Table 2: Range and mean values of nutrients in analyzed soil.

Available micronutrient	Range	Mean	Limiting value	Deficient %	Marginal %	Sufficient %
O.C.	0.26-0.93%	0.57%	0.50-0.75	20	66	14
M	180-294 kg/ha	236.23	280-560	87	13	Nil
K	80-795 kg/ha	324.27	108-280	7	33	60
Cu	2.81-7.95 mg/kg	3.73	0.2	Nil	Nil	100
Zn	0.55-0.92 mg/kg	0.69	0.6	13	20	67

The pH was measured by 1:2 soil:$CaCl_2$ extract while the E.C. was measured by 1:2 soil: water extract. For the estimation of total organic carbon from soil, wet digestion tritrimetric method [Walkey and Black, 1934] was adopted.[5] Available N in the samples was estimated by alkaline permanganate method.[5] Available K includes both exchangeable and water soluble forms of the potassium present in the soil. The available K was determined in neutral normal ammonium acetate [1 N CH_3CooNa] extract of soil using flame photometer.[5] The available Cu and Zn in soil samples were extracted with DTPA [0.005 M DTPA+0.01 M $CaCl_2$+0.1 M triethanolamine, pH 7.3] as per method described by Lindsay and Norvell (1978) concentration of Cu and Zn in the DTPA extracts was determined using atomic absorption spectrophotometer. The correlation analysis of data was computed in relation to available major and micronutrients contents with different physico-chemical properties of the soils as suggested by Pearson's correlation coefficient(r) using following formula. (table-3)

Table 3: Relationship between soil parameters and nutrient content in the soils determined using correlation coefficient.

Property	Nitrogen	Potassium	Copper	Zinc
pH	-0.030	0.023	-0.100	0.028
EC	-0.540	0.252	-0.016	0.196
O.C.	0.478	0.828	0.256	0.520

$$r = \frac{n\sum X1Y1 - \sum X1\sum Y1}{\{[n\sum X1^2 - (\sum X1)^2][n\sum Y1^2 - (\sum Y1)^2]\}^{1/2}}$$

The soil fertility index and classification of available nutrients as low, medium and high was evaluated as follows: **(Table 4)**

Table 4: General Interpretation of soil properties

Parameter	*Interpretation*
pH	< 4.6 - extremely acidic 4.6-5.5-strongly acidic 5.6-6.5-moderate acidic 6.6-6.9-slightly acidic 7 –neutral 7.1-8.5-moderate alkaline > 8.5 –strongly alkaline
EC mmhos/cm	0-2- salt-free 4-8- slightly saline 8-15-moderately saline >15-highly saline
OC%	<0.5 –low 0.5-0.75-medium >0.75-high
Nitrogen Kg/ha	<280 – low 280-560-medium >560-high
Potassium Kg/ha	<108 –low 108-280-medium >280- high
Coppermg/kg Zinc mg/kg	0.2ppm-limiting value 0.6 ppm-limiting value

Fertility index = (NL X 1 + NM X 2 + NH X 3)/100

Where, NL, NM, and NH are number of samples in low, medium, and high classes of nutrient.(**Table-5**)

Table 5: Soil fertility index of nutrient content

Nutrient	Fertility Index
Organic carbon	0.39
Nitrogen	0.17
Potassium	0.38
Copper	0.45
Zinc	0.38

The fertility index is used for the recommendation of fertilizers and suitable crop selection.

3. Results and Discussion

Soil properties and available macro and micro nutrients are given in table-1 while the range and mean values of analyzed soil are given in the table-2. pH ranges from 7-8.Most of the samples were moderately neutral to alkaline in nature. Several nutrients are affected by soil pH. E.C. varies from 1.26 to 2.47 mmho/cm. Most of the soil samples under investigation fall in the category of normal soils.

Organic Carbon content varies from 0.26 to 0.93 in percentage. It shows great variation in O.C. levels. This is due to high temperature and oxidative nature of soils. Low level of organic carbon also decreases the availability of Nitrogen in the soils.

The Potassium content varies from 80.64 to 795.76 kg/ha. 60% samples have medium 108-280 kg/ha. While one sample was found to be deficient in the Potassium content.

Available Nitrogen content in the soil samples ranges from 181 to 294 kg/ha. About 86 % samples were found to be deficient. The lack of Nitrogen in the soils is due to low percentage of organic matter and cultivation of high yielding crops repeatedly.

Available Cu content in the soil varied from 2.81 to 7.95 mg/kg with mean value of 3.73 mg/kg. Available Zn content in the soil varied from 0.55 to 0.92 mg/kg with mean value of 0.62 mg/kg. From results the amount of Cu and Zn present in samples are in adequate amount.

Correlation study among pH, E.C., O.C. and nutrients:

Correlation analysis is given in table-3. The available Nitrogen shows positive correlation with organic carbon (r= 0.478) and negative correlation with pH (r= -0.030) and EC (r= -0.54).It shows that available N increased significantly with increase in organic carbon.

The available potassium shows positive correlation with pH (r= 0.023), EC (0.252) and O.C. (r= 0.828). The available K increases with increase in pH, EC, and OC of soil.

Copper content in soil sample shows negative correlation with pH (r=-0.100) while it shows positive correlation with EC (0.016) and OC (r= 0.256). The availability of Cu increases with increase in organic carbon and decreases with increase of pH level. Available Zn in the soil samples shows positive correlation with EC (r= 0.196), pH (r= 0.0.028), and OC (r= 0.520).

Soil Fertility Index

Soil fertility index were studied for evaluating soil fertility status for making judicious use of fertilizers. The soils were classified into different types of soil groups as deficient, medium and soils having sufficient amount of nutrient content. The fertility index is given in Table-5.The fertility index of Nitrogen is found to be poor (0.17),it is due to deficiency of Nitrogen in samples. The fertility index for Potassium IS 0.38, Copper is 0.45 and for Zinc it is 0.38.

4. Conclusion

The conclusions obtained from this study are:-

a) Correlation studies are well adopted for the the macro and micro-nutrients in soil samples and the conclusions drawn are:-
   1) Significant correlation of pH with Potassium and Zinc.
   2) Electrical conductivity shows good correlation with Potassium, Nitrogen and Zinc.

   Organic carbon shows significant correlation with Nitrogen, Potassium, Copper and Zinc.

b) Soil fertility studies were carried out and we can find out fertility status of soils for different plants and crops.

Present study concludes that statistical methods like correlation analysis can provide a scientific basis for controlling and monitoring agriculture soil fertility management.

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