



Study on use of Plant Based Materials as a Fertilizer

Pa Pa San, Lecturer, Department of Chemistry, Yadanabon University
Yadanar Aung, M.Sc Student, Department of Chemistry, Yadanabon University



Abstract

Soil is the mixture of mineral, organic material, living organisms, air and water that together support the growth of plant life. Fruit peels contain potassium, vitamins, minerals and some essential elements which enhance the growth of plant. Generally, fruit peels are thrown in garbage and it goes to solid waste dumping site. That causes odour problem due to degradation of peel content in dumping site. The present study deals with the utilization of different fruit peels such as orange peels and banana peels as fertilizer added to soil. The soil sample was collected from Shar-Taw-Lay village, Amarapura Township, Mandalay, Myanmar. Three soil samples were investigated by addition of organic waste fruit peel powder of orange and banana. Soil sample, S₁ (2000 g soil) as control, soil sample, S₂ (2000 g soil + 500 g orange peel powder) and soil sample, S₃ (2000 g soil + 500 g banana peel powder) were fertilized soil. The physicochemical properties of three soil samples such as pH, electrical conductivity, bulk density and texture were determined. The elemental composition of three soil samples was measured by applying EDXRF. The content of N, P, K nutrients of three soil samples were determined by chemical instrumental method. Different fruit peel powder add soil to compare the plant growth were investigated. The chemical fertilizers can be replaced by the fruit peel powder to protect the soil from the infertility. This fruit peel materials have not cost bearing and thus aids in converting this waste into a usable resource.

Keyword: Fertilizer, fruit peel powder, nutrient

Introduction

- Soil is important because it provides the nutrients that plant need to grow
- Without soil, there would be no plants, without plants, there would be no foods, without food, animals could not survive
- Soil is relating with fertilizer
- Soil is needed the fertilizer that is one of the sources for plant growth
- Fertilizers typically provide in varying proportions.
- The maintenance of adequate levels of nutrients in soil is essential for healthy plant growth, cheapest and harmless materials can be used for the plant growth.
- The fruit peels have nutrients like potash, iron, zinc, calcium, citrate content, etc.
- Therefore different fruit peels such as orange and banana were used in this research.

Objective

- To collect the soil sample and fruit peels of orange and banana
- To prepare the fruit peel powder and finely soil sample by 100 mesh size sieve
- To determine the chemical analysis of soil sample
- To evaluate the organic waste such as orange and banana fruit peel powder were used as natural fertilizer
- To compare the plant growth of organic waste fruit peel with soil

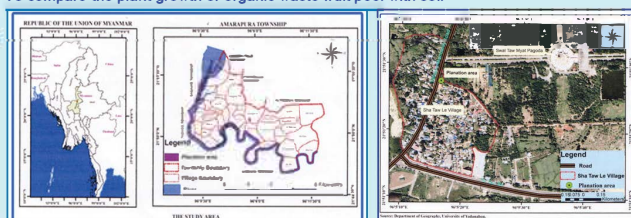


Fig. Map of study area

Materials and Methods

Analytical item, analytical method, apparatus used.



pH, 1 : 2.5 soil: Water suspension method, pH meter (F-51 HORIBA)



Electrical conductivity (EC), Saturation extract method, conductivity meter (DS-51HORIBA)



Organic matter, Tyurin's method, Analytical balance



Soil texture, pipette method, Analytical balance



Moisture, Gravimetric method, Temperature controlled oven



Total N, Kjeldahl distillation method, Gerhardt Vapodest20s



Total P, Molybdivanado phosphoric acid method, UV-visible Spectrophotometer Jenway 6305



Total K, Wet digestion with HNO₃ : HClO₄ (4 : 1), Atomic Absorption Spectrophotometer, NOV AA-400



Elemental percent composition, powder-pellet, EDXRF

Collection and processing of fruit peels



Preparation of Fruit peel powder with soil



Results and Discussion

Table 1. Physicochemical Properties of Soil Sample S₁, S₂, S₃

No	Soil sample	pH	Organic matter (%)	EC (dS/m)	Texture	Moisture
1	Control soil sample, S ₁	8.1	2.0 %	0.18	sandy loam	1.4 %
2	soil + orange peel powder soil sample, S ₂	7.2	11.6 %	0.39	sandy loam	2.4 %
3	soil + banana peel powder soil sample, S ₃	7.8	13.2 %	0.38	sandy loam	2.8 %

From the above Table, the pH of control soil sample was slightly higher than soil sample S₂ and S₃. Organic matter of soil sample S₂ and S₃ were higher than control soil sample S₁. Organic matter plays a major role in moisture retention, helping crops withstand drought contributes to the chemical and biological properties of the soil and also a source of and exchange for nutrients. Electrical conductivity (EC) is a measure of the salt concentration in the soil solution. Increasing electrical conductivity of control soil sample, S₁, than soil sample S₂ and S₃.

Table 2. pH of orange peel powder and banana peel powder

No	Fruit peel powder	pH	N	P	K
1	Orange peel powder	5.6	7.2	2.3	1.2
2	Banana peel powder	7.7	4.6	3.7	2.8

By the experiment, it can quantify how much amount of different peel powder required for the particular soil. The orange peel powder was used to decrease the pH of the soil and the banana peel powder was used to increase the pH of the soil.

Table 3. Major nutritive value of soil sample S₁, S₂, S₃

No	Soil sample	Total N	Total P	Total K
1	control soil sample, S ₁	0.09 %	0.11 %	0.31 %
2	soil + orange peel powder soil sample, S ₂	0.18 %	0.40 %	1.01 %
3	soil + banana peel powder soil sample, S ₃	0.20 %	0.35 %	1.03 %

According to results, control soil, orange peel powder soil and banana peel powder soil sample were analysed for the nutritive value of soil. Nitrogen, phosphorus, potassium were mainly observed. Different fruit peel powder applied soil is increased soil fertility.

Table 4. Determination of elemental composition of soil sample S₁, S₂, S₃

Soil sample	δr	Al	Fe	(S)	(S)	Fe	δr	δr	Pb	Pb
control soil sample S ₁	0.024%	5.528%	0.450%	1.333%	1.333%	0.450%	0.024%	0.024%	0.098%	0.098%
orange soil sample, S ₂	47.100%	15.200%	15.580%	6.470%	8.630%	15.580%	0.217%	0.153%	0.186%	0.0889%
banana soil sample, S ₃										0.0663%

Application of fruit peel powder in soil

Soil samples S₁, S₂, S₃ were filled with each pot. Pea seeds and chili seeds were sown in various pots and water was poured every day. Control and two different peel powder was used to compare the plant growth. After 45 days check the growth of pea plant and chili plant compare with the plant in control soil. Length of the plant was very less in control soil than the orange peel powder applied soil. Size of the leaves was also increased in the plants which were grown on banana peel powder with soil. Length of peas and chili plant were also bigger than control.



Figure: Show the different group of chili plant
a) control soil
b) soil plant banana peel
c) soil + orange peel



Figure: Show the different group of pea plant
a) control soil
b) soil plant banana peel
c) soil + orange peel

Conclusion

In this study, the plant base materials such as orange peel and banana peel were used as natural fertilizer. The physicochemical changes during the combination of orange peel powder or banana peel powder to soil were determined at enhancing properties of soil. The orange peel powder was used to decrease the pH of the soil and the banana peel powder was used to increase the pH of the soil. The pH of control soil samples is slightly higher than soil sample S₂ and S₃. It was found that, organic matter, electrical conductivity (EC), of orange peel powder soil sample S₂ and banana peel powder soil sample S₃ were higher than control soil sample S₁.

Furthermore, total N, P, K value of soil sample S₂ and S₃ were also found higher than control soil sample S₁ as well as elemental composition. So, the peel powder can be feasibly used as a soil fertilizer, improving soil morphology, as micronutrient supplement (Zn, Fe, Ca) and also for horticultural purposes. The plant growths of different fruit peel powder add soil were more than control soil. By using this orange peel powder and banana peel powder as fertilizer, it can be reduced to fruit peel waste. Discard substance of orange peel powder and banana peel powder into usable product as fertilizer that cheapest and harmless material can be used for the plant growth.

Acknowledgement

I express my gratitude to Rector Dr Maung Maung Naing and Pro-rectors Dr Si Si Khin and Dr Tint Moe Thu Zar, Yadanabon University, for their permission to do this research. I also wish to express many thanks to Professor Dr Hlaing Hlaing Myat, Head of Chemistry Department, Yadanabon University for her kind permission to carry out this work and her interest, constructive comment and suggestions and we also thank the ethical research committee of department of chemistry, Yadanabon University. I am also thanks to Dr Ni Ni Tint, Department of Agricultural Research, Yezin, Nay Pyi Taw, Myanmar.

Reference

1. Jenny, H., (2005), Factors of Soil formation, Dover Publications, Inc., New York.
2. Sparks, D.L., (2002), Environmental Soil Chemistry, Academic Press, Sanfransico.
3. Mercy S, Muchira Bonu S, Jenifer I 'Application of different fruit peel formulation as a natural fertilizer for plant growth' IJSTR Journal page 301-309, Volume 3, ISSUE 1, January, 2019, ISSN 2277-8616.
4. Tewari HK, Marwaha SS & Rupal (1986) Ethanol from Banana peels, Agric Wastes 16 : 135-146.
5. Alan Wild., (1993). "Soils and the environment. An introduction". CAMBRIDGE University Press.
6. Introduction to soil and soil Resources, (2001) [http://webcache.googleusercontent.com/search?q=cache:dvxxvRGnTYzkjhttp://www.environmental.ualberia.ca/soils/ERM/Lecturer 2/ lecture 2.ppt](http://webcache.googleusercontent.com/search?q=cache:dvxxvRGnTYzkjhttp://www.environmental.ualberia.ca/soils/ERM/Lecturer%20lecture%202.ppt)