Determination Of Soil Ph And Nutrient Using Image Processing

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Absract - *Soil is recognized as one of the most valuable natural resource whose soil pH property used to describe the degree of acidity or basicity which affect nutrient availability and ultimately plant growth. soil samples were collected and their pH was determined by using digital image processing technique. Soil colour is visual perceptual property corresponding in humans to the categories i.e red, green, blue and others. Soil colours are the parts of visual perceptual property where digital values of red, green and blue (RGB) provide a clue for spectral signature capture of different pH in soil. For the capturing images, digital camera was used. On the basis of RGB grey values, pixels properties and their digital correlations, results showed that there was a clear cut gap in grey values of colours in the images . Ranges of soil pH and pH index values were 7.30-7.50 and 0.0070-0.0261, respectively in deep brown colour. Similarly, soil pH range varies from 6.80-7.04 and 5.58-6.58 in light yellowish and greenish colour respectively while their corresponding pH index values were 0.0071-0.0451 and 0.0084-0.0239. Thus soil pH range varies from 7.30-7.50, 6.80-7.04 and 5.58-6.58 in deep brown colour, light yellowish colour and greenish colour respectively.*

Keywords: *Colour, Digital images, Signature capture, Soil pH*

I. INTRODUCTION

Soil is recognized as one of the most valuable natural resource. Soils are considered as the integral part of the landscape and their characteristics are largely governedby the landforms on which they have developed .Systematic study of soils provides information on nature and type of soils for various uses. The pH in soils is an important concerning part of the soil health. pH is a term that is used to describe the degree of acidity or basicity. Soil acidity or alkalinity directly affects plant growth. If a soil is too sour or too sweet, plants cannot take up nutrients like nitrogen (N), phosphorus (P) and potassium (K). Most nutrients that plants need are readily available when the pH of the soil solution ranges from 6.0 to 7.5. Below a pH of 6.0 (acid): Some nutrients such as nitrogen, phosphorus, and potassiumare less available. Above a pH of 7.5 (very alkaline), Iron, manganese, and phosphorus are less available . Wide range of soil colour; gray, black, white, red, brown and yellow is influenced by the content of organic matter, and due to the presence of water and oxidation state of iron and magnesium. Yellow or red soil indicates the presence of iron oxides. Dark brown or black colour in soil indicates that the soil has high organic matter content.Wet soil will appear darker than dry soil. Red and brown colours caused by oxidation. The presence of specific minerals can also affect soil colour.Manganese oxide causes a black colour, glauconitic makes the soil green, and calcite can make soil in arid regions appear white. Thus due to concentration of organic matters,presence of water and oxidation are influenced factors of pH and colour association.Colour is the byproduct of the spectrum of light, as it is reflected or absorbed, as received by the human eye and processed by the human brain. When light hits objects i.e. soil, water, vegetation some of the wavelengths are absorbed and some are reflected, depending on the materials characteristics . However, digital camera receives the light in the terms of blue green and red bands. Red, green and blue are fundamental colours which is arranged in bands 321 (RGB), denote the wave lengths of electromagnetic radiation in spectrum band 3(0.63-0.69 µm), band 2 (0.52- 0.60µm) and band 1 (0.45-0.52 µm) are distinctly represented by different wavelengths (Joseph, 2003). Reflected energy (Blue, green and red) from the various materials which was captured by digital cameras is responsible for signature capture of the object. Soil colours charts were derived though digital camera is the part of visual perceptual property where digital values of red, green and blue (RGB) provide a clue for spectral signature capture of pH in soil. Keeping above in view, the present investigation was conducted to determine the soil pH by using digital image processing technique.

II. METHODOLOGIES

Soil samples were collected and after processing soil pH were determined by using pH meter. Soil samples
were analyzed for the present study and digital

camera was used for capturing images (JPEG format). This JPEG format of images was converted into img. file for the purpose of digital value extraction and finally determined their digital values. Soil pH index value of each samples were analysed by using the following equation

$$\text{pH index} = \frac{\text{Red/Green}}{\text{Blue}}$$

Equation values and measured soil pH values were correlated .Determination of soil pH was based on digital image processing technique, in which digital photographs ofthe soil samples were used for the analysis of soil pH. A histogram is a graphical representation the distribution of numerical data. It is an estimate of the probability distribution of acontinuous variable (quantitative variable). It is a kind of bar graph. To construct a histogram, the first step is to "bin" the range of values— that is, divide the entire range of values into a series of intervals—and then count how many values fall into each interval. The bins are usually specified as consecutive, non overlapping intervals of a variable. The bins (intervals) must be adjacent, and are often (but are not required to be) of equal size. If the bins are of equal size, a rectangle is erected over the bin with height proportional to the frequency — the number of cases in each bin. A histogram may also be normalized to display "relative" frequencies. It then shows the proportion of cases that fall into each of several categories, with the sum of the heights equaling 1. However, bins need not be of equal width; in that case, the erected rectangle is defined to have its *area* proportional to the frequency of cases in the bin. The vertical axis is then not the frequency but *frequency density* — the number of cases per unit of the variable on the horizontal axis. Examples of variable bin width are displayed on Census bureau data below. As the adjacent bins leave no gaps, the rectangles of a histogram touch each other to indicate that the original variable is continuous. Histograms give a rough sense of the density of the underlying distribution of the data, and often for density estimation: estimating the probability density function of

III. RESULT AND DISCUSSION

When light hits objects, some of the wavelengths are absorbed and some are reflected, depending on the materials in the object. However, soil is a part of an object and digital photograph of this object (soil) was taken through a camera, it received wavelengths the underlying variable. The total area of a histogram used for probability density is always normalized to 1. If the length of the intervals on the x-axis are all 1, then a histogram is identical to a relative frequency plot.A histogram can be thought of as a simplistic kernel density estimation, which uses a kernel to smooth frequencies over the bins. This yields a smoother probability density function, which will in general more accurately reflect distribution of the underlying variable. The density estimate could be plotted as an alternative to the histogram, and is usually drawn as a curve rather than a set of boxes.Another alternative is the average shifted histogram, which is fast to compute and gives a smooth curve estimate of the density without using kernels.

The histogram is one of the seven basic tools of quality control. Histograms are sometimes confused with bar charts. A histogram is used for continuous data, where the bins represent ranges of data, while a bar chart is a plot of categorical variables. Some authors recommend that bar charts have gaps between the rectangles to clarify the distinction

IV. BAYER FILTER:

A Bayer filter mosaic is a color filter array(CFA) for arranging RGB color filters on a square grid of photosensors. Its particular arrangement of color filters is used in most single-chip digital imagesensors used in digital cameras, camcorders, and scanners to create a color image. The filter pattern is 50% green, 25% red and 25% blue, hence is also called RGBG, GRGB, or RGGB. It is named after its inventor, Bryce Bayer of Eastman Kodak. Bayer is also known for his recursively defined matrix used in ordered dithering. Alternatives to the Bayer filter include both various modifications of colors and arrangement and completely different technologies, such as color co-site sampling, the Foveon X3 sensor, the dichroic mirrors or a transparent diffractive-filter array. Bayer filter technique separate the colour bands for given information about the intensity of light in red, green,and blue (RGB) wavelength regions. Digita lphotographs or images were displayed with colour composites as well as incorporated wavelength bands.

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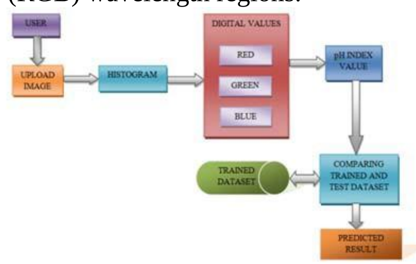

Digital photographs or images were displayed with colour composites as well as incorporated wavelength bands. RGB colours and their mixed components in the image were associated with Intensity Hue-Saturation (IHS) system, where intensity related with total brightness of a colour, Hue refers to the dominant or average wavelength of light contributing to a colour and saturation specified the purity of colour relative to gray e.g. solid pink has low saturation than the solid crimson (Lillesand and Kiefer, 2004). RGB+IHS yielded values provide very high accuracies for the calculation of the texture of the objects (Laliberte and Rango, 2008). In general, the multispectral transformation utilized a three-colour composite image from the original image data where the spectral information was separated into the hue and saturation components (Carper *et al.*, 1990). Transformation of the multispectral image was carried out through TNT Mips spatial software in image correction option. In whole images, colours of soil samples were taken through digital camera are different from one to another i.e. deep brown, light yellowish or greenish. There was clear cut difference in grey values of colours, when small sizes of image of soil samples were observed. Images 1, 2, 3, 4,10,11,14 and 16 showed deep brown, images 27, 33, 41 and 42 represents light brown and yellowish, images 43, 47, 49 and 50 represents greenish in colours.

Image data have been converted into geographical information system (GIS) environment for digital/pixel analysis using TNT Mips software. Digital values donot match in blue, green and red layers of the digital images (Fig. 2). RGB values in deep brown coloured soil were 133-98-30 to 207-186-157 and its value in light yellowish soil 128-105-27 to 229-210-152 whereas in greenish soil RGB value ranged 152-122- 52 to 189-164-113. Pixels and their digital values were demonstrated ingraphs.On the basis of RGB grey values, their pixels properties and digital correlations, Soil pH were analysed and plotted for result demonstration. Equation values (Soil pH index) of deep brown colours are different from light yellowish and greenish (Fig. 4). Soil pH values in deep brown colour were different from yellowish and other grey colours. Ranges of soil pH and pH index values were 7.30-7.50 and 0.0070- 0.0261, respectively in deep brown colour. Similarly, soil pH range varies from 6.80-7.04 and 5.58-6.58 in light yellowish and greenish colour respectively while their corresponding pH index values were 0.0071- 0.0451 and 0.0084-0.0239. Hence soils of Nathnagar block were alluvial and Tal land and colours under these land escape were light brown. However colours of soil samples in other geomorphologic areas may be black, grey and cotton black. This model may be helpful for signature capture of soil pH in different soil colour associations.

V. TABLE

LITERATURE SURVEY

S.NO	AUTHOR NAME	TITLE	METHODOLOGY
1	Sun-Ok Chung, Ki-Hyun Cho, Jae-Woong Kong	Soil texture classification using RGB characteristics	Soil sampling and texture analysis, Image acquisition and processing
2	Shweta Taneja, Rashmi Arora, Savneet Kaur	Mining of soil data using unsupervised learning techniques	Artificial neural network,Nearest neighbor method, Clustering technique
3	George Alan Blackburn	Hyperspectral remote sensing of plant pigments	Remote sensing of the plant pigments for RGB calculation

VI. CONCLUSION

This model is based on digital image processing technique where digital photographs of the soil samples were used for soil pH determination. Digital photographs were collected during sunlight while photographs of the soil sample were taken in dark room for the purity of digital value of the spectra. RGB values in deep brown coloured soil were 133-98-30 to 207-186-157 and its value in light yellowish soil 128-105-27 to 229-210-152 whereas in greenish soil RGB value ranged 152-122-52 to 189- 164-113. Correlation between digital value and soil pH values should be helpful in determination of soil pH of different type of soils. Ranges of soil pH and pH index values were 7.30-7.50 and 0.0070-0.0261, respectively in deep brown colour. Similarly, soil pH range varies from 6.80-7.04 and 5.58-6.58 in light yellowish and greenish colour respectively while their corresponding pH index values were 0.0071-0.0451 and 0.0084-0.0239. Thus soil pH range varies from 7.30-7.50, 6.80 -7.04 and 5.58-6.58 in deep brown colour, light yellowish colour and greenish colour respectively ACKNOWLEDGMENT Authors are thankful to Vinay Kumar and Dr. B.B. Mishra, University Prof.-cum-Chief Scientist, Department of Soil Science and Agricultural Chemistry, Bihar Agricultural University, Sabour, Bhagalpur, Bihar for his valuable suggestions during the research project work.

VII. FUTURE WORK

We will collect more number of soils in a particular region study and implement their feature extraction.We will handle the remote sensing Geographical Information System domain increase the assurability of this system.We hope comparative study of more number of soil samples and its characteristics it will increase the worth of this concept and our knowledge about this domain.

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