

# Studies on Physicochemical Characteristics and Fertility of Soil by Addition of Banana Peels – Waste Management

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**Abstract**— Soil is an important ecological factor because it is a complex physical and biological system providing support, water, nutrients and oxygen for the organism. It is a bridge between the inorganic, organic and living world. Soil is a very important material for plants and as well as animals and humans for their activity. It is very essential to determine the soil characteristics to know the soil quality. Here in our study soil sample of garden area of Christian Eminent College, Indore city have been analyzed for 7 days. The present study was undertaken with aim to study the effect of banana peels on physicochemical parameters such as colour, temperature, pH, electrical conductivity, moisture contents, available phosphate, ammonical nitrate content, total organic carbon, and sulphure content.

**Key words:** Garden, Soil, Organic carbon, Organic matter, Fertility

## I. INTRODUCTION

Soil is derived from the Latin word “Solum” which means earthly material in which plant growth takes place and which represents the top cover of earth crust. The study of soil is called “Pedology”. The study of soils and inter-relation between soil and living organism including man is called “Edaphology”.

The soil, a main part of the terrestrial ecosystem, is perhaps the most endangered component of our environment open to potential contamination by a variety of different pollutants arising from human activities such as nuclear, industrial, agricultural, etc. (Coskun et al, 2006: Kabata-Pendias, 2004: Djingova and Kuleff, 2000). Although the trace elements in soil are very important for the quality of soil and environment, excessive level of trace elements can cause pollution of waters, toxicity in plants, foods and ultimately in animals and humans that feed upon them (McLaughlin, 2001:Uchida et al, 2007: Rana et al, 2009) . The unit productivity of soil is dependent on its fertility. Soil fertility can be defined as the nutrient supplying ability of the soil. According to Follet *et al.* (1987), soil fertility means the capability of the soil to supply nutrients that enhance plant growth.

Most of the crops require higher amount of essential elements particularly nitrogen, phosphorus and potassium. The requirement of this element is fulfilled through fertilizers. This improper use of fertilizers creates an unbalance position of nutrient in soil. Therefore it is necessary to follow good nutritional and balanced use of manure and fertilizers for getting higher production from the soil and improving soil health. Under this circumstance it is essential to test the soil for knowing the fertility status of field .on this basis, fertilizer recommendation can be made for particular crop.

Banana Peel is rich source of starch , crude protein (6-9%) crude fat (38-11%) total dietary fiber and Polyunsaturated fatty acids particularly Linoleic acid,  $\alpha$ -

Linoleic acid, pectin, essential amino acids and macronutrients (K, P, Ca, Mg). It is also a good source of Lignin (6-12%) pectin cellulose (7.6 – 9.6%) hemicelluloses (6.4-9.4%) and galactouronic acid. Micronutrients (Fe and Zn) are also found in higher concentration in peels compared to pulps. Due to such high content of nutrients banana peel can provide a healthy nutrients to soil instead of discard them as a wastes.

## II. MATERIALS AND METHOD

### A. Study Area:

Garden of Biosciences department, Christian Eminent College situated in Indore. Indore district lies in the heart of Malwa plateau. The climate of Indore district is characterized by hot summer and well-distributed rainfall during the southwest monsoon season. The district is covered by medium black soils.

### B. Experimental Layout:

These trays were kept in laboratory for 7 days examined daily till 7days for observing soil physicochemical and biological properties.

#### 1) Collection of Soil Sample:

Soil samples were collected from different locations in garden of Botany Department of the Govt. Christian Eminent College Indore, during April month. Soil samples were taken randomly within garden and mixed into a composite sample representative of that particular site. The samples were collected in polythene bags and transported to laboratory, where stones in the samples were removed and the soils were homogenized through a 2 mm sieve and then placed in trays, each tray having 2 kg of soil. In one tray 5 banana chopped peels having weight 250g was added and this tray labeled as tray 2 and tray without banana peels labeled as tray.

These trays were kept in laboratory for 7 days examined daily till 7days for observing soil physicochemical and biological properties.

#### 2) Soil Analysis:

The collected soil sample in tray 1 was analyzed for various physicochemical parameters such as colour, particle size, temperature, pH, moisture contents, available phosphate, ammonical nitrate content, total organic carbon, and sulphure content. Similar analysis was also carried out for soil in tray 2 for 7days.

## III. RESULT AND DISCUSSION

The result of physico-chemical analysis of soil sample is showed in Tables and graphs respectively. During studies we have performed experiment on the change in physical and chemical parameters of soil in incorporate with the banana peels study have shown an increase in phosphate, sulphate, ammonia and organic matter content of soil.

**A. Soil Temperature:**

Soil temperature is the physical character which changes with the soil properties. In present study we have found that temperature was reduced from 34 to 28°C this may be due to increase in moisture content.

**B. Soil pH:**

Soil pH refers to acidity and alkalinity. It is the measure of hydrogen ion (H<sup>+</sup>) in the soil. Soil pH can also affect the cation exchange capacity (CEC) and anion exchange capacity (AEC) of soil. In present study the soil pH were

found to be increased. This show that the alkalinity of soil increases due to incorporation of banana peels and thus the AEC of soil increases. The AEC in turn benefits the plant growth thereby providing extra nutrients to soil easily

**C. Soil Electrical conductivity:**

Electric conductivity is a measurement that correlates with soil properties. That affects crop productivity including soil texture, cation exchange capacity (CEC), organic matter and salinity. In present study the EC is found to be increased which further aids in soil productivity.

S. No.	Soil sample	Absorbance at 660nm	Carbon present in sample(mg/ml)	%Carbon	Remark
1	Control	0.071	1.32	0.132	-
2	1 <sup>st</sup> day	0.074	1.38	0.138	Banana peel added
3	2 <sup>nd</sup> day	0.085	1.58	0.158	„
4	3 <sup>rd</sup> day	0.112	2.52	0.252	„
5	4 <sup>th</sup> day	0.145	3.12	0.312	„
6	5 <sup>th</sup> day	0.179	4.04	0.404	„
7	6 <sup>th</sup> day	0.183	4.13	0.413	„
8	7 <sup>th</sup> day	0.207	4.90	0.490	„

Table 1: Organic Carbon content of soil

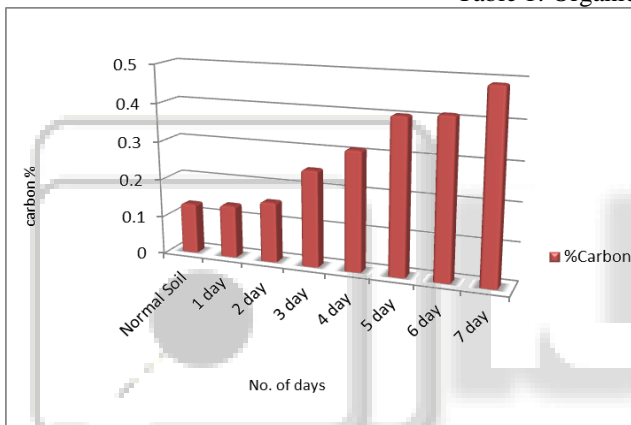


Fig. 1: Variation of Organic carbon content between control and Banana peel added soil

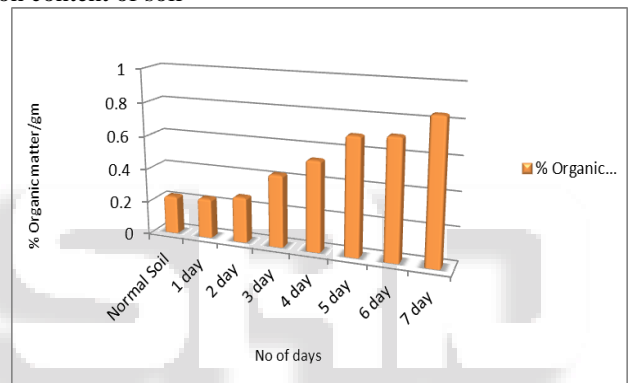


Fig. 2: Variation of organic matter between control and Banana peel added soil

S.No.	Soil sample	%Carbon/g	Organic matter/g	Remark
1	Control	0.132	0.227	-
2	1 <sup>st</sup> day	0.138	0.237	Banana peel added
3	2 <sup>nd</sup> day	0.158	0.272	„
4	3 <sup>rd</sup> day	0.252	0.43	„
5	4 <sup>th</sup> day	0.312	0.537	„
6	5 <sup>th</sup> day	0.404	0.696	„
7	6 <sup>th</sup> day	0.413	0.712	„
8	7 <sup>th</sup> day	0.490	0.844	„

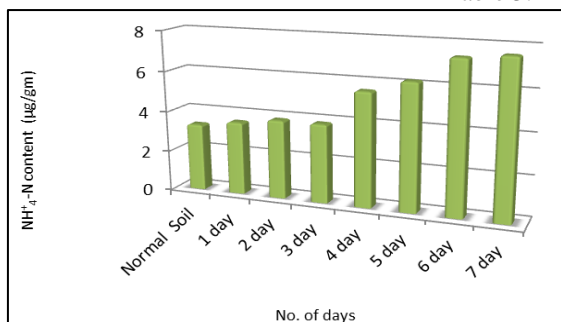
Table 2: Organic matter content of soil

Organic matter contributes to plant growth through its effect on physical, chemical and biological properties of soil. It acts as a source of nitrogen and phosphorus for plant growth. It promotes the good soil structure by improving aeration and moisture retention. Organic matter has both indirect and direct effect on availability of nutrients for plant growth. It serves as a source of energy for both macro and micro faunal organism. In present studies we have found that the organic matter of soil increases due to banana peel addition. This organic matter in soil can have direct physiological effect on plant growth. It is also determined that this organic matter in soil influences the incidence of pathogenic organisms in soils. This plentiful supply of organic matter may favor the growth of saprophytic organism relative to parasitic organisms and thereby reduce the population of pathogenic organisms

S. No.	Soil sample	Absorbance 636 nm	NH <sub>4</sub> <sup>+</sup> -N content in sample(µg/ml)	NH <sub>4</sub> <sup>+</sup> -N content (µg/g)	Remark
1	Control	0.060	1.66	3.32	-
2	1 <sup>st</sup> day	0.065	1.80	3.60	Banana peel added
3	2 <sup>nd</sup> day	0.070	1.94	3.88	„
4	3 <sup>rd</sup> day	0.070	1.94	3.88	„
5	4 <sup>th</sup> day	0.082	2.80	5.60	„
6	5 <sup>th</sup> day	0.092	3.10	6.20	„
7	6 <sup>th</sup> day	0.109	3.70	7.40	„

8	7 <sup>th</sup> day	0.113	3.80	7.60	„
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Table 3: Ammonium content of soil



Ammonia is used as a fertilizer for crops and thus to increase the soil fertility the ammonia is to be increased in soil. During our studies we have found that the banana peels increases the ammonium content in the soil fertility.

Fig. 3: Variation of Ammonium soil between control and Banana peel added soil

S. No.	Soil Sample	Absorbance at 660nm	Phosphorus content in sample(µg/ml)	Phosphorus (kg/hect)	Remark
1	Control	0.185	1.18	4.72	-
2	1 <sup>st</sup> day	0.185	1.18	4.72	Banana peel added
3	2 <sup>nd</sup> day	0.198	1.26	5.04	„
4	3 <sup>rd</sup> day	0.248	1.58	6.32	„
5	4 <sup>th</sup> day	0.275	1.75	7.00	„
6	5 <sup>th</sup> day	0.295	1.88	7.52	„
7	6 <sup>th</sup> day	0.375	2.01	8.04	„
8	7 <sup>th</sup> day	0.372	2.34	9.36	„

Table 4: Available phosphorus in soil

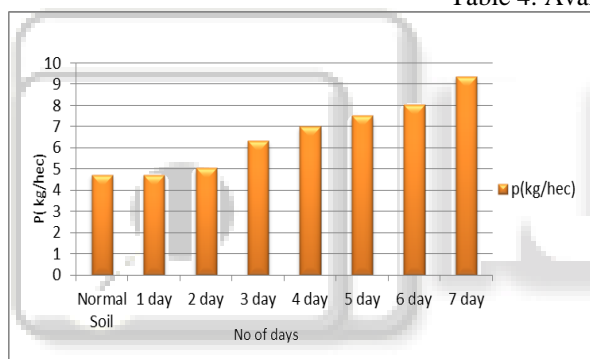


Fig. 4: Variation of available Phosphorus between control and Banana peel added soil

P and n are nutrient most likely to be limiting to plant growth phosphorus is readily absorbed by a plants primarily as mono valent phosphate anion and less rapidly as divalent anion phosphate is the most limiting plant nutrient .In plants the concentration of phosphorus ranges from .1 to .5%. It is important in many plant processes such as energy transfer reactions, development of reproductive structures, crop maturity, root growth and protein synthesis. In nature the atmosphere does not provide phosphorus as in case of N<sub>2</sub> and thus the phosphorus is provided by minerals or organic sources. In this study we have found that the banana peels when decomposed in soil increases the phosphorus content so it can be said that banana peels may enrich the soil with phosphorus content.

S. No.	Soil sample	Absorbance at 440nm	S content in sample(µg/ml)	SO <sub>4</sub> <sup>-</sup> S (mg/kg)	Remark
1	Control	0.070	4.00	2.00	-
2	1 <sup>st</sup> day	0.091	4.96	2.48	Banana peel added
3	2 <sup>nd</sup> day	0.127	5.97	2.90	„
4	3 <sup>rd</sup> day	0.153	7.20	3.60	„
5	4 <sup>th</sup> day	0.202	9.14	4.57	„
6	5 <sup>th</sup> day	0.220	10.00	5.00	„
7	6 <sup>th</sup> day	0.231	11.50	5.75	„
8	7 <sup>th</sup> day	0.239	11.90	5.59	„

Table 5: Sulphur content in soil

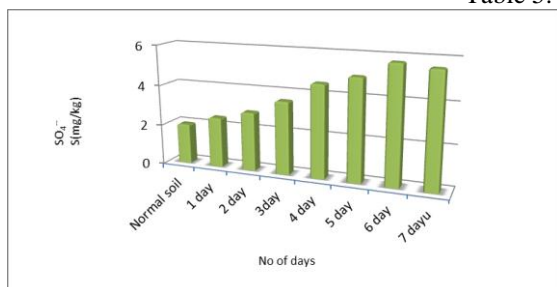


Fig. 5: Variation of Sulphur content between control and Banana peel added soil

In increased amount of sulphate is problematic for soil. To effectively use this soil the water content can be raised so as to reduce the acidity and serve as a management option for this type of soils. In our studies we have found that sulphate content is increased but in later on studies we have also found that due to banana peel addition the moisture content increases and this balance the effect of increased sulphur.

#### IV. CONCLUSION

Soil is a natural habitat for supporting the growth of various flora and fauna. It has a complete balance of ecosystem, but due to urbanization and industrialization, this balance is breaking. The direct disposal of various waste materials in the soil is changing the properties of soil. Therefore the present studies were undertaken for the management of particular type of waste. Today banana are best known fruit crop in India. Banana makes a healthy food for human but their peels also provide a healthy nutrient to garden soil. Banana peels contains nutrients which are needed by plants to flourish such as potassium, calcium, magnesium, sulphur, phosphate and sodium. Banana peels also help plants to resist disease.

All these are nutrients for the plants and thus we can say that dumping of banana peels in a proper way into the soil increases the soil productivity. The utilization of banana waste in proper way not only useful in increase soil fertility but also decrease pollution load and increase greenery, it is proving to be beneficial for human being as well as for nature. Thus the banana peels may be utilized as the fertilizers for soil. The study further suggests a better management for waste banana peels.

The overall conclusion of the study is that the waste materials mainly organic contents are beneficial for the soil in terms of its fertility

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