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Estimation of Available Nitrogen Content in Soil Directly by Temperature Measurement

Mr.Nagendra Tripathi[1], Dr.Anup Mishra[2]

[1]*Research scholar, Faculty of Elect. Engg.,Dr.CVRaman University, Bilaspur ,Chhattisgarh,India*
[1]*ntripathibit@yahoo.com*

[2]*Professor,Electrical and Electronics Engg.Dept,,BIT, DurgChhattisgarh, India*
[2]*anupmishra.bit123@gmail.com*

Abstract-Nitrogen (N) is the largest available element in the atmosphere .It is normally available in gaseous form. For the proper growth of plant it is the most nutrients.The scarcity as well as the abundance of the nitrogen directly effect the crop yield. There is a natural nitrogen cycle which maintains the nitrogen level in soil. Various methods are used to replenish the nitrogen level in soil. This method evolves the conversion of nitrogen into form which plants can use. Some processes can lead to N losses such as leaching or volatilization. Nitrogen is added to soil naturally from N fixation by soil bacteria and legumes and through atmospheric deposition in rainfall. Externally N is added supplied to the crop by fertilizers, manure, or other organic materials. Hence there is a direct correlation between crop yield and the nitrogen content in the soil. In this paper an easy and fast method of determination of available nitrogen in soil is discussed.

Key words: Nitrogen, temperature, qualitative

I. INTRODUCTION

Agriculture has been one of the oldest occupation since the evolution of civilization. Farming not only provides foodto the people but it also contributes a lot in most of the nations economy.. The analyses of nitrogen content provide valuable information regarding the deficiency or excess of nutritional elements important for plant growth. Nitrogen content analysis is also essential when determining the quality of various types of crops for feeding and processing, as well as for N-cycle and N-fixation monitoring in agricultural and environmental research.

For maximum analytical performance, nitrogen content determination in soils and plants must be performed using accurate instrumental analytical techniques while also avoiding the use of toxic chemicals. To achieve this, the classic Kjeldahl method has been replaced by the Dumas combustion method, a simple and automatic technique that does not require sample digestion of toxic chemicals and facilitates faster analysis combined with excellent reproducibility. The FLASH 4000 is based on the Dumas combustion method, providing significant advantages over the Kjeldahl method including laboratory staff safety, improved sample throughput, automation, reduced operational costs and quantitative determination of nitrogen in a large range of concentrations.

For better yield site-specific management is used.In this technique agricultural inputs are to increase profitability of crop production, improve product quality, and protect the environment. Also the

information about the variability of different soil attributes within a field is essential for the decision-making process. The inability to obtain soil characteristics rapidly and inexpensively remains one of the biggest limitations of precision agriculture. Numerous researchers and manufacturers have attempted to develop on-the-go soil sensors to measure mechanical, physical and chemical soil properties. The sensors have been based on electrical and electromagnetic, optical and radiometric, mechanical, acoustic, pneumatic, and electrochemical measurement concepts. While only electric and electromagnetic sensors are widely used at this time, other technologies presented in this review may also be suitable to improve the quality of soil-related information in the near future.

Soil testing results are important inputs to the profitable application of fertilizer, lime, and other soil amendments. When soil test results are combined with information about the nutrients that are available to the various crops, a reliable basis for planning the fertility program can be established (Hoeft et al., 1996). An appropriate test may be based on localsoil and crop conditions as well as personal preference.

One of the most critical aspects of soil testing is actually obtaining representative soil samples (i.e. collected with adequate spatial density at the proper depth and during the appropriate time). Practical advice related to the collecting and handling of soil sampleswas given by Vitosh et al. (1995), Hoeft et al. (1996), and Gelderman and Mallarino (1998). However, the location and number of soil samples depends on the approach used to manage soil fertility (Havlin et al., 1999). Currently, random, adaptive, and grid sampling techniques are often used.

The site-specific application of inputs such as seed, fertilizer and crop protection chemicals has the potential to reduce input costs, maximize yields, and benefit the environment. These improvements include cost-effective identification and management of the spatial variability of soil and nutrients, applying inputs based on each site's productive capacity, and correct decision-making using the available layers of information.

Various methods for determining nitrogen content in soil.

1. Kjeldahl method.
2. Dumas combustion method.
3. Electrical conductivity (EC) measurements.

Method 1& 2 requires minimum 30-45 min whereas Method 3 takes less time as compared to 1 & 2 but relatively large experimental set-up is required that to of high precision and accuracy grade.

Principle:Nitrogen in nature is available in gaseous form, on adding water to soil the condensed nitrogen level can be approximated.

An experimental set is made to determine the nitrogen content in the soil using temperature sensing device. Temperature of the soil was measured using digital thermometer which shows reading upto one digit after decimal place.

II. METHODOLOGY

1. Take 25 gm of soil sample in the container
(30mm x 20mm x10 mm)
2. Note the room temperature.
3. Note down the soil (dry) temperature.
4. Add 25ml of water to the container .Wait for 20 sec (maximum).
5. Stir the soil with wood stick (optional)
6.Again measure the temperature of the soil (now wet).
7. A significant change (decrease)in the temperature is seen.
8. Repeat set 1 to 5 with another soil sample.
9.Compare the temperature range with the nitrogen level i.e. low ,medium and high.(qualitative)
10. The change in temperature of each soil sample was noted five times to eliminated the error in measurement. The temperature reading shown in table 1 is the average reading.
11.The soil samples on which the experiments were performed were send to the government soil testing agency for the estimation of nitrogen content in soil (qualitative).

III.OBSERVATION

The temperature variation of the different soil samples were noted .Note the room temperature first.
Room Temperature- 28 ^{o}C

S.N	Soil Sample No.	Temperature in ^{o}C	Nitrogen Level
1	1	26	Low
2	2	26.3	Low
3	3	25	Medium
4	4	25.4	Medium
5	5	24	High
6	6	26.5	Low
7	7	26.4	Low
8	8	26.3	Low

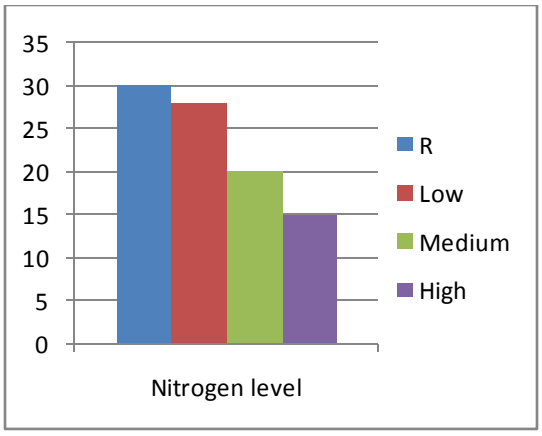
9	9	26.7	Low
10	10	25	Medium
11	11	25.1	Medium
12	12	26.7	Low
13	13	26.6	Low
14	14	26.8	Low
15	15	25.2	Medium

IV.RESULT

The nitrogen level (qualitative) has been verified from the soil test report of the same samples from the authorized soil test (Government Agency)

V.CONCLUSION

1.For low nitrogen level in soil the temperature drops from (room temperature) 28^{o} C to 26^{o} C.
2. For medium nitrogen level in soil temperature drops is from (room temperature)28^{o} C to 25^{o} C. Most of he reading are found in the range of 25.9^{o} C to 25^{0}C.
3. For high nitrogen level in soil temperature Drops from (room temperature) 28^{0}C to 22^{o} C.Most of the reading are found in the temperature range of 24.9^{o}Cto 22^{o} C.



Temp variation	Nitrogen level	Remark
28^{o} C to 26^{o} C	Low nitrogen	2^{o} Cless from room temp
25.9^{o} C to 25^{o} C.	Medium nitrogen	3^{o} C less from room temp
24.9^{o} C to 22^{o} C.	High nitrogen	5to 6^{o} Cless from room temp

Advantages: The method discussed above is rapid, safe and reliable for nitrogen content determination in soil.
Disadvantages: Various factors may affect the outcome like the sand,silt andclay percentage in soil.

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