



**A Training Guide to Trainers**

# **MICRONESIA GROWS TECHNOLOGY**

**A Program to Facilitate Distance Learning for Agriculture and  
Extension Students at the College of Micronesia-FSM**

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# GLOSSARY

**COMPOST**

any product in solid or liquid form, of plant or animal origin, that has undergone substantial decomposition that can supply available nutrients to plants with a total N-P-K 2.5 to less than 5 percent.

**KOREAN NATURAL FARMING**

an approach to agriculture that specializes in producing farm input to improve plant growth. It was developed by Cho Han-Kyu in the 1960s.

**ORGANIC CONCOCTIONS**

are based on the principles of K.N.F which utilizes fermentation in the production of farm inputs.

**ORGANIC EXTRACT**

are ingredients that have been pulled from natural sources, such as plants, fruits, vegetables, grains, meat or seafood.

**ORGANIC FERTILIZER**

is a fertilizer that is derived from organic sources, including organic compost, cattle manures, poultry droppings and domestic sewage.



# TABLE OF CONTENTS

I	Acknowledgment	1
II	Glossary	2
III	General Instruction	4-5
IV	Project Brief	6-7
V	Pre-test	8
VI	Module 2 Formulating Organic Concoctions & Extracts	9
	Objectives	10
	Topic 1 Organic Concoctions & Extracts	11-19
	Topic 2 Preparing for Organic Fertilizer Production	20-24
VII	Post-test	25
VIII	References	26

# GENERAL INSTRUCTION

**01**

## INFORMATION AND INSTRUCTIONS TO THE TRAINER

This manual should be used purely as a facilitator's guide. The sessions under each module are presented with an outcome(s) to facilitate the assessment of participants' understanding and depth of knowledge at the end of each session. Following the outcomes are the topics to be covered and facilitating methodology. However, the facilitator should feel free to adapt the methodology suggested to the needs of participants. To enhance a participatory learning process, some methods of presentation and the steps to follow are therefore outlined. The manual also provides some background information on each session. The information is also meant to aid the facilitator in the preparation for the session. Like all participatory methods, the involvement of the participants in all stages of the learning process is vital. However, all users of this manual must study and research into the content of each module before the presentation. Start each sub-topic and group activity by explaining the objective and learning outcomes expected of them, and ensure they are met.

The session should be interactive, participatory, lively and interesting. Let the participants express themselves in local language, if deemed necessary, for them to understand the concepts. Encourage them to ask questions especially on concepts that they do not understand. Switch to either English or vernacular language when you find some farmers or all of them do not understand you in one of the languages.

Start the session with greetings, welcoming remarks, and introduce yourself. Ensure you have the necessary stationery, equipment, and materials for the trainees: projector, flip charts or whiteboard, whiteboard markers, marking pens, posters, and handouts. Be time conscious as you facilitate the session.

This manual is organized around aspects of Organic Agriculture, its fundamentals and principles, formulating organic concoctions and extracts, and producing organic fertilizers.

02

## **USERS OF THE MANUAL**

The manual is intended to be used by facilitators in conducting training workshops across the College of Micronesia-FSM through the aid of C.R.E extension agents and agriculture major students.

03

## **PRESENTATION METHODOLOGY**

The methods of presentation outlined in the manual are suggested as a guide to the facilitator. The facilitator is expected to use his or her judgement in selecting the appropriate method or combination of methods in presenting each session.

04

## **ASSESSMENT**

At the end of each session, the facilitator is expected to assess/evaluate the participants' understanding and level of knowledge by using a simple question and answer session as appropriate. In some of the sessions, assessment questions are suggested as activities whilst in some, the facilitator is given a free hand in determining the kind of questions to be asked. However, all assessments must relate to the session.

# PROJECT BRIEF

The Federated States of Micronesia are situated in the Pacific Island region and have a mix of traditional cultures impacted greatly by successive Spanish, German, Japanese, United Nations and United States colonizations and territorial agreements. The food systems here are in transition. Large pelagic and near shore aquatic resources are spread across thousands of kilometers and the potential for misuse is extreme. Local land-based agricultural practices are a mix of traditional and imported crop farming and husbandry. Both ocean- and land-based systems are subject to increasingly challenging results from climate change. In this context, one of the most important tools that local communities have is their knowledge. Showing how traditional knowledge integrates with modern, scientific agricultural research and practices is one of the benefits of a robust CRE program.

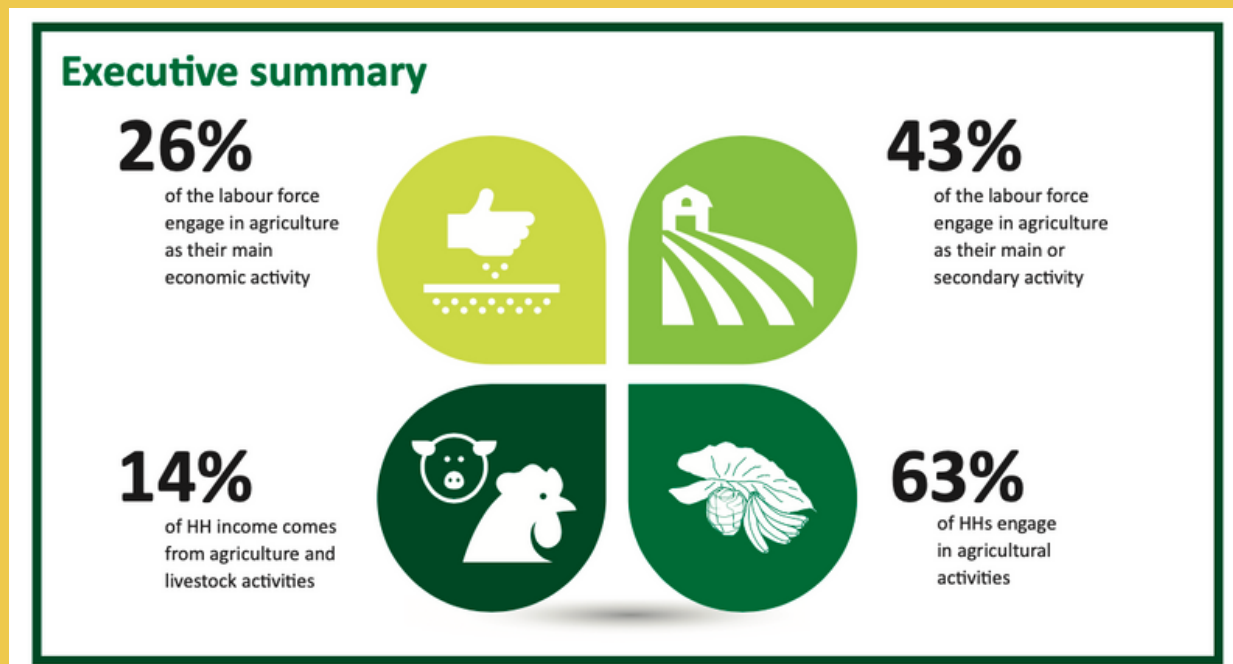
The College of Micronesia-FSM is a learner-centered institution of higher education that is committed to the success of the Federated States of Micronesia by providing academic and career & technical educational programs characterized by continuous improvement and best practices. The college is accredited by the Accrediting Commission for Community and Junior Colleges (ACCJC) of the Western Association of Schools and Colleges (WASC). Prior to the coronavirus pandemic, the college was not accredited to offer distance education programs to its students.

Distance education plays a major part in this process of integration now with the pandemic, as academic offerings of the college are exclusively online where feasible. As a result of the Micronesia Grows Technology program, well-trained agricultural workers will adopt best practices in the region, and will succeed in bringing integrated knowledge to local, state, and regional actors. Acting in concert with the college, which serves all four states of the Federated States of Micronesia (FSM), this progress will reach national communities and impact international practices as well-spoken contributions come from these former agricultural research and extension students. Affording them with personal laptop computers will make this possible in a way that faces forward and opens up access to the whole world of internet offerings in agricultural practices. Familiarity with computing helps make this happen.

The Cooperative Research and Extension (CRE) program provides training, knowledge and skill development in agriculture and aquaculture, nutrition, resource management, and youth and families through our research, extension, and resident instruction programs. The rental program providing laptops to agriculture students will add momentum to the overall goals of the college, and in particular will aid the CRE in its mission to provide unrestrained support in aiding the development of the Federated States of Micronesia.

## In a Nutshell

# FSM AGRICULTURE



Agriculture is extremely important for the livelihoods of households (HH) across the Federated States of Micronesia (FSM). 63% of HHs report conducting some form of agriculture and forestry. 43% of the labour force conduct agriculture as a primary or secondary activity, and agriculture contributes 14% to overall HH income.

However, most of these agricultural activities are for subsistence. Nearly 40% of HHs produce goods purely for their own consumption (subsistence). Only 24% of FSM HHs have sold any part of their agriculture production. Very few agriculturally active HHs hire labour or use inputs such as fertiliser and irrigation.

Agricultural production varies considerably across states. The most important food crops (in terms of total value sold, gifted and consumed) were: taro in Yap, breadfruit in Chuuk, yam in Pohnpei and banana in Kosrae.

Other crops also provide significant income in some states. Sakau (kava) had the highest value of production in total, and provides the highest income from sales, with more than USD2.5 million in sales in Pohnpei. Betel nut was a major income earner in Yap, and was sold, gifted and consumed across all states.

Livestock is also important for subsistence. 51% of HHs reported raising livestock but only 20% of these HHs sold their production. Pigs are the most important livestock, with 80% of livestock HHs reporting having pigs.



# PRE-TEST

Direction. Read and analyze the questions thoroughly. Choose the letter of the correct answer.

- 1 THE FOLLOWING ARE COMMON RAW MATERIALS FOR ORGANIC CONCOCTIONS AND EXTRACTS EXCEPT.**

a. Fruits                      b. Vegetables                      c. Molasses, Muscovado, Brown sugar                      d. Salt
- 2 THE FOLLOWING ARE THE USES OF ORGANIC CONCOCTIONS AND EXTRACTS EXCEPT.**

a. Plant Defense                      b. Growth enhancer                      c. Flower inducing                      d. Plant replicating
- 3 THESE ARE FARM INPUTS DERIVED FROM PLANTS, MICROORGANISMS AND ANIMAL MATERIALS PROCESSED TO HARNESS THEIR BENEFICIAL PROPERTIES.**

a. Wet fertilizer                      b. Organic concoctions                      c. Soil conditioner                      d. Dry fertilizer
- 4 A FERTILIZER THAT IS FREE FROM CHEMICAL AND SYNTHETIC SUBSTANCE.**

a. Inorganic                      b. Organic                      c. Complete                      d. Limestone
- 5 THE FOLLOWING ARE ALL ADVANTAGES OF ORGANIC FERTILIZER EXCEPT:**

a. OHN                      b. FPJ                      c. FAA                      d. FFJ
- 6 THIS IS AN ORGANIC CONCOCTION THAT HELPS IMPROVE THE FLOWERING CYCLE AND FRUITING STAGES OF PLANTS.**

a. FPJ                      b. FFJ                      c. FAA                      d. OHN
- 7 THIS IS AN ORGANIC CONCOCTION THAT USES COMMERCIAL RICE THAT AIDS IN INCREASING BENEFICIAL BACTERIA DURING FERMENTATION.**

a. Calcium Phosphate                      b. LABS                      c. Indigenous Microorganism                      d. OHN
- 8 THIS ORGANIC EXTRACT CAN BE USED AS BIO-PESTICIDE FOR PLANTS**

a. FPJ                      b. FFJ                      c. FAA                      d. OHN
- 9 THE FOLLOWING ARE FACTORS AFFECTING COMPOSTING EXCEPT:**

a. pH                      b. Moisture content                      c. Aeration                      d. Acidity
- 10 THIS IS AN ORGANIC EXTRACT USED TO LURE AWAY FLYING INSECTS FROM CROPS.**

a. Probiotic                      b. Natural Insect Attractant                      c. FAA                      d. OHN



## MODULE 2

# FORMULATING ORGANIC CONCOCTIONS & EXTRACTS

This module covers the knowledge, skills, and attitudes you need to know about Organic Agriculture. It includes an overview of Organic Agriculture, and its underlying principles, models of organic agriculture, industry sectors, opportunities, and trends. It also introduces to the fundamentals of Organic Agriculture.





## OBJECTIVES

### AT THE END OF THE MODULE, YOU SHOULD BE ABLE TO:

- Enumerate uses and advantages for organic concoctions and extracts;
- Formulate and process the different Korean Natural Farming concoctions & extract;
- Explain what happens in the composting process;
- Discuss the factors affecting the composting process and its different methods



## Topic 1 Organic Concoctions & Extracts

# INTRODUCTION

Korean Natural Farming (K.N.F) is an approach to agriculture that specializes in producing farm input to improve plant growth. It was developed by Cho Han-Kyu in the 1960s. The fundamental principle is that strengthening the biological aspects of the plant would eliminate the need for chemical intervention. KNF can be applied to livestock management but its products mostly address plant growth and soil fertility.

Organic concoctions and extracts are farm inputs heavily based on the principles of Korean Natural Farming (K.N.F).

Organic concoctions and extracts are farm inputs derived from plants, microorganisms, and animal materials processed to harness their beneficial properties. These are usually in liquid form.

The most common use for organic concoctions, is fertilizer. They are applied by drenching (soil) or spraying (leaves, flowers, and fruits of plants).

### USES OF ORGANIC CONCOCTIONS

- Growth Enhancer
- Pesticide
- Flower Inducer
- Soil Conditioner
- Food Supplement for animals
- Natural antibiotic for animals
- Sanitizer for livestock and poultry houses

Organic concoctions are based on the principles of K.N.F which utilizes fermentation in the production of farm inputs.

In fermentation, plant and animal materials are extracted fro their energy. That energy is then converted into organic acids which are beneficial to plants. Most organic concoctions and extracts are fermented.

RAW MATERIALS FOR ORGANIC  
CONCOCTIONS



COMMON TOOLS IN PREPARING  
CONCOCTIONS





PROCESSING ORGANIC CONCOCTIONS

# Indigenous Micro Organisms (IMO)

- Revive soil nutrients. It speeds growth of plants.
- Speed up composting works like “vaccinating” against sickness, illness and weeds.
- These are present in the soil but have deteriorated due to many factors.

## HOW TO MAKE THE CONCOCTION

- Put cooked/ steamed rice in a wooden box or perforated plastic tray that is 8 ½" x 11" x 3" or a length of a bamboo pole open or split open on one side. Make sure there is enough moisture in the box. Fill half of the container. Do not compress.
- Cover the box, tray or bamboo with a clean sheet of paper and tie with a string. Label the box indicating when concoction was prepared and the day it will be harvested.
- Cover and wrap with plastic to keep out rainwater, protect from wild rats or small rodents that may interfere, or destroy its contents.
- Collect from forest floors, leaf molds, bamboo plantation, rice paddy or coconut husk
- In 3-5 days, take the rice along with the white molds that formed on top of it. Disregard the black molds.
- Place in a plastic container/ jar the moldy rice and mix with 1 kilo of molasses or crude sugar.
- Cover the jar with a clean sheet of paper and tie with a string. Place in a cool and shaded place. After 7 days this will yield a mud like juice.
- How to use the concoction:**
  - Mix 2 tablespoons of the juice to 1 liter of water
  - Spray on soil and plants

**Ingredients:**

- cooked rice
- muscovado sugar/molasses
- clean water (no chlorine or other chemicals)

**Materials:**

- bamboo trough/clay pot
- Manila paper
- basin
- strainer
- funnel
- plastic
- marker

# Oriental Herbal Nutrient (OHN)

- Natural Pest repellent. It is used throughout the early, vegetative and change over period and fruiting stages.
- Is a very important input in natural farming
- Helps to develop the immune system of plants and animals.

## HOW TO MAKE THE CONCOCTION



**1** **Ingredients:**  
8 kilo crushed ginger for plants/garlic for animals  
2 kilo muscovado sugar  
10 liters of gin or liquor 30-40 proof  
Use ceramic or glass jar

**2** Divide container into three parts. Mix ginger/garlic and muscovado sugar together preferably by hand and put inside jar. Cover and seal. Ferment for seven days.



**3** After seven days add 10 liters of gin. Cover and seal. Decant liquid after ten days. First extraction is good for animals. Second extraction is good for plants. Just add gin same amount taken from the first extraction. You may add fresh or dry chili, neem fruit, curry fruit, makabuhay, marigold for stronger potency and repeat same process the third time. And continue to ferment for ten days.



**4** Together with other mixtures spray on plants every week when they weaken or start to flower.



### HOW TO USE THE CONCOCTION:

1. Mix the following
  - 2 tablespoons of OHN to 1 liter of water
2. Add to the IMO and FPJ mixture and spray together on the leaves and soil every week

### Materials:

- bamboo trough/clay pot
- Manila paper
- basin
- strainer
- funnel
- plastic
- marker





# Fermented Fruit Juice (FFJ)

To sweeten the fruit (Potassium)

It increases plant nutrition through leaves and roots with potassium factor

## HOW TO MAKE THE CONCOCTION



**1** Prepare 1 kilo sweet fruits to 1 kilo brown sugar; you may use molasses. Suggested materials include banana, papaya, pineapple, mango, jack fruit, star fruit, guava, pumpkin, etc (citrus fruits is not recommended). Matured squash can also be used. Recommended "best" mixture is banana 3 kg, papaya 3 kg, and pumpkin 3 kg. Rule of thumb-fermented fruit juice from tomatoes fed to tomatoes is just like feeding breast milk to the baby!

**2** Ratio 1:1 Put 1 kilo sweet fruit inside the clay jar /plastic container & add 1 kilo of crude sugar. Best prepared in the evening to prevent interference from flying insect.



**3** Cover with a clean sheet of paper and tie with a string and label the jar indicating the date it was prepared. Place in a cool and shaded place. Ferment for 7 days.



**4** This will make approximately 1 ½ liters of juice. Drain the liquid and place in plastic bottles (always leave about 1/3 of bottle empty so IMOs can breathe).

### HOW TO USE THE CONCOCTION

**For Plants:**

Apply using 2 tbsp of FFJ / 10 liters of water. Apply directly to leaves of plants when sun is not out. Add to the IMO and FFJ mixture and spray together to the leaves and soil of fruit bearing trees or during vegetative and reproductive stages.

**For Animals:**

Mix 2 tablespoons of the juice to 1 liter of water. This is also good for human consumption.

**IMPORTANT:** Do not tighten bottle lid for 2 weeks following bottling to allow gasses to escape and avoid a sticky explosion! Solid material can be used as animal feed or compost. FFJ should have a pleasant smell and sweet, tangy taste. Keeps for about a year.

**Other:** Use FFJ to reduce latrine smell. Use 3 spoons / 10 liters while cleaning. Pour 2-4 spoons directly down toilet to help septic system.



### POINTS TO REMEMBER:

Chlorophyll in leaves does not dissolve in oil or water. It can dissolve only with very weak alcohol. There are lot of enzymes in leaves, when enzymes are mixed with brown sugar or molasses they ferment through osmosis pressure and in the process we get the liquid or juice. Small fruits fermented in brown sugar are used to promote growth. Get the little fruits and fed back to the tree to make fruits grow a lot larger. You can also used the flowers or blooms of acacia and flowers that bee loves.

It helps in the digestion of animal and plant nutrients. It resists plant diseases and protects plant nutrients. It protects plants from insects. It speeds harvesting. It is plant hormones. Spray to leaves and soil.

### Ingredients:

- One or more fruits
  - designated assembly point
  - squash
  - papaya
  - banana
  - mango
  - jackfruit
  - watermelon
- muscovado sugar/molasses

### Materials:

- pail/plastic container
- weighing scale
- Manila paper
- tape and marker
- cloth
- net
- rubber band or plastic straw
- stone (at least 50g)
- knife
- chopping board
- wooden ladle



# Fermented Plant Juice (FPJ)

There are a lot of enzymes in leaves that enhances plant growth; and promote photosynthesis

## HOW TO MAKE THE CONCOCTION



**1** Use any green colored leaves such as kangkong, kamote, kalabasa, alughati tops, bamboo shoots and other fast growing plants. Fresh, juicy, succulent leaves are best. Some suggestions are banana stem, water spinach, bamboo shoots, green grasses, bamboo leaves, and duck weed or azola. Cut young banana trunk (cardava) Collect before sunrise. Avoid collecting after excessive rain. Quickly snap the growing points of the plants. Baby fruits can be used to promote growth.

**2** Chop 2 kilo plants and mix 1 kilo of crude sugar in a large basin. Place in a clay jar or plastic container. Put a rock on top of the jar and wait for the ¼ of the contents to settle at the bottom. After five hours and remove the rock and cover the jar with a clean sheet of paper and tie with a string. Put the jar/plastic container in a cool and shaded place. Fermentation will be complete in seven days.



**3** This will yield 2 ½ liters of juice when the banana trunk is used. Filter to separate sludge.

### POINTS TO REMEMBER:

Do not wash the material.  
Seal the container with clean sheet of paper at room temperature. Avoid direct sunlight. Solution is ready in seven days. Strain and transfer in a clean container.  
Drain the liquid and place in plastic or glass bottles (always leave about 1/3 of bottle empty so IMO to breathe).  
**IMPORTANT:** Do not tighten bottle lid for 2 weeks to allow gasses to escape and avoid a sticky explosion!

**Note:** Wait till the tiny bubbles disappear then close the container tightly. if you observe undissolved sugar at the bottom, it means the fermentation did not take place. Extend for another day and add a little water to reactivate.

### APPLICATION:

- Apply using 2 tablespoon of FPJ / 10 liters water.

- Apply directly to the leaves of plants when sun is not hot. Before sunrise or two hours before sunset.

- Plant material can be used as animal feed or compost. FPJ should have a pleasant smell and sweet, tangy taste. Keep for about one year.



### Ingredients:

- green, leafy plants
- water spinach or kangkong
- banana trunk
- sweet potato shoots
- bamboo shoots
- pumpkin leaves
- perennial peanut or
- malavar spinach
- molasses/muscovado sugar

### Materials:

- pail/plastic container
- weighing scale
- Manila paper
- tape and marker
- cloth
- net
- rubber band or plastic straw
- stone (at least 50g)
- knife
- chopping board
- wooden ladle



# Fish Amino Acid (FAA)

Make nitrate from fish. It contains abundant amount of nutrients and various types of amino acid.

**1** Put whole fish or bones, gills and guts, scales, tails etc. in a glass/plastic container. Wash, crush live snail or *kuhol* (eggs can also be used) and place in the container. Pestle or crush materials. Don't use hands. Add the same amount of molasses or Muscovado sugar. Mix sugar in ¼ container with fish ingredients then remaining molasses. Prepare at night to prevent flies from breeding in the concoction.



**2** Cover and keep in a cool place or shaded area. Drain to extract liquid after 10 to 15 days. Transfer liquid into a clean plastic bottles. Wait till tiny bubbles disappear before sealing the cover and storing. Always leave about ¼ of bottle empty so IMO can breath.



## Calcium Phosphate Ca-P (animal bone)

- Induces flowering, prevent overgrowth. For older plants, it increases calcium factor on roots and leaves. Calcium Phosphate (Ca-P) is the product which according to the plants' lifecycle, can be fast-effective. Ca-P is applied when the plants are about to flower. Feed to animals during pregnancy or breeding time at 200 times dilution. Spray when the first flowers comes out. ex: tomato plant, cucumber, eggplant etc.

**1** Boil or broil 2 kilos of animal bones to separate meat and fat until remaining meat to the bone is charcoal black scrape charred meat and let it cool. Do not burn the bone. Ratio 1:10



**2** Place bone in a plastic container and pour 5 gallons of pure coconut or sugarcane vinegar. Cover for 30 days. Filter and use. Cover container- air tight.



## Calcium (eggshell and shells)

- Strengthen Flowers. Contributes to better utilization of carbohydrates and protein. It is also a major element in forming a cell membrane and enables smooth cell division; makes fruit hard and sweet. Spray CA on the leaves after the fruits have become large. The concoction helps prevent overgrowth and promote the development of sweet hard fruits. Add seawater, calcium phosphate or OHN for better taste and aroma of the fruits. It is applied when the plants' supply of nitrogen is excessive. It is the most important ingredients for flowering.



**1** Wash and crush eggshell and take the inside filament or film. Pan fry 2 kilos eggshell until brown, set aside and cool. Pour vinegar first then slowly pour the eggshell.



**2** Wait till the tiny bubbles disappear. Use exact size of container just enough to fill the contents. Cover and ferment for 20 days. Filter and use keep in airtight container.

### APPLICATION: FAA / CALPHOS / CALCIUM

- Apply using 2 tbsp / 1 liters of water.
- Apply directly to the soil or to the ground, not to the leaves.
- Keep concoction from direct sunlight. Store in dry cool place.



### Ingredients:

- fish or fish trimmings such as scales, gills, entrails, head; OR
- molasses/muscovado sugar
- bones from pig, goat, cow or fish
- coconut vinegar
- eggshells

### Materials:

- pail/plastic container
- weighing scale
- Manila paper
- tape and marker
- cloth, knife
- net, funnel
- rubber band or plastic straw
- stone (at least 50g)
- strainer
- chopping board
- wooden ladle



# Natural Attractant for Flying Insects and butterflies

## Elimination of flying insects



**1** One (1) gallon of coconut vinegar or coconut wine (tuba) and add ½ kilo of crude sugar before boiling. Cool and add 1/3 liter of FPJ concentrate.



**INSECT ARE ALCOHOLICS  
PUT A LITTLE BAR. THE  
INSECTS COME BY, HAVE A  
DRINK, GET DRUNK , FALL  
AND DIE! Dead insect  
cannot multiply!**

**2** Put some of the mixture in containers and hang on fruit-bearing trees.



**3** Put some of the mixture and hang on vegetable trellises.



**4** Put some of the mixture in a container and place near vegetable plots.



### Ingredients:

- 1gal coconut vinegar
- 0.5L molasses
- 300mL fermented plant juice

### Materials:

- stove and pot
- wooden ladle
- container

**STORING ORGANIC CONCOCTIONS & EXTRACTS**

**Keep away from direct sunlight.**

Exposure to direct sunlight accelerates spoilage so keeping it in a cool, dry place will preserve its potency for longer.



**Keep storage area safe from pests.**

Use pest-proof materials OR secure your concoctions and extracts and areas where pests can't reach.



**Practice the "First In, First Out" policy.**



**Do not seal the caps too tightly.**

Pressure will continue to build up for 2 weeks after harvest and this may cause the products to gush out.



**If possible, store in refrigerators.**

Concoctions and extracts stored in the refrigerator will last up to 6 months; except for *Natural Health Enhancer* which can only last for 40 days and *EMAS* which is good for 1 month.





## Topic 2 Preparing for Organic Fertilizer Production

# INTRODUCTION

The most widely used organic fertilizer is compost. It is a natural form of recycling that turns certain waste into organic material that can be used in a variety of ways. It is made from organic materials that have undergone complete decomposition; it contains essential plant nutrients and humus.

### ADVANTAGES OF COMPOST

- availability of raw materials
- minimal technology required for production
- utilizes farm wastes that would, otherwise, contribute to pollution
- preparation does not require technological equipment
- does not occupy a huge portion of farm space

Composting does not mean to complete decomposition of all degradable organic materials, but to degrade only putrescible that could otherwise create odors and nuisance in the environment. Contrary to general belief, composting process also releases a few odorous gases even in most favorable conditions.

### SOURCES OF COMPOST

**Brown Materials**

- Aged Hay
- Oat Hay
- Cardboard
- Dry, Shredded Leaves
- Sawdust
- Chipped Wood
- Cardboard Egg Cartons
- Shredded Paper
- Paper Towels
- Straw
- Toilet Paper Rolls
- Wood Ash (not coal)
- Dried Grass

**Green Materials**

- Vegetable Trimmings
- Algae
- Green Leaves
- Grass Clippings
- Kelp or Seaweed
- Green Shrub Prunings
- Tea Bags
- Alfalfa Meal/Hay
- Coffee Grounds/Filter
- Animal Manure (herbivores only)
- Houseplants
- Weeds (without seed heads)
- Old Flower Bouquets
- Human/Animal Hair
- Aquarium Water (freshwater only)

Note: Small materials decompose faster. For best results, shred any paper products into strips.

### COMPOSTING FACTS

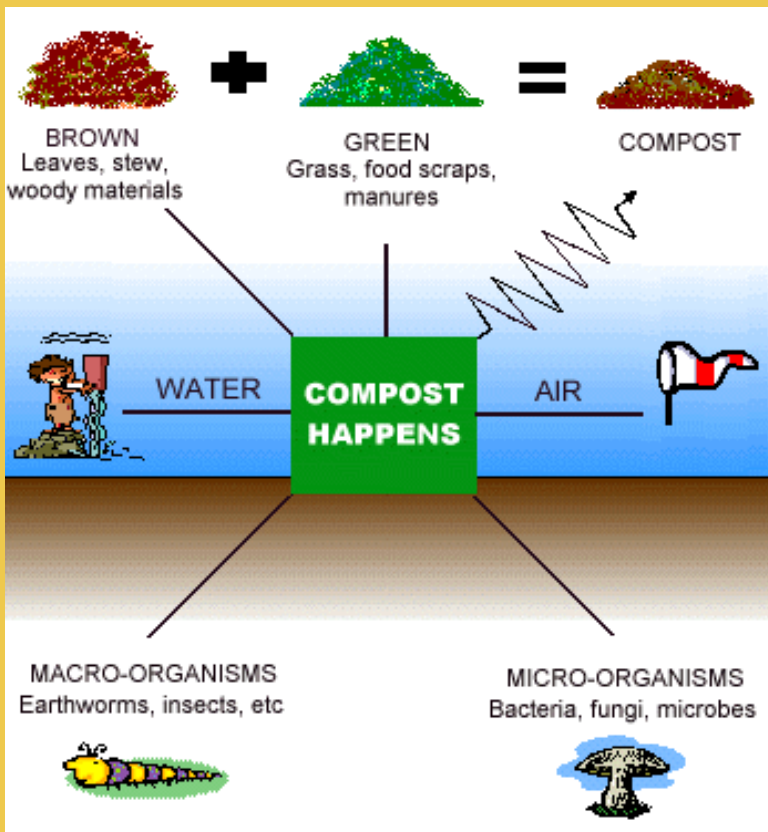
**38 million tons of food waste was generated in 2014**

**5.1% of food waste was composted**

**20% of discarded waste is food waste**

**3 TYPES OF COMPOSTING**

	<p><b>VERMICOMPOSTING</b></p> <p>AKA, "worm composting." Uses various species of worms (usually red wigglers) to decompose plant-based foods like fruits and veggies. The process creates "vermicast" (worm poop), which can be added to soil as a nutrient-rich fertilizer.</p>
	<p><b>BACKYARD COMPOSTING</b></p> <p>Combines "brown" (dead) and "green" (living) materials, water, and oxygen using a composting bin or tumbler to create a nutrient-rich, organic mixture that can be added to soil to help retain moisture and suppress plant diseases.</p>
	<p><b>COMMERCIAL FOOD SCRAP COMPOSTING</b></p> <p>Uses a designated container and compostable bags that are picked up by--or dropped off to--a Commercial Composting service. Commercial Composting operations can compost a larger variety of organic material like meat, bones, &amp; dairy.</p>



**Figure 1. Process Flow Diagram of Composting Process**

The easily degradable carbon is converted in to carbon dioxide and process does not stop at a particular point. Material continues to break down until the last remaining nutrients are consumed by the last remaining organisms and until nearly all of the carbon is converted to carbon dioxide.

However, the compost becomes relatively stable and useful long before this point. Compost is judged to be "done" by characteristics related to its use and handling such as carbon to nitrogen ratio, oxygen demand, temperature and odor. The carbon, chemical energy, protein and water in the finished compost are less that that of the raw materials. The volume of the finished compost is 50% or less of the volume of the raw material.

**FACTORS AFFECTING THE COMPOSTING PROCESS**

<b>C:N Ratio</b>	<b>MOISTURE CONTENT</b>	<b>AERATION</b>
<p>Carbon and nitrogen are the two fundamental elements in composting, and their ratio (C/N) is significant. The bacteria and fungi in compost digest or "oxidize" carbon as an energy source and ingest nitrogen for protein synthesis. Carbon can be considered the "food" and nitrogen as the digestive enzymes.</p>	<p>Microorganisms can only use organic molecules if they are dissolved in water, so the compost pile should have a moisture content of 60-80% of water holding capacity. If the moisture content falls below 40% of water holding capacity the microbial activity will slow down or become dormant. If the moisture content exceeds 80% of water holding capacity, aeration is hindered, nutrients are leached out, decomposition slows, and the odor from anaerobic decomposition is emitted.</p>	<p>The decomposition occurring in the compost pile takes up all the available oxygen. Aeration is the replacement of oxygen to the center of the compost pile where it is lacking. Efficient decomposition can only occur if sufficient oxygen is present. This is called aerobic decomposition. It can happen naturally by wind, or when air warmed by the compost process rises through the pile and causes fresh air to be drawn in from the surroundings. Therefore composting systems or structures should incorporate adequate ventilation.</p>

<b>TEMPERATURE</b>	<b>AMOUNT OF SURFACE AREA</b>	<b>pH</b>
<p>Microorganisms generate heat as they decompose organic material. A compost pile with temperatures between 90 and 140 OF (32-60 OC) is composting efficiently. Temperatures higher than 140 OF (60 OC) inhibits the activity of many of the most important and active organisms in the pile. Given the high temperatures required for rapid composting, the process will inevitably slow during the winter months in cold climates.</p>	<p>Decomposition by microorganisms in the compost pile takes place when the particle surfaces are in contact with air. Increasing the surface area of the material to be composted can be done by chopping, shredding, mowing or breaking up the material. The increased surface area means that the microorganisms are able to digest more material, multiply more quickly, and generate more heat. It is not necessary to increase the surface area when composting, but doing so speeds up the process.</p>	<p>The level of pH in the waste depends upon the decomposition rate and characteristics of feed material. The release of organic acids may decrease the pH and production of ammonia from nitrogenous compounds may raise the pH. At higher pH levels, more ammonia gas is generated and may be lost to the atmosphere. A pH value between 6.5 and 8.5 is optimal for compost microorganisms. As bacteria and fungi digest organic matter, they release organic acids.</p>



**METHODS OF COMPOSTING**

**A. RAPID COMPOSTING**

Chinese Rural Composting – High Temperature Method	14-Day Method	Institute of Biological Science (IBS) Rapid Composting
<p><b>Materials:</b></p> <ul style="list-style-type: none"> <li>• animal manure and plant residues (1:4)</li> <li>• water</li> <li>• bamboo poles</li> <li>• mud</li> <li>• shovel</li> </ul> <p><b>Procedures:</b></p> <ol style="list-style-type: none"> <li>1. Collect animal manure and plant materials (ratio = 1:4).</li> <li>2. Pile in alternate layers starting with chopped plant materials followed by animal waste.</li> <li>3. Insert bamboo poles in the compost heap for aeration.</li> <li>4. Add water to an optimal amount.</li> <li>5. Add 3 cm of mud on top.</li> <li>6. After 2 days, remove the bamboo poles, leaving holes for aeration.</li> <li>7. After two weeks, turn the pile. Add more manure or water for moisture. Add another layer of mud.</li> <li>8. In 2 months, the compost will be ready for harvest. The compost should have an earthy smell, not a foul odor. The raw materials should be unrecognizable and broken down to humus.</li> </ol>	<p><b>Materials:</b></p> <ul style="list-style-type: none"> <li>• plant materials and animal manure (1:1)</li> <li>• 20kg plant materials</li> <li>• 20kg animal manure</li> <li>• shovel</li> <li>• 1m x 1m plastic sheet</li> <li>• banana/coconut leaves or jute sacks</li> </ul> <p><b>Procedures:</b></p> <ol style="list-style-type: none"> <li>1. Bring plant and animal materials to the compost site.</li> <li>2. Reduce the size of the plant materials by using a shredder or by manual chopping.</li> <li>3. Mix the crop materials with equal amount of fresh manure (ratio = 50:50).</li> <li>4. Pile the mixture into a heap, measuring at least 1m x 1m x 1m (length, width, height).</li> <li>5. Cover the heap with banana leaves, coconut leaves, or other suitable material such as damaged jute sacks.</li> <li>6. After 3-4 days, check if the compost heap is generating heat. If not, add more manure.</li> <li>7. On the same day, turn the pile inside out – from the center to the outer sides. This will also improve aeration.</li> <li>8. Turn the heap after every 2 days to hasten decomposition.</li> <li>9. In 14 – 18 days, the compost will be ready for harvest. The compost should have an earthy smell, not a foul odor. The raw materials should be unrecognizable and broken down to humus.</li> </ol>	<p><b>Materials:</b></p> <ul style="list-style-type: none"> <li>• Trichoderma harzianum (CFA)</li> <li>• substrates: rice straw, weeds, grasses, ipil-ipil leaves, legumes, chicken manure</li> <li>• compost pen OR bamboo poles with holes</li> <li>• plastic sheet/sack</li> </ul> <p><b>Procedures:</b></p> <ol style="list-style-type: none"> <li>1. Collect raw materials for the compost. Reduce the size of the plant materials by using a shredder or by manual chopping.</li> <li>2. Mix carbonaceous and nitrogenous substrates at a ratio of 4:1. Some possible combinations are: <ul style="list-style-type: none"> <li>◦ 4-parts rice straw to 1-part chicken manure</li> <li>◦ 4-parts grasses to 1-part legumes to 1-part manure</li> </ul> </li> <li>3. Pile the substrates loosely in a compost pen that is raised 30 cm from the ground. OR pile the substrates and insert perforated bamboo poles horizontally and vertically.</li> <li>4. Scatter the CFA onto the substrates during piling. Use 1% or more of the total weight of the substrates for faster decomposition. Mix thoroughly. Cover with plastic sheet or plastic sack.</li> <li>5. The compost heap will gain heat in 24-48 hours. Maintain the temperature at 50°C or higher.</li> <li>6. Turn the pile every 5 – 7 days for the first two weeks, and thereafter once every two weeks.</li> <li>7. The compost will be ready for harvest in 21 – 45 days. The compost should have an earthy smell, not a foul odor. The raw materials should be unrecognizable and broken down to humus.</li> <li>8. Harvest the compost and let it dry under the sun for 2 days.</li> <li>9. Place in sacks and store in a shaded area.</li> </ol>



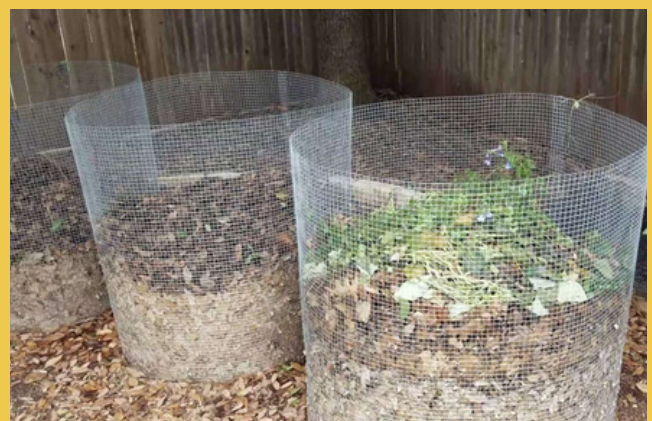
## B. CONVENTIONAL COMPOSTING

### Materials:

- plant residues
- animal manure
- soil
- spade/shovel
- plastic sheet
- PVC pipe/bamboo sticks

### Procedures:

1. Optional: If you want to prevent the nutrients from leaching, place a plastic sheet at the base of the compost pile. Add soil up to 10 – 20cm high around the plastic to create a “shallow tank.”
2. Bring plant and animal materials to the compost site.
3. Reduce the size of the plant materials by using a shredder or by manual chopping.
4. You can add soil and/or ashes to the compost pile.
5. Build compost layers in the following sequence:
  - 1st layer (bottom): crop and other plant residues (15cm)
  - 2nd layer (middle): animal manure (8cm)
  - 3rd layer (topmost): soil (3cm)
6. Repeat the sequence until the pile is 1-meter high.
7. Insert a hollow tube (bamboo stick or PVC pipe) in the middle of the pile for air to enter and circulate. You can also put holes in the PVC pipe for added aeration.
8. Water the pile until it is sufficiently moist. Water regularly to maintain moisture content at 45 – 60%.
9. Begin turning the pile after 3 weeks. Afterwards, turn the pile every after 1 week.
10. The compost will be ready for harvest in 3-4 months. The compost should have an earthy smell, not a foul odor. The raw materials should be unrecognizable and broken down to humus.



# POST-TEST

Direction. Read and analyze the questions thoroughly. Choose the letter of the correct answer.

- 1 THE FOLLOWING ARE COMMON RAW MATERIALS FOR ORGANIC CONCOCTIONS AND EXTRACTS EXCEPT.**

a. Fruits                      b. Vegetables                      c. Molasses, Muscovado, Brown sugar                      d. Salt
- 2 THE FOLLOWING ARE THE USES OF ORGANIC CONCOCTIONS AND EXTRACTS EXCEPT.**

a. Plant Defense                      b. Growth enhancer                      c. Flower inducing                      d. Plant replicating
- 3 THESE ARE FARM INPUTS DERIVED FROM PLANTS, MICROORGANISMS AND ANIMAL MATERIALS PROCESSED TO HARNESS THEIR BENEFICIAL PROPERTIES.**

a. Wet fertilizer                      b. Organic concoctions                      c. Soil conditioner                      d. Dry fertilizer
- 4 A FERTILIZER THAT IS FREE FROM CHEMICAL AND SYNTHETIC SUBSTANCE.**

a. Inorganic                      b. Organic                      c. Complete                      d. Limestone
- 5 THE FOLLOWING ARE ALL ADVANTAGES OF ORGANIC FERTILIZER EXCEPT:**

a. OHN                      b. FPJ                      c. FAA                      d. FFJ
- 6 THIS IS AN ORGANIC CONCOCTION THAT HELPS IMPROVE THE FLOWERING CYCLE AND FRUITING STAGES OF PLANTS.**

a. FPJ                      b. FFJ                      c. FAA                      d. OHN
- 7 THIS IS AN ORGANIC CONCOCTION THAT USES COMMERCIAL RICE THAT AIDS IN INCREASING BENEFICIAL BACTERIA DURING FERMENTATION.**

a. Calcium Phosphate                      b. LABS                      c. Indigenous Microorganism                      d. OHN
- 8 THIS ORGANIC EXTRACT CAN BE USED AS BIO-PESTICIDE FOR PLANTS**

a. FPJ                      b. FFJ                      c. FAA                      d. OHN
- 9 THE FOLLOWING ARE FACTORS AFFECTING COMPOSTING EXCEPT:**

a. pH                      b. Moisture content                      c. Aeration                      d. Acidity
- 10 THIS IS AN ORGANIC EXTRACT USED TO LURE AWAY FLYING INSECTS FROM CROPS.**

a. Probiotic                      b. Natural Insect Attractant                      c. FAA                      d. OHN

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