International Journal of Recent Trends in Engineering & Research
ISSN : 2455-1457 Impact Factor : 3.344

Plant Nutrient Estimation System

S. G. Galande[1], Dr. G.H. Agarwal[2], Mrs. S. S. Barve[3]

[1]Associate professorP.R.E.C.,Loni, Ahmednagar,Maharashtra,India
[2]Professor & Dean,KDKCOE,Nagpur
[3](ME-II-VLSI & Embeded)P.R.E.C., Loni, Ahmednagar

Abstract- Nitrogen (N), phosphorus (P), Potassium (K) is one of the essential macronutrients for plant growth and development. However, NPK content in soils is usually limited so that the crop yields are restricted. Plants may adapt to NPK deficient environment by adjusting their physiological and morphological status, indicating that plants may have evolved their sensing and signaling mechanisms in response to NPK. This short review particularly discusses some components as possible sensors or signal transducers involved in plant sensing. There has been a significant growth, in the Agriculture field. Now every function ranging from temperature control to provide nutrient to plant is controlled by electronic system. This is a trend that is expected to continue as plant producer to attempt to make further advancements in productivity, safety and reliability as well as incorporated into future automotive design.

Keywords: Plant nutrient, agriculture, fertilisers, sensor, Bouguer law

I. INTRODUCTION

As environmental concerns continue to escalate and agriculture production becomes more scrutinized, new fertilizer application practices will continue to be researched with the goal of increasing fertilizer use efficiency.

We are aware of the farm fertility and productivity in India. Traditionally, fertilizers or other crop inputs have been applied to plants without considering spatial variability of field characteristics. Such agricultural management may be inefficient due to under-application and over-application of field inputs in plant. Due to do not reach optimum levels of yield whereas in over-treated.

There may be high risk of pollution of the environment and increases of costs. At present agriculture scientist are testing plant health and fertilizer in laboratory. This analysis process is laborious and time consuming and can be used only in laboratory. The plant nutrient estimation system will reduce labor and time and improve accuracy it can be portable and field usable.

The nutrients N, P and K play critical role in plant growth and development and many times referred as complete fertilizer. We shall develop a embedded based system to estimate N, P and K. This system is important for optimizing crop production and economic return to farmers, and reducing the environmental impact of farming operations.

II. TRADITIONAL PRACTICES

Flat rates of fertilizer are applied regardless of varying crop conditions. This usually results in either too much or too little material being applied in many parts of the paddock.

III. CURRENT PRECISION

Farming Practices Aerial and satellite imagery is used to develop prescription maps, subsequently used for making variable rate applications. Many times these images are taken several days or weeks before actual use due to cloud and weather conditions.

IV. PRINCIPLE

The principle of photometry is used for measurement. In photometry the power of light beam absorbed by the sample is determined. The intensity of a beam of radiation is characterized by its radiant power. A beam caring radiation of only one discrete wavelength is said to be monochromatic and radiation of several wavelength is said to be polychromatic [1].

The main components of photometer are light source and its detector. Usually, a filter is used to pass only the desired wavelength of the radiation of sample, whose absorbance is to be finding out. The detector detects the unabsorbed energy, which come through the sample. Usually such analysis measurement used double beam, as second beam is reference and transmittance is measured as the ratio of P and P_0.

P = Power of the unabsorbed energy which comes from the sample

P_0= power of the reference light beam

When a beam of radiant energy impinges upon a substance several phenomenon may occur as

1. It may pass through the matter with little absorption taking place and therefore little energy loss.
2. The direction of propagation of the beam may altered by reflection, refraction or diffraction. Scattering by particular suspended matter also be included.
3. The radiant energy may be absorbed. The absorption involves a transfer of energy to the medium and absorption process is specific phenomenon related to characteristics molecular structure.

The ratio of radiant power transmitted by sample to the radiant power incident on the sample is the transmittance T written as

$$\mathbf{T = {}^{P}/_{P0}}$$

Where P_0 is the rate at which energy is transported in a radiant energy beam and P is the quantity remaining unabsorbed after passing through the sample. The logarithm to the base 10 of b the reciprocal of the transmittance is the absorbance.

$$\mathbf{A = \log_{10}\left(\frac{1}{T}\right) = \log_{10}\left(\frac{P}{P0}\right)}$$

The principle of testing is based on Bouguer or Lambert law and Bernard's or Beer's laws

Bouguer or Lambert law states that when a beam of monochromatic light enters in an absorbing medium at right angles to plane ,parallel surface of medium (or container of solution) the rate of decrease in radiant power with the length of light path through the absorbing medium b is proportional to the radiant power of beam . the light is diminished in geometric or exponential, progression. Thus

$$\mathbf{\log_{10}\left(\frac{P}{P0}\right) = abC}$$

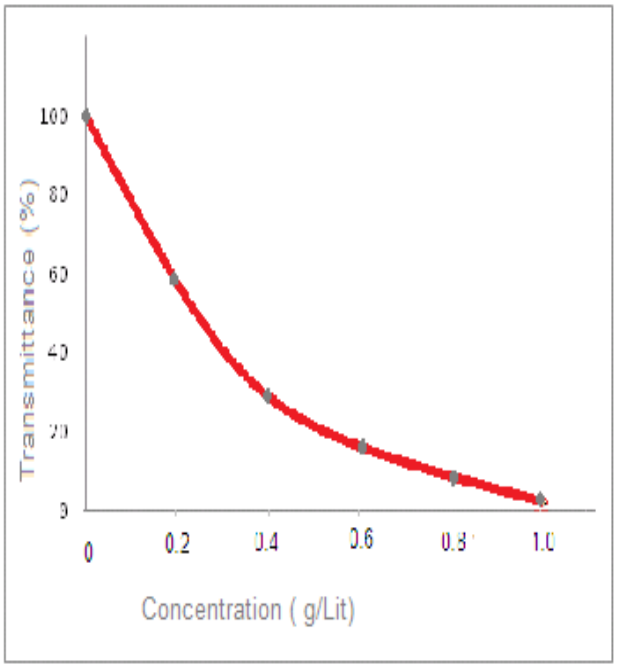
$$\mathbf{P = P_0 10^{-abC}}$$

P_0 = intensity of reference light beam

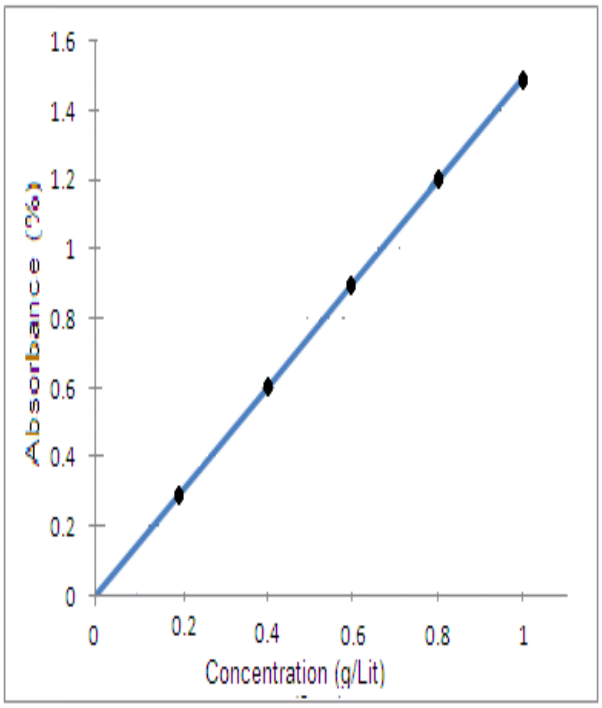
P = intensity of transmitted light beam

(i.e. unabsorbed light which comes through the sample)
a = Absorptive of solution
b = Thickness of media.
c = Concentration of media

The value of a, i.e. absorptive will depend on the wavelength of radiation and nature of absorbing material.

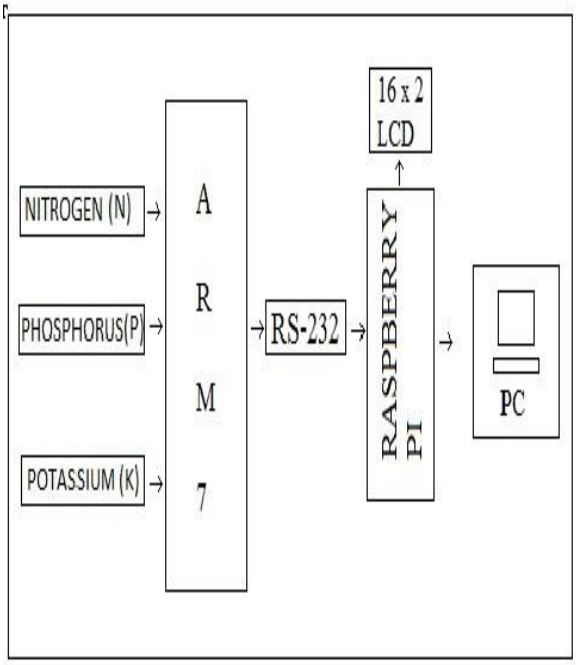


Graph-1 Transmittance Vs Concentration



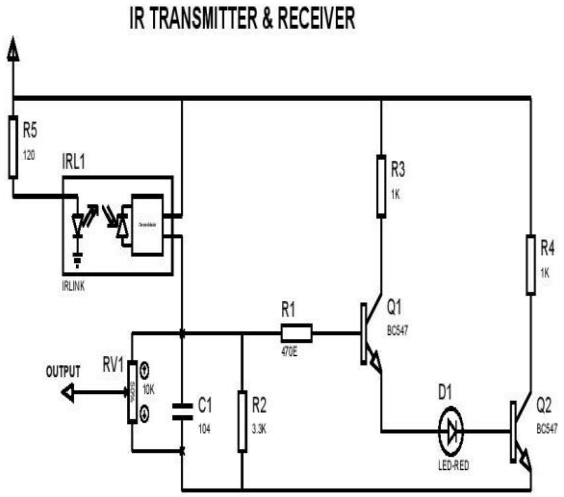
Graph-2 Absorbance Vs Concentration

V. BLOCK DIAGRAM



5.1 SENSING MECHANISM

For measurement of N, P and K contents, red LED (KL53SRC) and phototransistor (KP53PTT) may be used as light source and detector. The samples in test tube are mounted on sample holder which also contains light source and detector.



For measurement of N, P and K contents red LED is mounted on surface ADEG and phototransistor is on BCHF, on the opposite face of each other, such that light emitted from red LED falls on the phototransistor(detector).

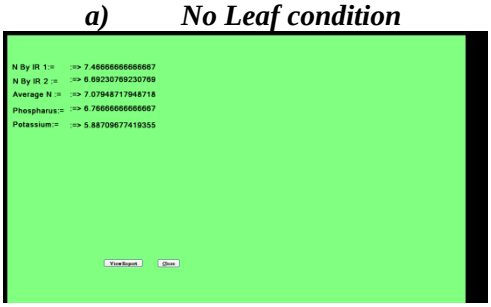
VI. VALUE AND BENEFITS

- More effective and economical use of fertilizer.
- Grower/consultant chooses the rates.
- Works in any weather conditions, day and night.
- No application delay due to cloud cover hindering aerial.
- Does not require third part coordination for crop mapping/imaging.
- One time investment in system, no annual contracts, no per image charges.
- System can be used to variable rate apply nitrogen to all broad acre crops.

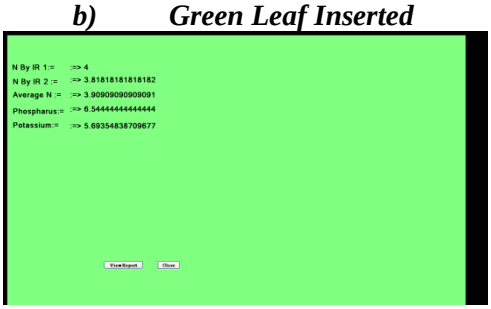
VII. RESULTS OBTAINED

The results obtained by the the kit developed for the testing of different plant leaves were obtained on the software windoe are as given below.

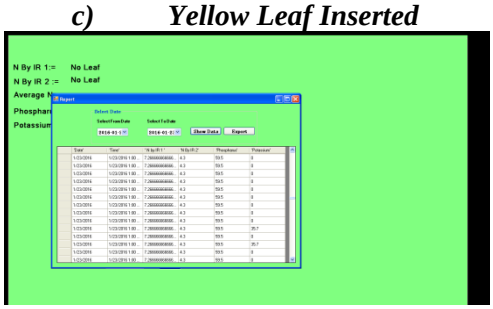
a) No Leaf condition



b) Green Leaf Inserted



c) Yellow Leaf Inserted



d) Cumulative report Generated

VIII. CONCLUSION

The system was developed to automate the analytical components of plant nutrient testing with the goal of providing: (i) a field portable system for simple and rapid estimation of plant nutrient concentrations through the soil profile and (ii) to characterize the spatial variability of nutrient concentrations in surface soil.

In both these roles this sensor will provide an improved understanding of plant and soil nutrient variability both spatially and temporally. It will provide sensing capabilities for more effective continuous and site specific nutrient management.

REFERANCES

I. Krishna Kant, Microprocessor based agriculture instrumentation, 2010.

II. Qiang Cao,Yuxin Miao,Siaowei Gao, Bin Liu ,"Estimating the nitrogen nutrition index of winter wheat using active canopy sensor in north chaina plain," IEEE,1st international conference on agro- geoinformatics,2012.

III. Chunhua Jin, Min Huang, Fei Liu, Yong He,"ESTIMATING NITROGEN STATUS OF PLANT BY Vis/NIR spectroscopy and mathematical model," IEEE,5th international conference on natural computation, 2009.

IV. Hajjdiab H, Abu Dhabi, Obaid A,"A Vison based approach for non distructive leaf area estimation,"IEEE, international conference on environmental science and information application technology,2010.

V. Yi Wang and Wei-Hua Wu1,"Plant Sensing and Signaling in Response to K1-Deficiency" Molecular Plant , Volume 3, Number 2 , Pages 280–287, March 2010

VI. Q. U. Zaman, A. W. Schumann, H. K. Hostler," ESTIMATION OF CITRUS FRUIT YIELD USING ULTRASONICALLY-SENSED TREE SIZE," American Society of Agricultural and Biological Engineers,2006.

VII. E. Conejo, j.-p. Frangi, S. Jacquemoud, g. De rosny,"ramis:a biophotonic physiological plant sensor".

VIII. F. López-Granados, M. Jurado-Expósito , S. Álamob, L. Garc´ıa-Torres ,"Leaf nutrient spatial variability and site-specific fertilization mapswithin olive (Olea europaea L.) orchards", Europ. J. Agronomy 21 (2004) 209–222