

Efficient way to Sense the Soil Health based on the Policies and Guidelines to Prescribe Nutrients for better Yield

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Abstract

Agriculture serves the nation with health and wealth. Food is the basic need of people made agriculture the leading employability area. The status of agriculture is inclining steeply down due to the lack of knowledge of farmers regarding the climate and nutrients in the soil. The farmers are not testing the health of the soil before cultivating a crop. Checking the health of soil plays a vital role in increasing the production and the health of the plant and the products produced from the plant. The soil quality has been dramatically redefined due to the requirement in the environment and agriculture sustained. The ancient method the farmers used to follow has lost its scope due to climate change. There is a need of technical help in the health checkup of soil to increase productivity. The efficient way of sensing the soil using easily available resources can be done that leads to improvement in the agricultural style.

Keywords: Soil, Quality of soil, health of soil, nutrients in soil.

1. Introduction

Soil, a vast material rich in silica found in all parts of the landfills. The mixture of organic and inorganic material that provides a medium for the plant to grow. The soil health is not only the water content and moisture in the soil[1]. It is the combination of mineral composition, gases, liquids and living organisms that are present in the soil. Soil serves as the topmost layer in the atmosphere. Soil is classified into different types based on the layers. The farmers assume the quality of the soil either by the top layer or by the ancient methodology[2], [3]. Ancient methodology of predicting the soil health is by growing different sets of crops. For example. Cultivating brinjal after sugarcane will produce better yield. The nutrients required by brinjal and sugarcane are different and that doesn't affect the health of the second plant. The soil gains the strength before a round shift of cultivation[4]. This method was good when there was no use of external use of fertilizers. When external fertilizers take a pitch in the agricultural land, the overall play of the plant life is changed. Fertilizers are supplied to plants based on the needs. Even they are provided in excess to increase productivity. They increase productivity with the increase in land pollution. The health detection of the soil must be done in a proper way that would help the farmers to increase in production with a cheaper way with cultivating a selected crop.

2. Motivation of this paper

Agriculture is the backbone of our country, India. India is known for Agriculture and seeing a gradual decrease in the occupation of farmers made us feel guilt and forced us to search the reason and provide a solution to farmers[5], [5]. The reason behind the tragedy is not a straightforward reason. It is a chain reaction that brings impact on the farmers. The farmers started selling their lands for building factories or other buildings. The poverty they face made them sell their lands. The markets have a demand in the vegetables but there will never be acceptable increase in the price of vegetables from a farmer's point of view. They started facing the losses rather than profit. On the other hand, the production is less and the quality of the produced vegetables are not up to the level. The main reason we found after a survey is the improper cultivation of plants. They don't have the knowledge of the climate change effects and the environment pollution[6]–[9]. They couldn't select a most suitable plant. They lag in the checking the health of the soil. The Government is providing a lot of easier and efficient ways to check the soil. The awareness and knowledge of checking the health of the soil has to be given to the farmers. The actual way to test the soil for selecting a plant to be cultivated is done. A survey of around 1200 farmers stating the reason of leaving agriculture is shown in the Table 1.

Result	Number of Farmers
Decline in crop yield	403
Loss of Assets	213
Loss of Income	201
Food insecurity / Shortage	140
Death of Livestock	128
Decline Consumption	124
Total	1209

Table 1: Reason behind farmers leaving farming.

3. Materials and Methods

The soil is basically classified into five major types. Organic matter, surface soil, subsoil, parent rock, bed rock are the classifications. The standard classification in terms of horizon is denoted as O, A, E, B, C, R. The plant growth depends on the soil layers. In standard classification, health of plant directly depends on the O, A, E, B Horizons and indirectly on the C and R Horizon. The surface soil, organic matter and sub soil plays a vital role in determining the health of the soil. Horizon O holds the plants litter and leads to the immediate growing capability of the soil. There are few plants that their growth depends only on the top layer. The determination of the health of the top layer is sufficient enough for determining these kinds of crops. Example wheat, paddy crops. The trees and saplings depend on the lower layers or horizons of soil. The soil in the layers can be majorly of four types. Clay, Loam, Sand Slit are the varieties. The plant growth depends on it majorly. The farmer planning to plant a crop has to take care of the health of soil on the basis on layers, Horizons and on the type of soil. If a better decision is taken in selecting the crop for his land or providing the required supplements would help him/her to produce a reasonable amount of outcome with good health of the product. The plant has to be selected based on the Table 2.

Soil Type	Water holding Capability	Nutrients Holding capability	Water moving capability	Air holding capability	Color of the soil
Loam	Good	Medium to Good	Medium	Good	Brown to Black
Sand	Poor	Poor	Good	Good	Often Light Brown
Clay	Good	Good	Poor	Poor	Grey
Slit	Medium to Good	Medium	Medium	Medium to poor	Brown to Black

Table 2: Features of the different types of soil.

3.1. Soil Sensing by layers

The major failure in the farming is the improper testing of soil. Soil has to be tested in layers for determining the exact details of the soil. The results of the different layers are discussed. A result of a soil test based on the iron, manganese, Zinc and copper content is shown in Table 3. The capturing component or element with the chemical properties are discussed in the Table 4. The Research number states the specific number that corresponds to a sample.

S.No	Research No	Iron	Manganese	Zinc	Copper
A1	E1875	0.2	1.5	0.1	0.2
A2	E1876	0.7	2.6	0.2	0.1
A3	E1877	0.1	1.4	0.2	0.1

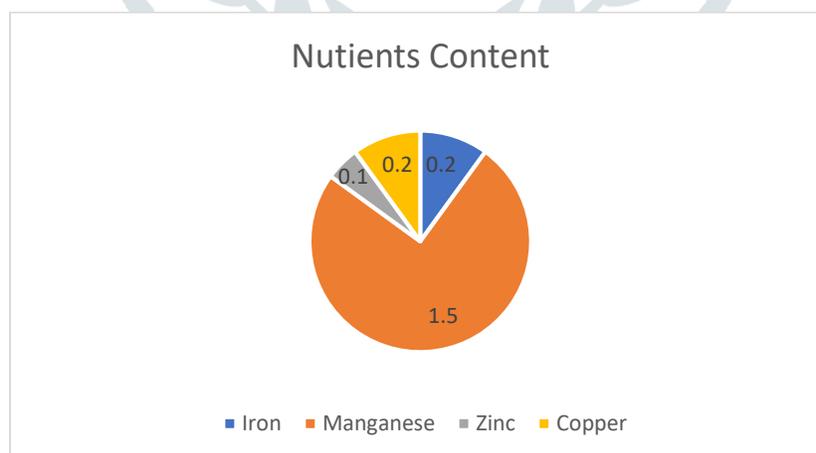
Table 3: Different metal compounds in the soil (Sample from a farm)

S. No	Research No	Tex	LS	PH	EC	Nitrogen	P ₂ O ₅	K ₂ O ₃
A1	E1875	Cl	P	8.2	0.4	47	0.9	80
A2	E1876	Cl	P	9.1	0.9	23.5	0.2	73
A3	E1877	Cl	P	8.9	1.3	72.8	0.4	77

Table 4: Different Chemical properties in Soil (Sample from a farm)

The research number states the unique sample number. The A1, A2, A3 are the layers of soil taken from the different layers from a single point. The difference in the value of nutrients in the soil changes with respect to the layers is clearly seen. The results of the soil test show the soil is rich in Potassium (P) and Chlorine (Cl). The PH variation in different layers is noted. The A1 states the topsoil. The A2 states the soil below 1 feet of the same place and A2 still 1 foot deeper from same point. The Farmer has to take care of all the features in the soil for better scalable output. The EC states the Salt content in the soil. The results also provide us with the suggestion for improving the health of the soil. They provide us the perfect season crop for cultivation based on the health. The soil health never stated by the topsoil. It is stated the layers of soil health. The Health of the soil in the middle 1 foot is greater as a comparison between the three layers. The salt layer is gradually increasing as the sample is taken from a deeper place. The farmers are lagging in the knowledge of collecting samples that makes them face issues, less yield of crops. The most common mistake done by farmers is just checking the nutrients of the topsoil. The soil of the top 3 horizons has to be taken care. The increased in efficiency is seen in the farms of the farmers who take a wise decision after checking the health of the soil. The Figure 1 shows the level of Nutrients in the sample of soil.

Figure 1: Nutrients level of soil



3.2. Soil Sensing in top layer

The health sensing of the soil for the cultivation of paddy and wheat crops doesn't require the nutrients level of the lower horizons of soil. Only the topsoil serves the base to these kinds of soil. The soil can be sampled and checked easily. The properties for testing these kinds of soil are totally different and various parameters has to be checked. The results of the topsoil are shown in the Table 5 and 6.

Dietary supplements	Kg/Acre
Organic Carbon or Nitrogen	62
P ₂ O ₅	8.3
K ₂ O	148

Table 5: Dietary Supplements present in the sample soil.

Micronutrients	E31 Sample	PPM
Iron	Fe	3.2
Manganese	Mn	7.2
Zinc	Zn	0.4
Copper	Cu	0.2

Table 6: Micronutrients present in the sample soil.

The amount of dietary and micronutrients supplementary present in soil is tested and the report is prepared. The prescription is also developed based on it. The value of the soil is based on the neutrality, salt and Calcium content and the same is shown in the Table 7.

Texture	Calcium Carbonate	EC (dSm ⁻¹)	pH
Clay Slit	medium	0.38(good)	8.0(medium)

Table 7: Quality of the sample soil.

The soil being tested has a number of details that specifies the health and suggests a farmer with better option. As per the result, the organic carbon or Nitrogen is low and the K₂O is high. Iron is low and Manganese is in appropriate amount. Zinc and copper are in lower quantity. Calcium carbonate is on medium state and salt level is good. The salt should be less in the soil for better cultivation and pH is 8.0, shows the soil is basic in nature or alkaline. For the cultivation of wheat, a prescription is given. The required extra fertilizers and the needed components for the soil is recommended by the person who test the soil. The prescription is given in the Table 8 and 9.

Chemical Prescribed	Quantity
ZnSO ₄	2.5Kg/Acre
CuSO ₄	2 Kg/Acre

Table 8: Prescribed nutrients for better yield of wheat.

Chemical Prescribed	With Seed	While Ploughing	While Cultivating
Rhizobium	2 grams	4 grams	4 grams
Paspo Bacteria	2 grams	4 grams	4 grams

Table 9: Different stages of usage of Bacteria for better yield.

3.3. Sample Collection

The sample collection purely depends on the type of plant that we are planning to cultivate. Wheat and paddy require the testing done in topsoil. Fruit and vegetable plants needs the test results of the layers. The samples collected has to be checked at the same time. The samples have to be tested in a same place. The samples are taken and shouldn't be stored for a longer time. The Sample collected has a desired property and the properties changes with respect to time and the atmosphere in which it is held. The better suggestion for collecting sample would be collecting just few minutes before testing and storing in open air.

4. Results

The Government of India has taken a lot of measures to ensure the betterment of the Farmers. Farming being the backbone of India, Government provides subsidies and loans on various farming activities. The cost of checking a sample costs only 10 rupees. The description is provided for the same in that 10 bucks. The further improvement in the system is done by Providing remote services to farmers. The machine is brought to the farm and testing is done in the same 10 bucks. This is a cheap solution that motivates the farmers to take a suggestion for better yield.

5. Conclusion

The soil has to be checked before the cultivation of any crop. There is no need of deselection or demotivating the mood of the changing the crop, we can take some measures in increasing the quality of soil and cultivating the desired plant or tree. The tree or a plant planted by checking the soil strength and capability always gives a better yield. The better the planning of crop would give us better yield. This would linearly increase the health of the plants that indirectly gives a better platform for the farmers. The technical work in deciding the better crop or the required nutrients would pave a way to the better future.

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