

# Effect Of Fertilizers On Soil Properties For Different Crops In Pre-Monsoon Season Using Spectroradiometer For Raver Tehsil Of Jalgaon District

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**Abstract:** Suitable fertilizer application is important in the agriculture sector to improve soil fertility and soil quality. Fertilizers are used for enhancing soil fertility and productivity, but proper use of fertilizers based on the requirement for a particular crop and soil has always remained a challenge. Furthermore, habitual laboratory methods are very time consuming and expensive. In this work, we assessed the soil spectral reflectance curve using the absorption feature parameter for soil properties assessment. Spectral reflection data are acquired using ASD fieldSpec4 Spectroradiometer for assessment of chemical properties like nitrogen, phosphorus, potash, carbon, pH as well as physical properties like sand, silt, clay, soil organic matter (SOM), moisture. The reflectance data having unique soil spectral signatures were obtained and analysed statistically. The pre-monsoon season (first week of June) soil samples are collected where Organic, Chemical Inorganic), mixed (Organic and Inorganic) fertilizers treatments were applied for different crops are taken in the study area. The soil samples were collected in the context of the surface (topsoil), Subsurface (subsoil) layer. For this study soil samples are collected in the pre-monsoon season for finding the effect of fertilizers on soil. The physical and chemical properties are analyzed in surface and subsurface soil for different crops and different fertilizer treatment.

**Keywords:** Soil properties, influence of fertilizers, Spectroradiometer,

## INTRODUCTION:

Ample requirement of food production in India over the last decades is the result of modern agricultural technologies, and fertilizers are one of the most important components of these improved technologies [1]. Soil nutrients are the major source of soil fertility that helps for plant growth as well as yield production. Farmers put nutrients, micronutrients, macronutrients as inputs in the form of fertilizers. Different types of fertilizers are used in the agriculture field like organic, inorganic, and mixed (organic & inorganic). In the agriculture field farmers used the organic, inorganic or mixed fertilizers for fulfilment of nutrients. Fertilizers play an important role for enhancing soil fertility in agriculture field since last decades, but accurately use of fertilizers based on the required amount for a certain site or type of crop and soil has always remained a challenge [2-3]. Due to the improper fertilizers management, improper tillage practices, heavy use of chemical fertilizers, soil quality and soil fertility can be affected [4]. Soil having different properties physical, chemical and biological, in this paper, physical and chemical properties are analysed. Sand, silt, clay, Soil Organic Matter (SOM), moisture contents are calculated in physical properties. Soil texture can be identify on the basis of sand, silt, clay. Soil moisture is the water that is held in the spaces between soil particles. In some mineral soils aluminium can be dissolved at pH levels below 5.0 becoming toxic to plant growth [5]. Soil pH may also affect the availability of plant nutrients. Nutrients are most available to plants in the optimum 5.5 to 7.0 range. pH can also affect the structure of the soil, especially in clay soils. Nitrogen (N), Phosphorous (P), Potash (K), pH, Carbon (C) are the chemical properties of the soils are calculated. Nitrogen is important for formation of amino acids and the building blocks of protein [6-7]. It is essential for plant cell division and vital for plant growth. Phosphorus involved in photosynthesis, respiration, cell division and enlargement of cell. It promotes early root formation and growth of plant [8,

22-23]. Phosphorous is important to improve the quality of fruits, vegetables and grains. Potassium is useful for increase photosynthesis as well as it increases water-use efficiency. It is important in fruit formation [9-11, 23]. Increasing soil organic carbon has two benefits as well as helping to mitigate climate change, it improves soil health and fertility [12]. Soil organic matter is a crucial indicator of soil fertility status and soil health. The presence of organic matter in soil significantly affects the soil colour [13]. Soil quality has extended attention as a result of environmental issues related to soil degradation and production sustainability under different farming systems [14]. Chemical fertilizers influence detection can be difficult due to the different elements on the surface. The surface features creating spectral confusion with different elements of reflectance properties [15]. The appropriate methods selection is very important task for analysis of soil properties. The spectral data is used for fast non-destructive estimation of chemical properties nitrogen, phosphorous, potash, carbon, pH as well as physical properties sand, silt, clay, soil organic matter (SOM), moisture based on diffuse reflectance spectroscopy using Visible, NIR, SWIR (350-700, 700-1100, 1100-2500) spectral range respectively. Spectroscopic techniques gives the fast results as compare to traditional methods, there is no need of harmful chemical for soil testing and it reduced the cost of chemical. The spectral reflectance data can be alternative to the traditional methods for determining soil properties.

## 2. STUDY AREA

The study is Raver Tahsil of Jalgaon District in Maharashtra, which is located between Lat: 21°12'30"N, Lon:75°56'36"E and Lat: 21°11'42"N, Lon:75°58'08" E in, India with GPS information. In this study area different crops like Jowar, banana, cotton, gram and, soybean, wheat, corn taking farmers. Banana and cotton is the main cash crop and Banana is very famous in the national and international

market from the study area. Banana and cotton crops are associated with the formation of soils, nature of surface, availability of groundwater. The kharip and rabbi crops can be taken in this study area. Single and double crops can be produce in this area, it is depend on the crop whether it is one year crop or three to four months crops.

### 3. Material and Methods:

Soil Samples were collected in the first week of June 2019 before the monsoon and end of the summer season. The climate was extremely hot (temperature was 45<sup>0</sup>-47<sup>0</sup> C.) and dry at the time of soil sample collection. The random soils samples are collected where the different crops are taken with different fertilizers treatment were used. Cotton, Gram, banana fields were selected for soil sample collection where organic, inorganic and mixed fertilizers treatments were used. Soil samples are collected after harvested of the crops. Maximum field are ready for rabbi crops by applying different tillage practices. The tillage practices are depending on previous as well as future crops. Tillage practices are very important for mixing and changing the soil in two layers. Some samples are collected from no tillage were applied. Soil sample are collected in the group of two samples from same location in the surface and subsurface category for each crops and fertilizers treatment were used. Total 60 samples are collected from surface and subsurface. The surface soil samples are collected from 15 CM from the top and subsurface soil samples are collected from 30 CM from the top. The total 5 samples are collected from each field four corner and one centre for each farm then mixed it together then hand crushed the soil bulk. The soils were sieved through 2-3 mm sieve then air dried the soil sample in the shadow of tree for 1-2 hours. Then divide the soil in four groups and pick-up any two part of soil which are placed in the cross of each in the group of four soil sample. Keep the collected soil sample in the airtight zip lock bag and transport to the lab for spectral data acquisitions.

#### 3.1 Spectral Data Acquisition:

ASD Field Spec4 having spectral range (350- 2500 nm) Spectroradiometer is used for data acquisition in the form of spectral signature from collected soil Samples. Spectroradiometer giving minimal sample preparation, fast analysis, cost-effective to analyse a single or batch of samples, several constituents can be determined simultaneously, no destruction of samples, no hazardous chemical used, and results can be accurate and fast [8-10]. After data collection, approximate ten spectral signatures are acquired for every sample. Then calculate the mean of every ten spectral signature using View Spec Pro version 6.2 software. Generate the statistic data of each mean sample and process data using View Spec Pro 6.2 software [17-20].

#### 3.2. Data Processing:

Calculate the mean of ten spectral signatures which are collected for each sample then calculate the average of five samples which are collected from each category field. All soil samples divide in different six category organic cotton,

organic banana, mixed gram, inorganic gram, inorganic banana, mixed banana. The sand, silt, clay, Soil organic matter (SOM) , Moisture content are analysed for estimation of physical and properties and pH, Carbon (C), Nitrogen (N), Phosphorous (P), Potash (K) content are analysed for estimation of Chemical Properties. After processing the spectral data extract the numerical data in MS-excel and arranged in tabular format. The cotton soil having less reflection than banana soil in organic and mixed fertilizers category. Cotton and banana crop surface soil having less reflection than subsurface soil. Mixed subsurface soil having a high reflection in banana crop soil. An organic fertilizer surface soil having less reflection in cotton crop soil. Subsurface soil sample having more reflection than surface soil sample in all categories.

### 4. RESULTS

Soil physical as well as chemical parameters are calculated from statistical data which is collected from spectral signature. Statistical data is released in Microsoft Excel. Spectral data is represented in the numeric format in the range of 350-2500 total 2150 values. Different chemical soil parameters are analysing on different spectral absorption range. Then calculate the average of ranges values for every soil parameter for different fertilizers treatment used soil sample from the surface and subsurface. In Mixed gram soil sample the contents are higher in subsurface than surface soil sample in physical and chemical properties. In Chemical gram soil sample the contents are higher in subsurface than surface soil sample in physical and chemical properties. In Organic Cotton and organic banana soil sample there were no more difference recorded in subsurface and surface soil sample in physical and chemical properties. This soil sample farm having no tillage practice was applied. In chemical banana soil sample the contents are higher in surface than subsurface soil sample in physical and chemical properties. Mixed banana soil sample there were no more difference recorded in subsurface and surface soil sample in physical and chemical properties. In the physical properties analysis mixed banana and mixed gram having almost same content in surface soil sample category. Chemical gram soil sample having less content recorded than all other sample in physical surface and subsurface category of soil sample as well as in Chemical properties of surface soil sample. Organic banana having the more content in all class and category of soil samples. Mixed banana having the less content in subsurface of chemical properties in the soil samples.

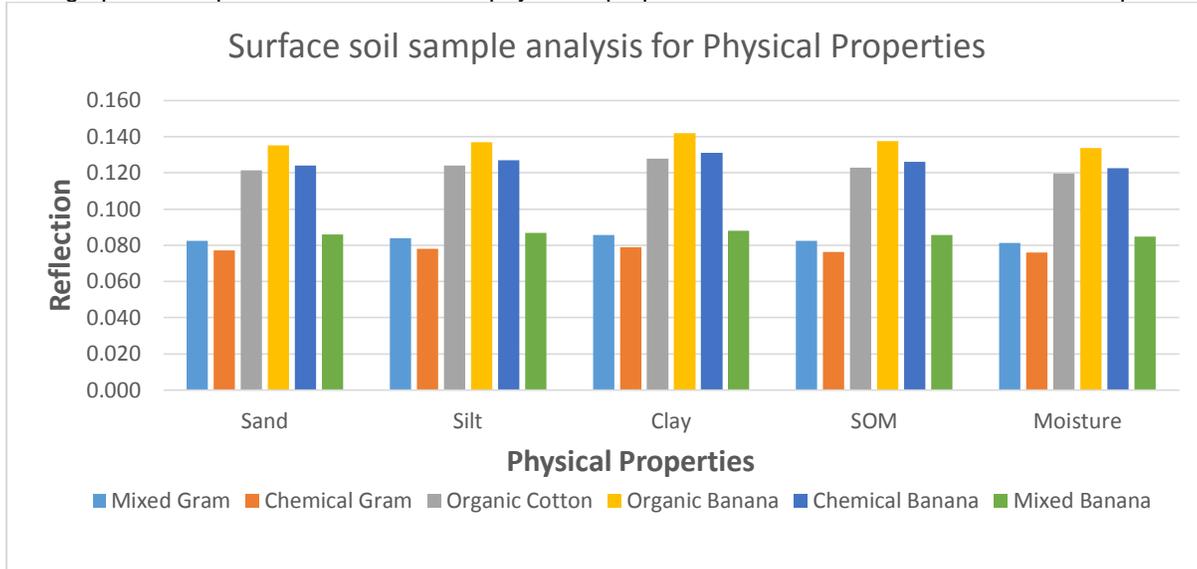
#### Physical Properties:

In physical properties sand, silt and clay content are calculated for soil texture. SOM and moisture contents are also calculated and the results is shown in table1 and table 2. Table no.1 shows the availability of physical properties content in the surface soil sample. In this table organic banana field soil having the more content and chemical gram field having the less content as compare to other crops and fertilizers treatments.

**Table No.1. Availability of physical properties content in the surface soil sample**

Surface Soil Sample analysis for Physical Properties					
	Sand	Silt	Clay	SOM	Moisture
Mixed Gram	0.083	0.084	0.086	0.082	0.081
Chemical Gram	0.077	0.078	0.079	0.076	0.076
Organic Cotton	0.121	0.124	0.128	0.123	0.120
Organic Banana	0.135	0.137	0.142	0.137	0.134
Chemical Banana	0.124	0.127	0.131	0.126	0.123
Mixed Banana	0.086	0.087	0.088	0.086	0.085

The graphical representation of the physical properties content in surface soil sample shown in figure 1



**Figure 1: Representation of physical properties content in the surface soil sample**

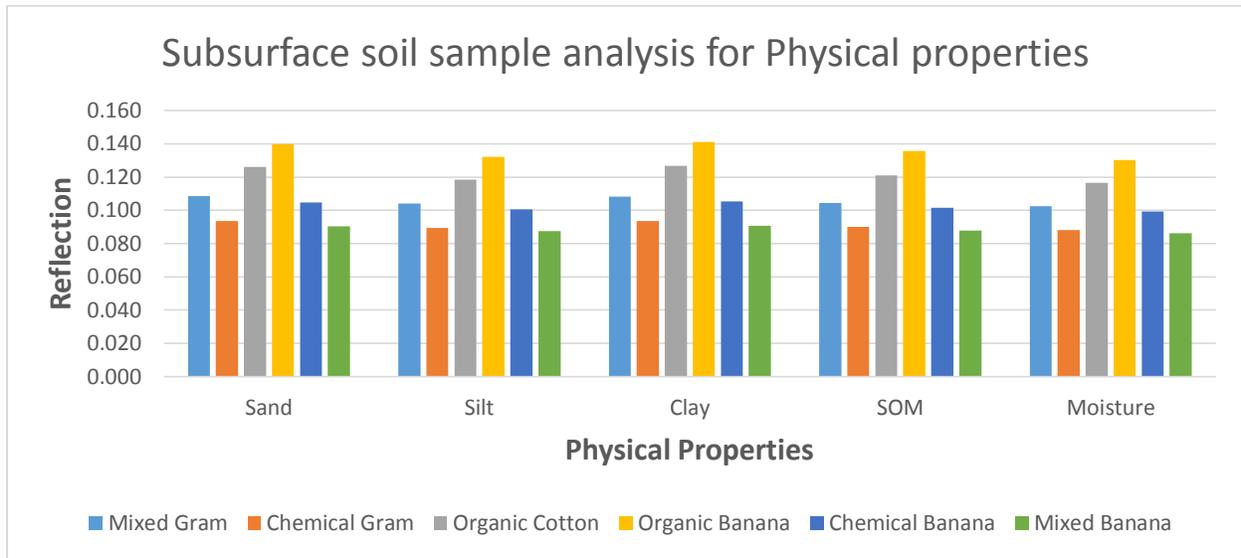
Table no.2 shows the availability of physical properties content in the subsurface soil sample. In this table organic

banana field soil having the more content and mixed banana field having the less content as compare to other crops and fertilizers treatments.

**Table No.2. Availability of physical properties content in the subsurface soil sample**

Subsurface Soil Sample analysis for Physical Properties					
	Sand	Silt	Clay	SOM	Moisture
Mixed Gram	0.108	0.104	0.108	0.104	0.103
Chemical Gram	0.093	0.090	0.094	0.090	0.088
Organic Cotton	0.126	0.119	0.127	0.121	0.117
Organic Banana	0.140	0.132	0.141	0.135	0.130
Chemical Banana	0.105	0.101	0.105	0.102	0.099
Mixed Banana	0.090	0.087	0.091	0.088	0.086

The graphical representation of the physical properties content in subsurface soil sample shown in figure 2



**Figure 2.** . Representation of physical properties content in the subsurface soil sample

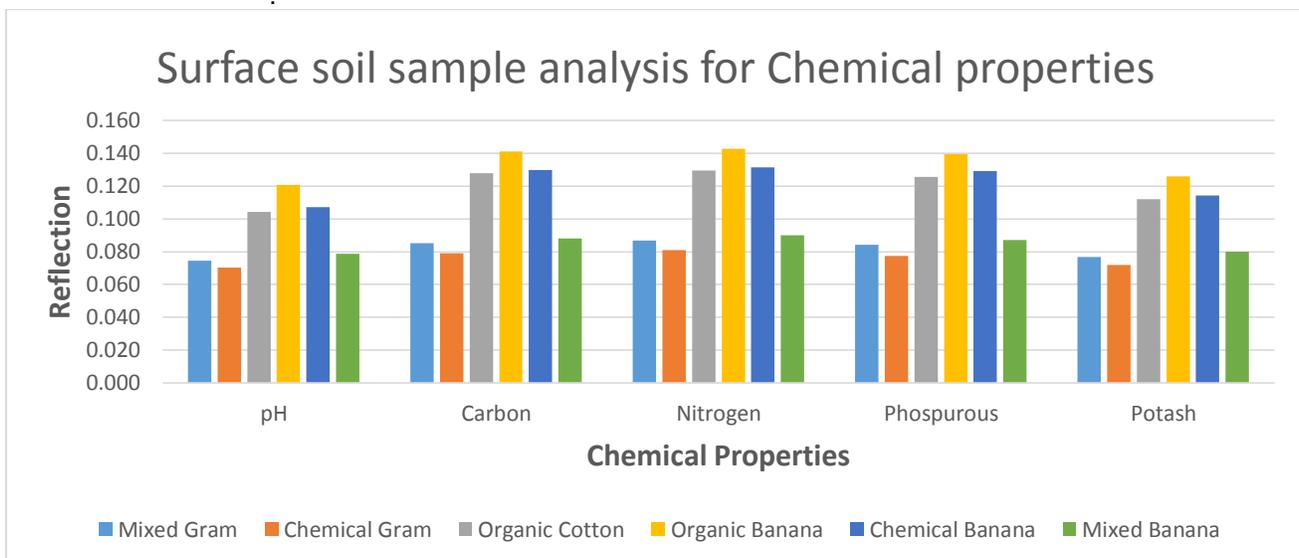
Chemical Properties: chemical properties pH, Carbon, Nitrogen, Phosphorus and Potash are calculated and the results shown in table 3 for surface soil sample and the table 4 shown the subsurface soil sample with chemical properties.

Table no.3 shows the availability of chemical properties content in the surface soil sample. In this table organic banana field soil having the more content and chemical gram field having the less content as compare to other crops and fertilizers treatments.

**Table 3:** Availability of chemical properties content in the surface soil sample

Surface Soil Sample analysis for Chemical Properties					
	pH	Carbon	Nitrogen	Phosphorous	Potash
Mixed Gram	0.075	0.085	0.087	0.084	0.077
Chemical Gram	0.070	0.079	0.081	0.078	0.072
Organic Cotton	0.104	0.128	0.130	0.126	0.112
Organic Banana	0.121	0.141	0.143	0.140	0.126
Chemical Banana	0.107	0.130	0.131	0.129	0.114
Mixed Banana	0.079	0.088	0.090	0.087	0.080

The graphical representation of the chemical properties content in surface soil sample shown in figure 3



**Figure 3.**Representation of chemical properties content in the surface soil sample

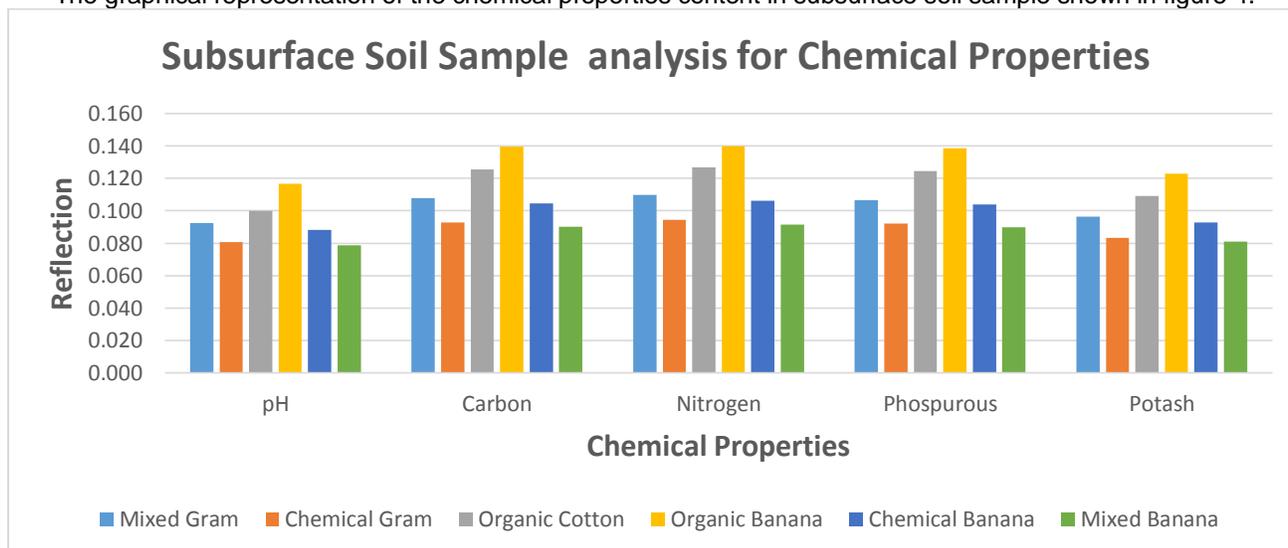
Table no.4 shows the availability of chemical properties content in the subsurface soil sample. In this table organic banana field soil having the more content and mixed banana field having the

less content as compare to other crops and fertilizers treatments.

**Table 4:** Availability of chemical properties content in the subsurface soil sample

Subsurface Soil Sample analysis for Chemical Properties					
	pH	Carbon	Nitrogen	Phosphorous	Potash
Mixed Gram	0.092	0.108	0.110	0.107	0.096
Chemical Gram	0.081	0.093	0.094	0.092	0.083
Organic Cotton	0.100	0.126	0.127	0.125	0.109
Organic Banana	0.117	0.140	0.140	0.139	0.123
Chemical Banana	0.088	0.105	0.106	0.104	0.093
Mixed Banana	0.079	0.090	0.092	0.090	0.081

The graphical representation of the chemical properties content in subsurface soil sample shown in figure 4.



**Figure 5.** Representation of chemical properties content in the subsurface soil sample

## 6. CONCLUSION:

The spectral reflectance data can be alternative to the traditional methods for determining soil properties. Different physical and chemical properties are analysed in the acquired spectral data where different fertilizers treatment were used for banana, cotton and gram crops, in surface and subsurface soil samples in pre-monsoon season. Pre-monsoon season is a dry season, it is best for soil sample collection and in this season maximum crops are cultivated and harvested. The agriculture lands are ready for kharip cropping, it is well prepared with tillage practices. In the preparation of agriculture land for next growing crop the different tillage practices are required for mixing the soil (surface Vs. subsurface) with organic matter, leaf etc. after that collected soil samples gives the better results. The result shows that the more content are available in organic banana soil sample in surface as well as in subsurface soil sample as compare to other soil sample. The less content are available in chemical gram soil as compare to other soil

sample in surface soil. But mixed banana soil having less content in the subsurface soil where the chemical properties are asses. Thus, these indicated that organic fertilizers should be recommended to improve soil quality and soil fertility.

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