

Organic Fertilizer

**Fermented Plant
Juice**

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**Nur Samahah bt Mohd Zainual @ Zanuar
Muhammad Shukri bin Mohd Yusof
Nur Amalina Farhana binti Shariffudin**

**Diterbitkan oleh:
Politeknik Sandakan Sabah
Education Hub, Batu 10
Jalan Sungai Batang
90000 Sandakan, Sabah
<https://www.pss.edu.my>**

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tanpa mendapat kebenaran dari pihak penerbitan**

Pre-words

We are grateful to Allah for his abundant mercy in enabling us to finish this e-book, "Organic Fertilizer - Fermented Plant Juice."

Based on the criteria of the DYA20053 Microbial Technology course, the topic Fermented Plant Juice (FPJ) is the main focus of this e-book. The purpose of this book is to give students pursuing the Diploma of Agrotechnology more knowledge and to help them comprehend this particular subject. Additionally, it might serve as a manual for those wishing to learn how to make their own organic fertilizers from green plants.

We really appreciate the cooperation of everyone who helped with this e-book's creation. All readers should profit greatly from this e-book, hopefully.

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1.0 Introduction

1.1 Plant

A plant is an organism of the kingdom Plantae and is a living thing. The unique capacity of plants to harness sunlight, or transform light energy into chemical energy stored as glucose, is one of their defining characteristics. In order to create glucose and oxygen, this process requires absorbing sunlight, carbon dioxide from the atmosphere, and water from the soil.



Because they are vital to many ecological processes, especially ensuring the supply of oxygen, the feeding of animals, and the cycling of nutrients in ecosystems, plants are necessary for life as we know it on Earth.

1.2 Plant Fertilizer

Crop growth and yield are effected by soil organic matter either directly or indirectly supplying nutrients by modifying the soil physical properties to improve the root environment and stimulating the plant growth (Liebig and Doran, 1999). A plant fertilizer is a substance or mixture of substances that is applied to the soil or directly to plants in order to provide vital vitamins and minerals that are beneficial in their growth and development. For their metabolic functions, plants need a variety of nutrients, which can be discovered in the soil or in additional fertilizers. The three main nutrients, nitrogen (N), phosphorus (P), and potassium (K), or NPK for short, are what plants require in comparatively large amounts.

1.3 Types of Fertilizer

There are many kinds of plant fertilizers, and each one is intended to provide specific vitamins and nutrients to suit the necessities of distinct plant species and soil types. NPK, or nitrogen, phosphorus, and potassium, are the main nutrients that are present in fertilizers. Fertilizers may also include, in varying amounts, micronutrients (iron, manganese, zinc, copper, molybdenum, and boron) and secondary nutrients (calcium, magnesium and sulphur) in addition to these macronutrients.

There are several types of fertilizer such as complete fertilizer, incomplete fertilizer, synthetic fertilizers, liquid fertilizer, granular fertilizer, slow-release fertilizer, specialty fertilizer and organic fertilizer.

Under the organic fertilizer there many types of fertilizer using organic matters such as fermented plant juice (FPJ), fermented fruit juice (FFJ), lactobacillus serum (LAB), fish amino acid (FAA) and etc. These kind of fertilizers were established by Master Han Kyu Cho who developed a sustainable system called Korean Natural Farming (Miller et. al 2013).

The organic fertilizers listed are produced by fermentation process. Therefore, lactic acid bacteria are involved in the fermentation process by anaerobic process. Anaerobic process is a process which microorganisms not producing oxygen in their respiration. During the fermentation process, lactic acid bacteria transform indigestible substance into other compound that is easier to digest and produce different antimicrobial compounds.

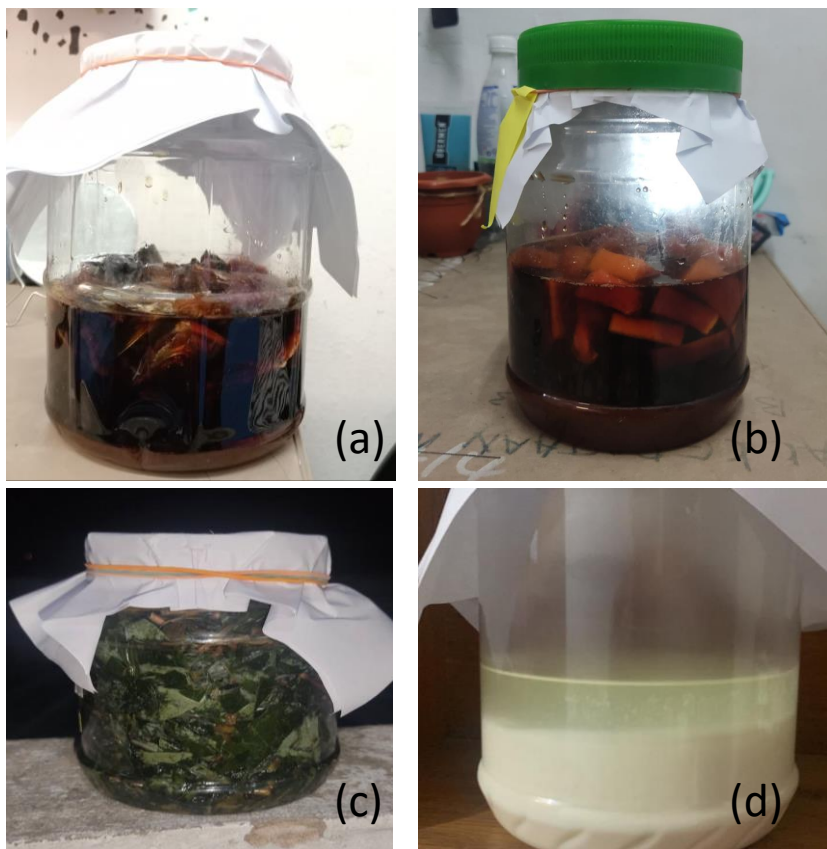


Fig. 1 Types of organic fertilizers; (a) Fish Amino Acid using fish bone, (b) Fermented Fruit Juice using papaya, (c) Fermented Plant Juice using vegetables and (d) Lactobacillus serum using milk and rice.

This book will be focusing on fermented plant juice.



2.0
**Fermented
Plant Juice**

2.1 What is Fermented Plant Juice (FPJ)

A key stage in the creation of Fermented Plant Juice (FPJ) is fermentation. Plant materials are fermented to create FPJ, an organic fertiliser that is natural. Complex organic compounds are broken down into simpler, more bioavailable forms which can be easier for plants to absorb through the fermentation process.



It originated from the young growth of fast-growing plants that have fermented with brown sugar for about seven days. Brown sugar encourages the extraction of plant fluids through osmosis and serves as a food source for the microorganisms responsible for the fermentation process. Among of all Lactic acid bacteria, *Lactobacillus plantarum* is the most used species for vegetable fermentation. The carbon sources and free amino acids which present in the medium is utilizes by lactic acid bacteria to produce metabolites of interest (Ricci, 2019).

An anaerobic reaction is one in which microorganisms respire without producing oxygen in the air. During fermentation, lactic acid-producing bacteria not solely produce various antibacterial compounds but also modify indigestible materials into more easily digested chemicals. Weak alcohol is created. It is edible and non-toxic.

2.2 Factors Determine the Quantity and Quality of Fruit Plant Juice (FPJ)?

Numerous factors affect the quantity and quality of fermented plant juice (FPJ) during the production process. All of these variables may impact FPJ's total effectiveness, microbial activity, and nutrient content. The amount as well as the quality of FPJ are determined by a few important factors.



Plant Material Selection

The kind and quality of plant material used in the manufacturing of FPJs have a big impact on the finished product. To guarantee a nutrient-rich FPJ, select fresh and healthy plant parts like leaves, young shoots, or fruits.



Harvesting Time

Plant parts should be harvested when the plants are in respiration mode, which is before sunrise, rather than photosynthetic mode, which is during daylight, because of the effects of the process on plant chemistry. It is not advisable to gather plant parts during or after rain. It is recommended to hold off until two bright days following the day the rain stops.



Cleanliness and Hygiene

Throughout the production process, keep things clean to avoid introducing unwanted microorganisms. Properly preserved utensils, containers, and equipment are necessary for producing an exceptional FPJ.

Sugar Source

The variety and quantity of sugar that is used during fermentation impact the amount of energy that is available for microbial activity. Although molasses and brown sugar are common sources, they can also work well.

Microbial Diversity

The various amounts and kinds of microbes that are present during the fermentation process enhance the quality of FPJ. Plant material often gets fermented by yeast and lactic acid bacteria.

Straining Method

The clarity and quality of FPJ can be influenced by the method that is used to separate the liquid product of fermentation from the solid plant material. While eliminating solid particles, gentle straining with a fine cloth or mesh helps keep beneficial microbes in place.

Storage Conditions

After fermentation, proper storage is essential to maintaining FPJ's quality. In order to keep the liquid fresh and functional, keep it somewhere cold and dark.

Fermentation Temperature

Microorganism activity can be impacted by the ambient temperature at which fermentation takes place. In general, fermentation is most effectively promoted by a temperature that is consistently warm. Extreme heat, however, may have a detrimental effect on the procedure.

Fermentation Time


The duration of the fermentation process affects both the amount and caliber of FPJ. A product with more potency and nutrients may come from a longer fermentation period, but overfermentation can cause deterioration.

Dilution Ratio

The amount of nutrients applied to plants can vary depending on the ratio of diluted FPJ to water. For best outcomes, adhere to suggested dilution ratios.



A premium fermented plant juice that provides plants vital nutrients and promotes their general health and growth can be made by meticulously weighing and controlling these variables.

A close-up photograph of several pink flowers, likely morning glories, with water droplets on their petals. The background is a soft-focus green and blue, suggesting an outdoor setting. The text is overlaid on the center of the image.

3.0
Materials
and
Procedures

Fermentation is a crucial process in the production of fermented plant juice (FPJ). FPJ is a type of natural fertilizer made by fermenting plant materials to extract their nutrients and beneficial microorganisms. The fermentation process helps break down complex compounds in the plant material into simpler forms that are more readily available for plants to absorb.

Ingredients:

1. Fresh and healthy plant material (leaves, young shoots, fruits, etc.)



2. Molasses, brown sugar or another source of sugar
(for energy to promote fermentation)



Equipment:

1. A clean container with a lid (glass or plastic)
2. Cheesecloth or a breathable fabric
3. Rubber band or string to secure the cloth



3.1 Procedure for Making Fermented Plant Juice (FPJ)

Step 1: Harvest and Prepare Plant Material

- Choose fresh and healthy plant materials. Leaves, young shoots, and fruits are commonly used.
- Wash the plant material to remove dust or contaminants



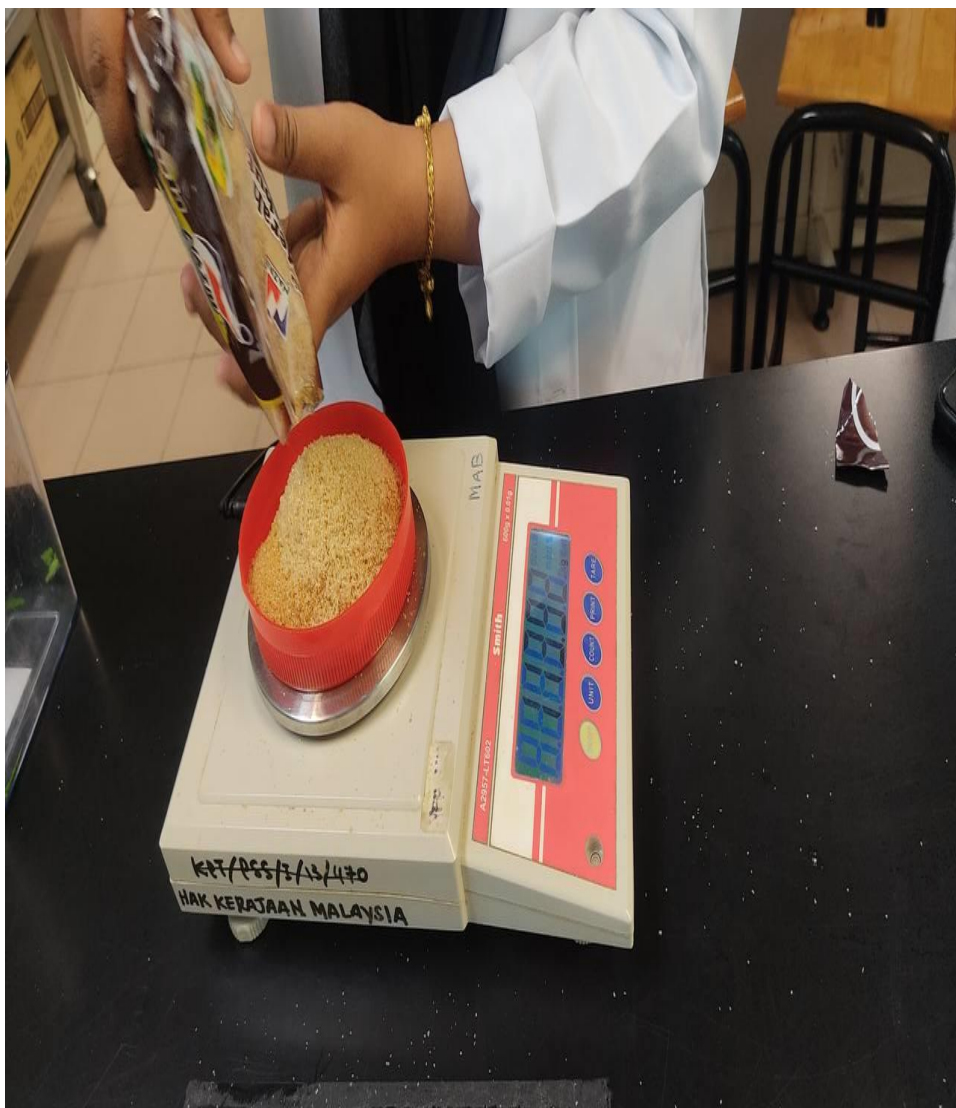
Step 2: Chop or Crush Plant Material

- Chop or crush the plant material to increase its surface area, making it easier for the fermentation process to take place



Step 3: Mix with Sugar

- Add an appropriate amount of brown sugar. The sugar provides a source of energy for the fermentation process.



- With your hands, thoroughly combine mixture. The goal is to ensure that all the plant material is combined with sugar to facilitate the easy extraction of juice.



Step 4: Place the mixture into container

- It is recommended to use plastic or glass container.
- Avoid using metal container to avoid any chemical reaction between water use and container. Tightly fill the container to the brim with the plant material and brown sugar mixture.



Step 5: Cover with Cheesecloth

- Cover the container with a breathable material, such as cheesecloth, and secure it with a rubber band or string. This allows gases produced during fermentation to escape while preventing contaminants from entering.



- On the cover, note the processing date and the anticipated harvest date. The covered container should be stored in a well-ventilated area away from artificial or natural light and extreme heat or cold.

Step 6: Fermentation

- Place the container in a dark and warm location to facilitate fermentation. The duration of fermentation can vary but is typically several days to a couple of weeks.



Step 7: Straining

- After the fermentation process is complete, strain the liquid from the solid plant material. The liquid is the fermented plant juice, rich in nutrients and beneficial microorganisms.



Step 8: Storage

- Store the strained fermented plant juice in a cool, dark place. It is usually diluted with water before application to plants.



A close-up photograph of a pink flower with numerous water droplets on its petals. The background is a blurred landscape with a body of water and a blue sky with white clouds. The text "4.0" and "Characteristic" is overlaid on the image.

4.0
Characteristic

4.1 The Fermentation Juice Plant Characteristic

Fermented plant juice's (FPJ) characteristics can change regarding the kinds of plant material utilized, the fermentation procedure, and the circumstances surrounding production. Depending on the type of plants used, FPJ can have a variety of colors. It could be lighter amber, browner, or greener. The pigments found in the plant material have an impact on color.

FPJ typically has a distinct aroma resulting from the fermentation process. The smell can be slightly sour, earthy, or fermented, and it may vary based on the types of plants fermented.

The clarity of FPJ may vary, and it may contain suspended particles or particles from the plant materials. The clarity of the liquid can be impacted by straining it during production.

The fermentation process has an impact on FPJ's pH. As a result of the organic acids produced during fermentation, it may have a slight acidic taste. Plants' ability to access nutrients can be impacted by pH.

FPJ is packed with vitamins and minerals derived from the plant materials used. Depending on the type of plants and where they are in their growth cycle when they harvest, the nutrient profile might include an array of macronutrients and micronutrients.

FPJ is typically soluble in water, ensuring dilution simple. Utilization as a liquid fertilizer depends on its solubility. Because they are soluble, the nutrients are easily absorbed by plants. The taste of FPJ can reveal information about the fermentation process, even though it is not intended for human consumption. It might taste fermented or slightly tangy.



5.0
Application
Method

5.1 How to use Fermented Plant Juice (FPJ).

Fermented Plant Juice (FPJ) is applied to plants after the concentrated juice has been diluted with water. Here's a general guide on how to use FPJ effectively.

Materials Needed:

1. Fermented Plant Juice (FPJ)
2. Clean water
3. Measuring cup or container
4. Sprayer or watering can



Step 1: Dilution.

FPJ is usually administered diluted with the intent to prevent overfertilization. The type of plant and stage of growth may affect the dilution ratio. A typical ratio is one part FPJ to five hundred parts water, or 1:500.

One litre of FPJ, for instance, would require 500 litres of water to dilute it.



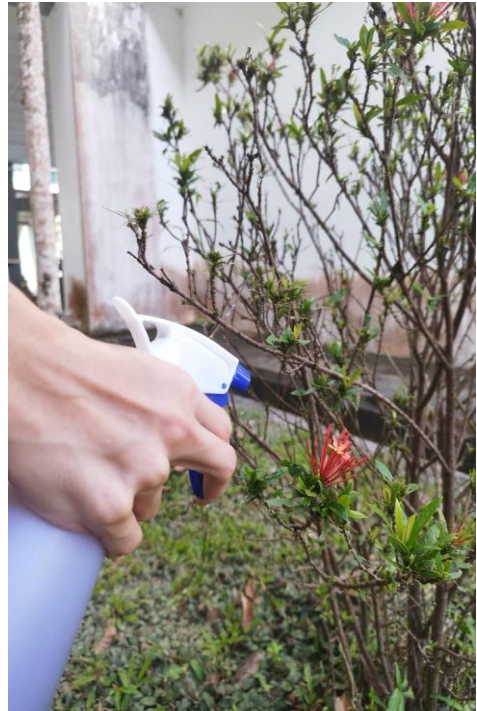
Step 2: Mixing

Measure the desired amount of FPJ and add it to a container. Use clean water for dilution. Mix thoroughly to ensure an even distribution of nutrients.

Step 3: Application Method

Plants can be treated with FPJ using a variety of methods, such as foliar spraying and soil soaking.

- a. Foliar Spray: Evenly coat the plant stems and leaves with a sprayer. To completely cover the plant surfaces, make sure the spray is finely misted.
- b. Soil Drench: Directly apply the dilute form of FPJ to the soil surrounding the plant roots. This process enables the roots to absorb the nutrients.



When to Apply

Use FPJ at certain stages of growth for best results. Foliar spraying, for example, is typically applied in the early morning or late afternoon to avoid hot weather and promote optimal nutrient uptake by the plant.



Frequency of Application

Based on the necessities of the plant and particular guidelines, frequency of application can change. Generally speaking, during the growing season, FPJ is typically applied every single 7–14 days.

Adjusting Dilution

According to the reaction of the plants and specific requirements, you can modify the concentration ratio. A little weaker or stronger solution might be beneficial to certain plants or conditions.

Observation and Monitoring

Maintain an eye out for any adverse consequences or symptoms of improvement in the plants. If necessary, change the frequency of application or the dilution ratio.

Storage of FPJ

To maintain the concentrated FPJ stable, store it somewhere in the cold and dark. Make sure the container is adequately sealed to avoid deteriorating.



A close-up photograph of a plant with large, reddish-pink leaves. The leaves are covered in numerous small, clear water droplets, suggesting they have been recently watered or it has rained. The background is a soft-focus green lawn and a white fence with blue accents.

6.0 References

Ayed, L., M'hir, S., & Hamdi, M. (2020). Microbiological, biochemical, and functional aspects of fermented vegetable and fruit beverages. *Journal of Chemistry*, 2020.

Calunod, J.M. N. (n.d). Successful FPJ. Scribd.com.
<https://www.scribd.com/document/445348300/SUCCESSFUL-FPJ-docx>

Liebig, MA and Doran, JW. (1999). Impact of organic production practices on soil quality indicators. *J EnvironQual*, 28: 1601–1609.

Miller, S.A., Ikeda, D.M., Weinert, Jr. E., Chang, K.C.S., McGinn, J.M., Keliioomalua, C. and DuPonte, M.W., (2013). Natural Farming – Fermented Plant Juice. Sustainable Agriculture (SA-7). College of Tropical Agriculture and Human Resources, Cooperative Extension Service, Hilo, HI

Natural farming Inputs (n.d). “*Cho’s Global Natural Farming*”. Retrieved from <http://www.cgnfindia.com/ffj.html>

Ricci, A., Cirilini, M., Calani, L., (2019) .In vitro metabolism of elderberry juice polyphenols by lactic acid bacteria. *Food Chemistry*, vol. 276, pp. 692–699, 2019.

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