

Studies on Soil Physico-chemical Parameters of Different Vegetable Crop Fields of Cachar District, Assam

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ABSTRACT

Soil characterization of four vegetable crop fields viz. Bhagpur, Gobindapur, Irangmara and Barjalenga of Cachar district, Assam were carried using standard procedures. Physico-chemical parameters of the soil of different sites studied were in the range of 0.65% to 1.48%, 17.08% to 23.88%, 10.9 to 14.78 (g/cm³), 0.22 to 0.37%, 0.02 to 0.08% and 0.47 to 0.72% for OC, MC, BD, TN, TP, and TK, respectively. The pH was found to be mildly acidic in nature. The value of conductivity revealed that all the sites are non-saline. The soil of Bhagpur, Gobindapur, Irangmara and Barjalenga comprised of different textural groups viz., silty clay, silty clay loam and clay loam, respectively. Correlation analysis was done to study the relationship between various physico-chemical parameters in soil.

Key words: Physico-chemical parameters, Vegetable crop fields, Correlation analysis, Nutrient status.

Introduction

Soil is a vital component made up of minerals, water, soil organic matter and air. It is an important natural resource that plants need for their nutritional, water and mineral requirements Shaikh and Bhosle (2013). It is a basic life support component of biosphere. Soil is comprised of soil horizons or layers of mineral constituents of varying thickness, which differ from the parent materials in their basic characteristics like, physico-chemical, morphological, and biological properties Sumithra *et al.* (2013); Manimegalai and Sukanya (2014). Soil acts as a nutrient reservoir required by crops but may not al-

ways provide the entire ideal nutrient requirement of the plant. The lives of all living entities are closely intertwined with soil for many purposes or needs and about 95% of food for humans is derived from the earth. Soil is safe cushion that protects the entire ecosystem from various pollutants in the environment by either filtering them or altering their nature. Sumithra *et al.* (2013). Soil texture and acidity play an important role in plant mineral uptake Mamun *et al.* (2011), Tripathi and Misra (2012). The base material from which a type of soil is formed influences the pH of the soil. Nutrient leaching caused by rainfall and their replacement by acidic elements influences soil pH Michael and Aguin (2010). It is essen-

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tial for soil scientists to study the soil parameters in terms of its physical and chemical aspects to identify nutritional deficiencies which impact crop growth and decide necessary soil amendments. It is good agricultural practice to study status of soil fertility of a zone and characterize the various nutritional strata. The macro-nutrients viz. nitrogen, phosphorous, potassium and sulphur play a crucial role in soil fertility and crop yields Singh and Mishra (2012). Soil physico-chemical properties are complex, non-linear, spatially, and temporally dynamic Rakesh *et al.* (2012). The aim of the present work is to study the physico-chemical properties of soil collected from different crop fields from four different sites of Cachar district, Assam.

Materials and Methods

Study area

Cachar district is situated in southernmost part of Assam. It is bounded on the north by Barail and Jayantia hill ranges, on the south by the state of Mizoram and on the east by Hailakandi and Karimganj district. The district lies between Longitude $92^{\circ} 24' E$ and $93^{\circ} 15' E$ and Latitude $24^{\circ} 22' N$ and $25^{\circ} 8' N$ are its co-ordinates with a geographical area 3,786 Sq. Km. The average annual rainfall is

more than 3,000 mm for the district. The climate is Tropical wet with humid summer and cool winter. The study was conducted in four different vegetable crop fields of Cachar district, Assam namely Bhagpur (Latitude- $N 24^{\circ} 45' 34.5''$; Longitude - $E 92^{\circ} 50' 23.7''$), Gobindapur (Latitude- $N 24^{\circ} 41' 19.5''$; Longitude - $E 92^{\circ} 44' 33.5''$), Irangmara (Latitude- $N 24^{\circ} 42' 20.4''$; Longitude - $E 92^{\circ} 42' 20.4''$) and Barjalenga (Latitude- $N 24^{\circ} 40' 43.4''$; Longitude - $E 92^{\circ} 43' 54.4''$) (Fig. 1). The vegetables grown were mainly cabbage, cauliflower, brinjal, tomato, beans, and turnip.

Sample collection

Soil samples were collected by standard procedures at a depth of 0-10 cm with the help of a soil corer. From each four sites five sub-sites were taken. Three soil samples were collected randomly from each five sub-site and pooled together to obtain a composite sample. The samples were dried in a room temperature and sieved to pass through a 2 mm mesh for further analysis.

Physico-chemical analysis of soil samples

Analysis of soil is carried out using standard procedures. Soil pH was measured by Electrometric method using Elico pH meter. Bulk density was es-

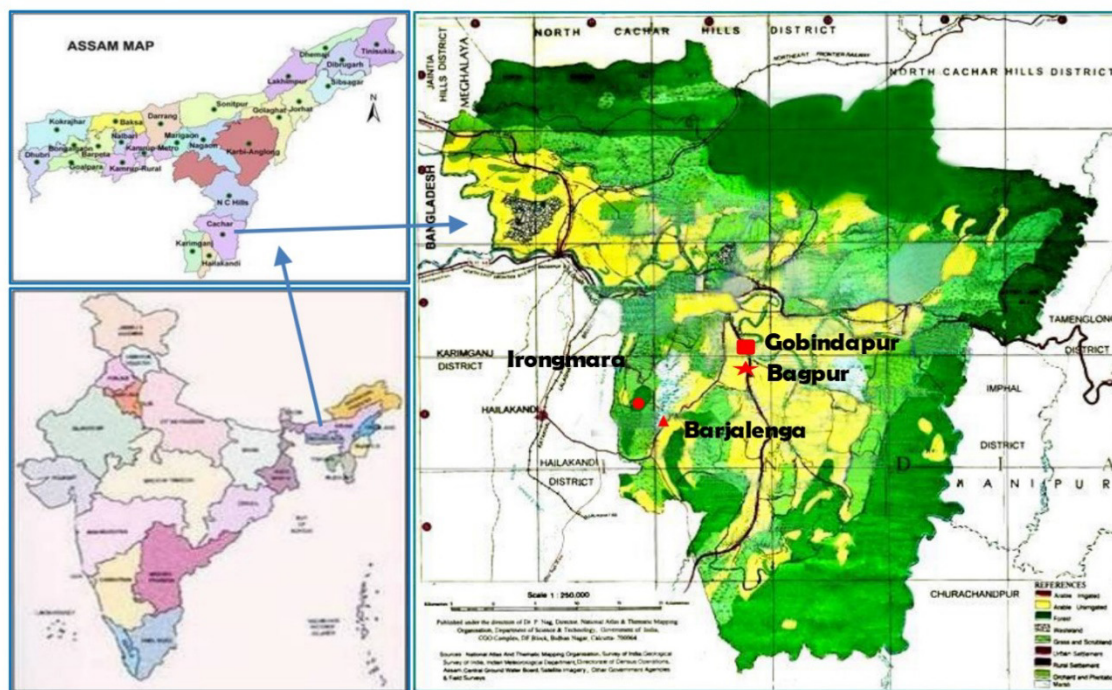


Fig. 1. Map of the study areas showing study sites location

timated by soil corer method Brady and Weil (2004). Conductivity of soil samples were measured using Systronic direct reading conductivity meter. Soil organic carbon was analyzed by Walkley and Black's rapid titration method Jackson (1958). Soil texture was estimated by Bouyoucos soil hydrometer method Allen (1989). Moisture content was determined by oven drying method (Soil Survey Standard Test Method). Total Nitrogen was determined by Micro-Kjeldahl method. Total Phosphorus was determined spectrophotometrically and total potassium was determined by flame photometer Jackson (1973).

Results and Discussion

Physico-chemical parameters of all the four sites are shown in **Table 1**. One-way ANOVA revealed that the differences in Moisture content, Bulk density, Organic carbon, Total nitrogen, phosphorus and potassium in the different study sites are statistically significant ($P = 0.00, 0.019, 0.003, 0.002, 0.001$ and 0.001 , respectively), whereas significant difference was not observed in pH and Conductivity ($P = 0.081$ & 0.123 , respectively). Significant differences among the different study sites were made by Tukey test and results are summarized in **Table 1**. Chemical analysis of collected soil samples shows pH value ranges from 5.64 to 6. Soil pH is one of the most important parameters which determines the availability of nutrients, microorganism's activity, and physical condition of soil. The highest pH was observed in Gobindapur and lowest in Bhagpur. The soil pH of all the crop fields was found to be mildly acidic in nature. The optimum range of pH required for crops

in the soil is in the range of 6.5 to 8.5 which is considered as neutral range for crops Ramachandra *et al.* (2012). Conductivity ranges from 0.16 to 0.38 (mS/cm) which indicates salt free and normal and good for agriculture. The value of conductivity was found to be highest in Bhagpur (0.38 mS/cm) from all the sites which may be due to excess use of fertilizer like P and K. Soil with conductivity below 0.4 mS/cm are considered as non-saline and soils above 0.8 (mS/cm) as severely saline (Hota *et al.* 2022). Moisture content is crucial for plant health. Low water level leads to plant stress. Moisture content ranges from 17.8% to 23.88 % highest in Barjalenga and lowest in Gobindapur. Bulk density ranges from 10.9 to 14.78 (g/cm^3). This could be due to differences in the soil texture, soil type and varying agricultural practices. Gathala *et al.* (2011), Benbi *et al.* (2012); Nath (2015). Organic fertilizer, green manure, animal manure, cover crop, crop residue contributes to the different sources of Organic Carbon in cultivation. Borkar, (2015); Meddich *et al.* (2022). Organic carbon of the soil is varied from 0.65 to 1.48 %. The site Barjalenga recorded highest value as compared to other three sites and Irangmara recorded minimum value. Organic carbon contributes to providing nutrients and water which ensures a positive physical condition to the plants. Total nitrogen of all the sites is measured and its value ranges from 0.22 to 0.37 % which is medium to high. Gobindapur site contain maximum value of total N and minimum in Irangmara. Phosphorous play a vital role in plant metabolism and energy transformation Rai *et al.* (2012); Neong *et al.* (2022). Concentration of phosphorous was recorded in a range of 0.02 to 0.08 % Highest was observed in Barjalenga

Table 1. Physico-chemical parameters of soil of different study sites (mean $\pm$ SD)

Parameters	Bhagpur	Gobindapur	Irangmara	Barjalenga	P value
pH	5.64 $\pm$ 0.38 ^a	6 $\pm$ 0.29 ^b	5.76 $\pm$ 0.44 ^{ab}	5.82 $\pm$ 0.04 ^c	$P = 0.081$
C (mS/cm)	0.38 $\pm$ 0.14 ^a	0.18 $\pm$ 0.13 ^b	0.16 $\pm$ 0.08 ^{cb}	0.23 $\pm$ 0.04 ^{abc}	$P = 0.123$
MC (%)	21.32 $\pm$ 1.46 ^a	17.08 $\pm$ 0.81 ^b	18.28 $\pm$ 2.21 ^b	23.88 $\pm$ 3.19 ^a	$P = 0.001$
BD (g/cm^3)	1.2. $\pm$ 0.22 ^a	1.27 $\pm$ 0.26 ^{ab}	1.48 $\pm$ 0.40 ^c	1.09 $\pm$ 0.36 ^{ab}	$P = 0.019$
OC (%)	1.1 $\pm$ 0.39 ^a	1 $\pm$ 0.21 ^{ab}	0.65 $\pm$ 0.18 ^b	1.48 $\pm$ 0.32 ^c	$P = 0.003$
T N (%)	0.27 $\pm$ 0.06 ^a	0.037 $\pm$ 0.09 ^b	0.22 $\pm$ 0.09 ^a	0.36 $\pm$ 0.01 ^c	$P = 0.002$
T P (%)	0.03 $\pm$ 0.01 ^a	0.02 $\pm$ 0.00 ^{ab}	0.03 $\pm$ 0.001 ^{ab}	0.08 $\pm$ 0.01 ^c	$P = 0.001$
T K (%)	0.72 $\pm$ 0.06 ^a	0.63 $\pm$ 0.07 ^b	0.47 $\pm$ 0.01 ^c	0.47 $\pm$ 0.04 ^c	$P = 0.001$
Soil texture	Silty clay	Silty clay loam	Silty clay loam	Clay loam	

Note: Values with different superscripts are significantly different from one another (at $p \leq 0.05$) as revealed by one-way ANOVA and Tukey test. C= Conductivity; MC= Moisture content; OC= Organic carbon; BD= Bulk density; TN=Total Nitrogen; TP=Total Phosphorous; TK=Total Potassium.

Table 2. Pearson's correlation coefficients between soil physico-chemical parameters

	pH	C	MC	BD	OC	TN	TP	TK
Ph	1							
C	-.495*	1						
MC	-.235	.380	1					
BD	-.097	-.319	-.657**	1				
OC	.227	.046	.361	-.688**	1			
TN	.057	.153	.128	-.278	.317	1		
TP	.022	-.054	.747**	-.564**	.572**	.176	1	
TK	-.024	.327	-.146	-.096	-.072	.181	-.571**	1

*Correlation is significant at the 0.05 level (2-tailed), **Correlation is significant at the 0.01 level (2-tailed).

and lowest in Gobindapur. Potassium plays an important role in water balance maintenance, protein synthesis in the plant physiology. Potassium concentration of all the sites ranges from 0.47 to 0.72 %. Maximum value was recorded in Bhagpur and minimum in two sites Irangmara and Barjalenga. The soil of study sites comprised of different textural groups viz., silty clay, silty clay loam and clay loam. Gobindapur and Irangmara have same soil texture i.e, silty clay loam and for Bhagpur silty clay and clay loam for Barjalenga Table 2. Study of soil physical and chemical parameters is important to soil scientists for understanding ideal growth of crops and the farm soils. Addis and Abebaw (2014); Neong, *et al.* (2022); Chetia *et al.* (2023). Physico-chemical parameters were correlated by Pearson's correlation coefficient and are shown in Table 3. Positive correlations were noticed for the parameters between MC and OC with TP. This shows that they are closely associated. Negative correlation was observed between pH with C, MC with BD, OC with TP, TP with TK and BD with OC and TP.

Conclusion

This study has provided a baseline information about soil nutritional status. Accordingly, the farmer can precisely work out his fertilizer requirement in a rational manner in order to optimize his crop output. The condition of the soil of all the study sites are slightly acidic and non-saline or salt-free.

Conflict of Interest : None

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