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INVESTIGATION OF THE NUTRITIONAL VALUES AND QUALITY OF SOIL IN THE FARM OF THE FLOATING REGION

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ABSTRACT

Food safety is very important for consumer who depends on the products that grows on the local farm yard. So, the investigation of nutritional values and the properties of soil quality are key roles for the production of effective and healthy food sources. This research work involved the investigation of physico-chemical properties of soils collected from Yenangyaung Township in the middle region of Myanmar. Firstly, soil samples from the farm of Yenangyaung Township were collected before and after flood followed by the determination of mineral contents, moisture contents, pH values and effective microorganisms of soil samples by using some spectroscopic methods. Moreover, nitrogen and potassium contents of the selected soil samples were investigated by alkaline permanganate methods as well as phosphorus content by colorimetric method. Finally, the mineral contents of samples were analyzed by EDXRF method and the identification of isolated bacteria lived in these soil samples were performed by Bergey's manual of determinative bacteriology.

Key words: nutritional values, soil, effective microorganisms, P^H, EDXRF

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INTRODUCTION

Soils are the loses mineral or organic materials found on the earth's surface, usually (or averagely) made up of about 25 % air, 25 % water, 45 % mineral and 5 % organic matter. It is the stuff that supports rooted plants in a natural environment. Physical and Chemical method of soil and water analysis are usually exposed to direct climatic and environmental factors and are easily blown away by wind, washed away by water or even broken down by temperature changes , human and animal activity. One important subject that many farmers and soils scientists look out for soil chemistry. This includes soil pH (the acidity of soil), nutrient level, its organic content and the chemical composition of the minerals found in it.

Soil is the medium which supports the growth of plants. It provides mechanical support, the water and oxygen supply to plant roots as well as the plant nutrients. Soil fertility is the capacity of soil to supply plant nutrients, water and oxygen in adequate amounts for optimum growth of the plant. The term soil fertility includes the chemical make-up and availability of nutrient elements to plants, the physical arrangements and properties of the soil particles and organic matter, which control water and oxygen availability, and the nature and activity of soil micro-organisms.

Microorganisms consist of an important source of biodiversity in soils and are an integral part of terrestrial ecosystems. They contribute to major biological functions such as nutrient and gas cycling, biogeochemical processes and the decomposition and transformation of organic matter. Fungi are also very abundant in the soil and may represent up to 80% of soil microbial biomass (Kirk *et al*., 2004)

The objective of this work is to study the characteristic properties of the farm soils from the agricultural point of view. In agricultural practice it is important to understand the properties of soil for determining its fertility level and usage. Without a substantial knowledge of the soil, it is impossible to give its correct agricultural estimation; some characters may vary from year to year depending on the constituents of the soil; and this may be due to the fact that some elements are more useful to plants than others. The climatic conditions and the agricultural practice may influence the constituents of the soil.

Methods and Materials

Materials

Concentrated sulphuric acid, potassium sulphate, cupric sulphate, sodium hydroxide, bromocresol and other chemicals were purchased from ABEL chemical company, Myanmar.

Sample Collection

The soil samples were collected from the farm yard of Yenangyaung Township before and after flood. In the uniform field, demarket the sampling points in a zigzag fashion randomly in such a way that the whole field should be covered. If there is to be kept in moist condition for moisture determination, bacterial count, were done. The collected soil samples were dried in shade and stored in well-stopped glass bottle.

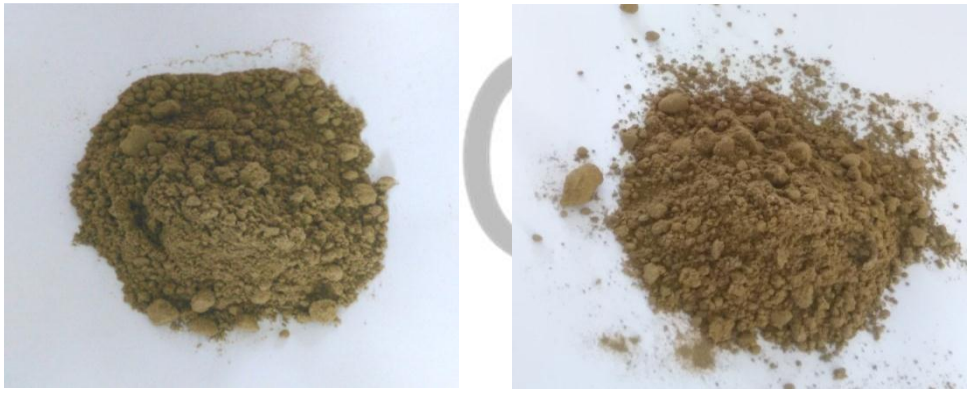

Figure. Soil Sample

Characterization

Determination of Mineral Contents by EDXRF

Mineral contents of soil samples were determined by EDXRF spectrometer at the Department of Chemistry, Monywa University. In this analysis, the soil samples were ground into a fine powder and directly analyzed. In this analysis, the sample is bombarded with X-ray which is high enough in energy to extract a K or L electron from many atoms. Electrons from a higher energy shell fill the vacancy and emit the radiation which can transform as a characteristic peak for particular element.

Determination of Physical Parameters

Determination of Moisture Content

Moisture content was estimated by gravimetric method.(Bouyoucos,G.J.1937)

Determination of Hydrogen Ion Concentration (pH)

The pH value of selected soil sample was determined by AOAC method (AOAC.2000)

Determination of Chemical Parameter of the Soil Sample

Determination of Total Nitrogen in Soil

Determination of total nitrogen in soil was determined by AOAC method.

Titration

The green color distillate is titrating with 0.02N sulphuric acid and the color changes to original shade (pinkish color). Note the blank & sample titer reading (mL) and calculate the total nitrogen content present in plant/soil samples.

$$\text{Nitrogen content in plant (\%)} = \frac{\text{R(sample titer} - \text{blank)} \times \text{Normality of acid} \times \text{Atomic weight of nitrogen} \times 100}{\text{Sample weight (g)} \times 1000}$$

$$= \frac{R \times 0.1 \times 14 \times 100}{0.5 \times 1000}$$

$$\text{Factor} = R \times 0.28$$

$$\text{Nitrogen content in soil (\%)} = \frac{\text{R(sample titer} - \text{blank)} \times \text{Normality of acid} \times \text{Atomic weight of nitrogen} \times 100}{\text{Sample weight (g)} \times 1000}$$

$$= \frac{R \times 0.1 \times 14 \times 100}{1 \times 1000}$$

$$\text{Factor} = R \times 0.14$$

Determination of Phosphorous in Soil

The phosphorus is an essential nutrient and it occurs in many different forms. Therefore, a reliable procedure for measuring the amount both in soil as well as in plant is needed. There are many methods available for the determination of phosphorous. However, colorimetric measurement is presented here (Koenig & Johnson, 1942).

$$\text{Available P (kg ha}^{-1}) = \frac{R \times F \times 50 \times 2.24}{5 \times 2.5}$$

Where, F (factor) = B/A

Determination of Potassium in Soil

$$\text{Available K (kg ha}^{-1}) = \frac{R \times F \times 25 \times 100 \times 20 \times 1 \times 1.121}{5 \times 1000}$$

$$= R \times F \times 11.217$$

Determination of Organic Carbon

$$\text{OC (\%)} = \frac{10}{\text{Blank}} \text{ (Blank – Reading) X } \frac{0.003 \times 100}{\text{Wt. of soil}}$$

Determination of Organic Matter (Humus)

$$\text{\% organic matter} = 10\left(1 - \frac{T}{S}\right) \times 0.672 \text{ for 1 g sample soil}$$

S = standardization blank titration

T = sample titration

Isolation and Identification of Soil Bacteria

Four bacterial strains (S_1, S_2, S_3, S_4) from soil sample were isolated on Nutrient media. According to the cultural and microscopic morphology, the abundant isolated bacteria were found to be Bacillus species in S_1, S_2 and S_4 and *Streptomyces* species in S_3.

RESULTS AND DISCUSSION

In this research work, the soil sample from the farm of Yenangyaung Township, Magwy Region has been characterized. The mineral contents, physical parameters, chemical properties and nutrients available were examined. The results for the mineral contents are shown in Table.

Table. Elemental Analysis of Soil Sample Before Flood

No	Elements	Symbols	Amount (%)
1	Silicon	Si	70.029
2	Aluminium	Al	18.451
3	Iron	Fe	6.247
4	Potassium	K	2.603
5	Calcium	Ca	1.534
6	Titanium	Ti	0.846
7	Manganese	Mn	0.133
8	Zirconium	Zr	0.042
9	Chromium	Cr	0.037
10	Strontium	Sr	0.027
11	Copper	Cu	0.013
12	Zinc	Zn	0.013
13	Nickel	Ni	0.012
14	Rubidium	Rb	0.007
15	Yttrium	Y	0.006

According to EDXRF report, the element found from the soil samples were Si, Al, Fe, K, Ca, Ti, Mn, Zr, Cr, Sr, Cu, Zn, Ni, Rb and Y in significant amount. Among them, the amount of silicon was 70.029% and it was the highest amount in this selected soil sample.

Table . Elemental Analysis of Soil Sample After Flood

No	Elements	Symbols	Amount (%)
1	Silicon	Si	67.029
2	Aluminium	Al	20.451
3	Iron	Fe	6.247
4	Potassium	K	2.803
5	Calcium	Ca	1.834
6	Titanium	Ti	0.806
7	Manganese	Mn	0.133
8	Zirconium	Zr	0.045
9	Chromium	Cr	0.037
10	Strontium	Sr	0.027
11	Copper	Cu	0.013
12	Zinc	Zn	0.013
13	Nickel	Ni	0.012
14	Rubidium	Rb	0.007
15	Yttrium	Y	0.006

According to EDXRF report, the element found from the soil samples were Si, Al, Fe, K, Ca, Ti, Mn, Zr, Cr, Sr, Cu, Zn, Ni, Rb and Y in significant amount. Among them, the amount of silicon was 67.029% and it was the highest one in this selected sample.

Comparison of Elemental Analysis of Soil Sample Before and After Flood

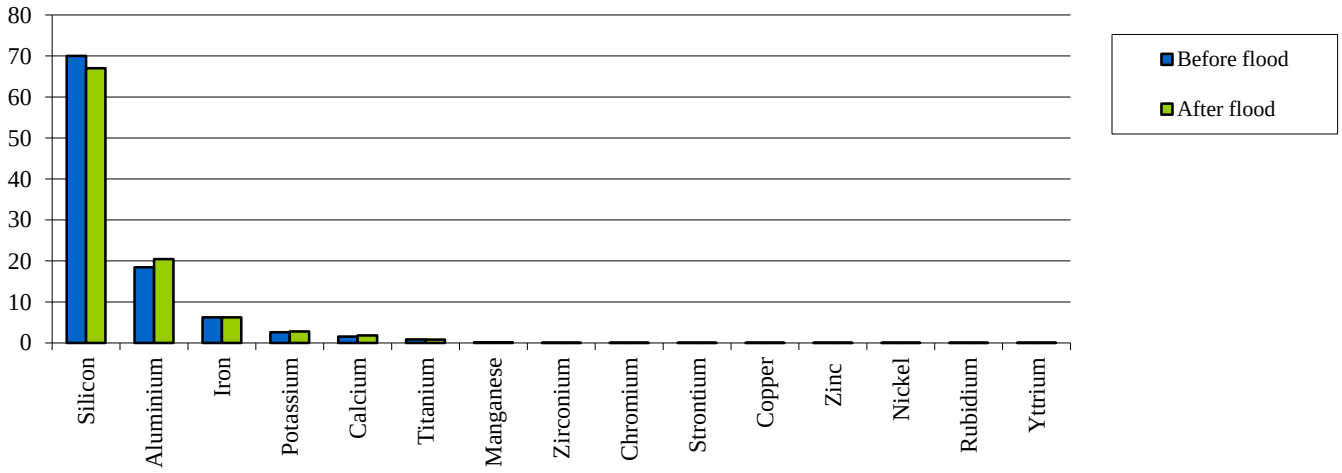

Figure. Comparison of Elemental Analysis of Soil Sample

According to EDXRF report, the elemental constituents of the collected soil sample could be determined by studying the quantitative results that indicate the highest amount of SiO_2 present in the soil sample where as the moderate amount of Al_2O_3, Fe_2O_3 and K_2O. Moreover, the content of potassium displayed that the collected soil sample is suitable for cultivation of crops such as onion, corn, chilly, potatoes and groundnut. The study area of the research work is one kind of farm yard as well as it is confirmed by the contents of Al_2O_3 and K_2O. Potassium is one kind of important nutrients in the soil for the plant growth.

Table . Results of Moisture Contents of Soil Samples

Soil sample	Moisture (%) before flood	Moisture (%) after flood
Sample 1	10.3	10.5
Sample 2	11.7	11.9
Sample 3	10.7	10.11
Sample 4	10.9	10.12
Sample 5	10.4	10.9

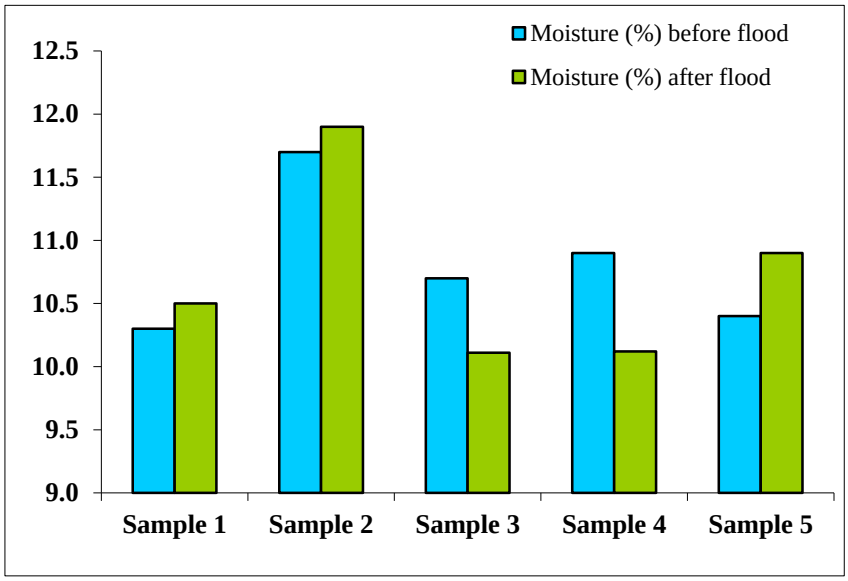

Figure. Moisture Contents of Soil Samples

From the observation of above table, the moisture content of the soil sample after flood is higher than that of the value of before flood.

Table . Results of pH Values of Soil Samples

Soil sample	pH before flood	pH after flood
Sample 1	8.15	8.16
Sample 2	8.15	8.16
Sample 3	8.15	8.16
Sample 4	8.15	8.16
Sample 5	8.15	8.16

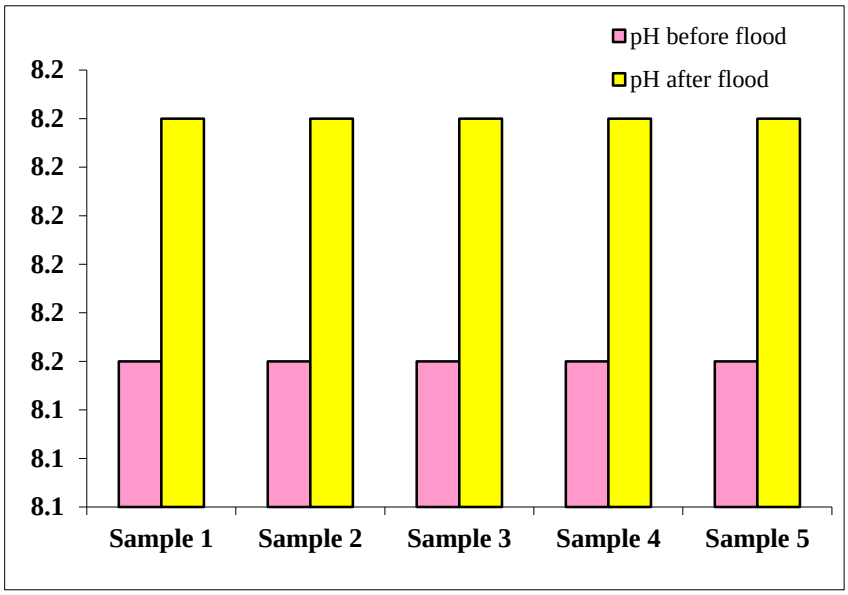

Figure. pH Values of Soil Samples

Table. Results of Nutrient Contents of Soil Samples Before and After Flood

Condition	Organic Carbon (%)	Humus (%)	Total N (%)	Available P (ppm)	Available K_2O (mg/100g)
Before Flood	0.514	0.886	0.14	8.39	4.69
After Flood	0.624	0.752	0.13	8.39	4.86

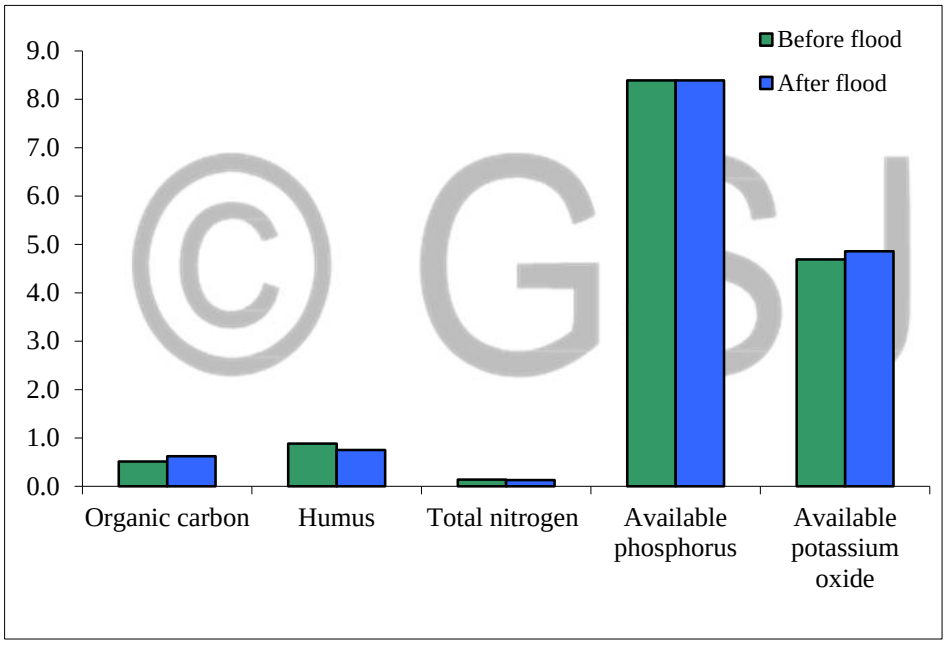

Figure. Nutrient Contents of Soil Samples Before and After Flood

According to the comparative values of the soil samples, the contents of organic carbon, humus, total nitrogen, available phosphorus and available potassium oxide of the sample after flood are higher than that of the values of before flood.

Table. Cultural and Microscopic Morphology of Isolated Bacteria

Colony Morphology						Microscopic Morphology	
No	Sample Name	Size (mm)	Color	Elevation	Shape	Gram' reaction	Shape
1	S_1	1.5	White (opaque)	Raised	Irregular	+	Rod (spore)
2	S_2	2	White (opaque)	flat	Irregular	+	Rod (spore)
3	S_3	3	White (opaque)	flat	Irregular	+	Rod
4	S_4	1-1.5	White (opaque)	flat	Irregular	+	Small Rod

CONCLUSION

In this research work, soil samples were from the farm of Yenangyaung Township, Magwy Region. The physical and chemical parameters of the soil samples before and after flood were investigated whereas pH values of the soils were 8.15 and 8.16 and that is why these soils should be added a small amount of gypsum for crops. Moreover, the moisture content of the selected soil sample was determined by the use of oven at 100^{o}C that informs a suitable moisture content of 28 % and it is a suitable data for farming. The elemental composition of this sample was analyzed by EDXRF method which displays the highest amount of Si (70.029 %), the medium amount of Al (18.451 %), a reasonable amount of K (2.603 %) and small amount of Ca as well as a less amount of others such as Ti, Mn, Zr,Cr, Sr, Cu, Zn, Ni, Rb and Y.

Moreover, the organic carbon (OC) content of collected soil samples were found to be 0.514 % and 0.624 % as well as the amount of humus contents were 0.886 % and 0.752 % that indicate the amount of OC contents were low in the samples. Furthermore, the available phosphorus contents were 8.39 ppm and 8.39 ppm that informs the medium amount of phosphorus present in these soils whereas the available potassium oxide values were 4.69 mg per 100 g and 4.86 mg per 100 g that displays

these soils need more K_2O for root crops. There were two types of bacteria, *Bacillus* and *Streptomyces* found in these soil samples. Both of two bacteria are symbiotic bacteria that can affect the productivity of the soil and can help the plant growth.

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