L water)

Procedure:

1. Pile 100kg of D2 and water with 30L IMO solution
2. Wait for 3 days
3. Add 200kg decomposed animal manure and water with 30L FAA solution

4. Wait for 3 days
5. Add 100kg of soil and water 30L FAA/FFJ/CalP solution
6. Wait for 3 days
7. Water with 15L FAA/FFJ solution for 5 days
8. Add 100kg of CRH water with 30L FAA solution

9. Wait for 3 days
10. Add 100kg vermicast water with 30L IMO/FAA solution
11. Wait for 3 days
12. Ready to use

MC: 30-40%

Total weight: approximately 600kg

Total days of Preparation: 20 days

EM Mudballs

EM Mudballs are made of dried mud into which EM Bokashi and Activated EM-1 (Activated EM) have been incorporated. They are used to clean up bodies of water such as rivers, lakes, and oceans where there are concentrated deposits of sludge and slime and improved beneficial microbial life.

Procedure

Basic Materials:

Dirt. It is usually best to use clay-like dirt that can easily be formed into balls. Activated EM-1 (AEM).

Molasses (At 10% the volume of the Activated EM-1. For example, 7 tablespoons of molasses for 1 litre (quart) of AEM.)

EM Bokashi.

- Mix 1 quart of EM-1 or EMAS per 16 quarts of materials.

- Add more Activated EM (or water) if not enough liquid.

- Mould materials into shape like a balls (mudballs)

- Let mud balls air-dry and ferment for at least 2 weeks before using.

- A white mould-like coating should form on the mud balls (may not always happen, which is okay)

You can play around with the type of bokashi materials (fermented wheat bran, fermented leaves, fermented wood shavings, fermented coffee husks, fermented brewery waste, etc.) and combine them in order to make your perfect mudball.

The mudballs should be fairly solid after fermenting and drying and not fall apart so easily. And you also don't want a mudball that's too hard and takes awhile to soak up water and sink to where they are most effective. In a flowing waterway, mudballs that float too long may be taken elsewhere.