International Journal of Ecology and Environmental Sciences
www.ecologyjournal.in
ISSN: 2664-7133
Received: 30-09-2026, Accepted: 30-10-2026, Published: 14-11-2026
Volume 8, Issue 4, 2026, Page No. 285-288

Assessment of chemical properties of maize growing soils of Hoovina Hadagali taluk, Vijayanagara District

Manjunatha Bhanuvally [1], Sunitha N H[2], Sharanabasava[3*]
[1] Associate professor, Department of Soil Science, UAS, Raichur, AEEC, Huvina Hadagali, Karnataka, India
[2] Associate Professor, Department of Home Science, UAS, Raichur, AEEC, Huvina Hadagali, Karnataka, India
[3] Department of Soil Science, UAS, Raichur, Karnataka, India
Corresponding Author: Sharanabasava
DOI: https://doi.org/10.66856/ijees.2026.8.4.8143

Abstract
A case study was conducted to assess soil nutrient constraints in the intensive maize growing soils of Hoovina Hadagali Taluk, Vijayanagara District, Karnataka. A total of 60 soil samples were collected from five villages, comprising 30 surface (0-15 cm) and 30 subsurface (15-30 cm) samples. In surface soils, available nitrogen, P_2O_5 and K_2O ranged from 109.72 to 238.29, 11.42 to 22.84 and 140.68 to 401.08 kg ha^{-1}, respectively. The mean soil pH was 7.74 (neutral to slightly alkaline) the mean electrical conductivity was 0.18 dS m^{-1} and soil organic carbon ranged from 3.20 to 5.80 g kg^{-1}. In subsurface soils, available nitrogen, P_2O_5 and K_2O ranged from 78.71 to 207.28, 10.20 to 19.45 and 112.57 to 354.11 kg ha^{-1}, respectively. The mean soil pH was 7.88, the mean electrical conductivity was 0.29 dS m^{-1}, and soil organic carbon ranged from 1.90 to 4.50 g kg^{-1}. Available nitrogen, phosphorus, potassium and organic carbon decreased with increasing soil depth. The results showed that the available nitrogen and phosphorus status of the maize-growing area of Hoovina Hadagali Taluk was low to medium, while available potassium ranged from low to high. This may be attributed to continuous cultivation coupled with inadequate nutrient management, such as continuous use of chemical fertilizers and limited use of organic sources which has led to nutrient depletion and low maize yield. The study highlighting the importance of organic matter in enhancing soil fertility and crop yield.

Keywords: Soil available nutrients, major nutrients, soil organic carbon, maize, Vijayanagara

Introduction
Soil is the primary source of the essential macro and micronutrients required for plant growth and nutrient deficiencies adversely affect crop yield and quality. In many Indian soils, deficiencies of nitrogen in particular have become major constraints to crop productivity, stability and sustainability, a problem aggravated by the decline in soil organic matter. Successful maize cultivation depends on climate, soil fertility, irrigation and agronomic practices among which balanced nutrient management plays a crucial role. Nitrogen is vital for vegetative growth and the development of yield attributes. Phosphorus is essential for energy transfer, root development and grain formation. Potassium regulates plant water relations, improves tolerance to diseases and stress and enhances crop quality.
Under intensive cultivation, macronutrient deficiencies are increasing, causing nutrient imbalance and yield reduction. This highlights the need for periodic soil testing and site-specific nutrient management. Hoovina Hadagali taluk of Vijayanagara district, Karnataka, has a semi-arid climate and maize is cultivated over about 6000 ha. Maize productivity in the taluk remains low because of nutrient limitations and soil constraints. Assessing the fertility status of these soils is therefore essential for improving maize productivity and ensuring sustainable agriculture. Hence, the present study was undertaken to assess the chemical fertility status of maize-growing soils of the taluk at two depths.

Materials and Methods
The study was conducted in five villages of Hoovina Hadagali taluk, Vijayanagara district, Karnataka, namely Hoovina Hadagali, Vinobhanagara, Hiremallanakere, Basarahalli and Dasarahalli. The taluk was selected based on its extensive area under maize cultivation. Thirty farmers cultivating maize each with more than eight years of farming experience were randomly selected with the assistance of the Agricultural Extension Education Centre (AEEC), Hoovina Hadagali. The study area falls under the Northern Dry Zone (Agro-climatic Zone III) of Karnataka and is influenced by the Tungabhadra River. The soils are predominantly sandy loam with red soils being the major soil type. The region receives an average annual rainfall of 612 mm with temperatures ranging from 16 to 43 °C.
A total of 60 soil samples were collected from the selected farmers' fields at two different depths, comprising 30 surface soil samples (0-15 cm) and 30 subsurface soil samples (15-30 cm). The collected soil samples were air-dried, ground and passed through a 2 mm sieve before analysis for their chemical properties. Soil pH and electrical conductivity (EC) were measured in a 1:2.5 soil to water suspension following the procedure described by Jackson (1973) [2]. Soil organic carbon was estimated by the wet oxidation method of Walkley and Black (1934) [10]. Available nitrogen was determined by the alkaline potassium permanganate method (Subbiah and Asija, 1956) [8], available phosphorus by Olsen's method (Olsen *et al.*, 1954) [4] and available potassium by extraction with neutral normal ammonium acetate (Jackson, 1973) [2].

Results and Discussion
Soil pH
The pH of surface soils (0-15 cm) ranged from 7.38 to 8.05, with a mean of 7.74 (Table 1). The lowest value (7.38) was

recorded in Hoovina Hadagali village (V1S2), while the highest (8.05) was observed in Vinobhanagara village (V2S1), indicating neutral to slightly alkaline soil reaction. In subsurface soils (15-30 cm), pH ranged from 7.48 to 8.21 with a mean of 7.88. The lowest value (7.48) was recorded in V1S2, whereas the highest (8.21) was observed in V2S1, indicating neutral to alkaline soil reaction. Overall, soil pH increased with increasing depth which might be attributed to the downward movement and accumulation of exchangeable bases in the subsurface layer.

Soluble salt content (electrical conductivity)

The EC of surface soils ranged from 0.12 to 0.26 dS m^{-1} with a mean of 0.18 dS m^{-1} (Table 1). The highest value (0.26 dS m^{-1}) was recorded in Basarahalli village (V4S4) and the lowest (0.12 dS m^{-1}) in Dasarahalli village (V5S7). In subsurface soils, EC ranged from 0.17 to 0.43 dS m^{-1} with a mean of 0.29 dS m^{-1}. The highest value (0.43 dS m^{-1}) was recorded in Basarahalli village (V4S4) and the lowest (0.17 dS m^{-1}) in Hiremallanakere village (V3S4). The EC of both depths was well within the normal range (<1 d m^{-1}), indicating that the soils were non-saline. The higher EC in the subsurface layer may be due to leaching of soluble salts from the upper layers by rainfall or irrigation and their accumulation at lower depths. Similar results and explanations were reported by Kiran (2008) and Sathish *et al*. (2018) [3, 6].

Table 1: Status of soil reaction (pH) and soluble salt content (EC) in selected soils of the study area

Sl. No.	Village Name	Sample code	pH (1:2.5 soil: water)		EC (dS m^{-1})	
			Surface	Subsurface	Surface	Subsurface
1	Huvina Hadagali	V_1S_1	7.88	8.00	0.20	0.32
2		V_1S_2	7.38	7.48	0.18	0.28
3		V_1S_3	8.00	8.20	0.22	0.36
4		V_1S_4	7.52	7.74	0.17	0.26
5		V_1S_5	7.51	7.68	0.16	0.24
6	Vinobhanagara	V_2S_1	8.05	8.21	0.14	0.21
7		V_2S_2	7.93	8.15	0.19	0.31
8		V_2S_3	7.50	7.65	0.13	0.17
9		V_2S_4	7.85	7.97	0.21	0.34
10	Hiremallanakere	V_3S_1	7.98	8.19	0.19	0.30
11		V_3S_2	7.77	7.89	0.23	0.38
12		V_3S_3	7.62	7.75	0.15	0.22
13		V_3S_4	7.86	7.99	0.13	0.17
14		V_3S_5	7.75	7.82	0.24	0.41
15	Basarahalli	V_4S_1	7.68	7.81	0.19	0.30
16		V_4S_2	7.42	7.61	0.15	0.22
17		V_4S_3	7.85	7.97	0.16	0.24
18		V_4S_4	7.81	7.90	0.26	0.43
19	Dasarahalli	V_5S_1	7.49	7.64	0.18	0.28
20		V_5S_2	7.46	7.62	0.21	0.34
21		V_5S_3	7.82	7.96	0.18	0.28
22		V_5S_4	7.89	8.02	0.25	0.42
23		V_5S_5	7.81	7.90	0.23	0.38
24		V_5S_6	7.91	8.06	0.18	0.28
25		V_5S_7	7.97	8.18	0.12	0.22
26		V_5S_8	7.39	7.56	0.16	0.24
27		V_5S_9	7.65	7.76	0.19	0.30
28		V_5S_{10}	7.92	8.12	0.22	0.36
29		V_5S_{11}	7.66	7.79	0.23	0.38
30		V_5S_{12}	7.75	7.82	0.20	0.32
Lowest			7.38	7.48	0.12	0.17
Highest			8.05	8.21	0.26	0.43
Mean			7.74	7.88	0.18	0.29

Soil organic carbon

Soil organic carbon content in surface soils ranged from 3.20 to 5.80 g kg^{-1} with a mean of 4.75 g kg^{-1} (Table 2). The lowest value was recorded in Vinobhanagara (V2S1), while the highest was observed in Hiremallanakere (V3S5). In subsurface soils, it ranged from 1.90 to 4.50 g kg^{-1} with a mean of 3.40 g kg^{-1}, following a similar trend. Overall, organic carbon content was higher in surface soils and decreased with increasing soil depth which might be attributed to the continuous addition and decomposition of crop residues and plant litter in the surface layer. Similar findings were reported by Rajesh *et al*. (2021) [5].

Available nitrogen

Available nitrogen in surface soils ranged from 109.72 to 238.29 kg ha^{-1} with a mean of 155.08 kg ha^{-1} (Table 2). The lowest value was recorded in Dasarahalli (V5S10), while the highest was observed in Hiremallanakere (V3S5). In subsurface soils, it ranged from 78.71 to 207.28 kg ha^{-1} with a mean of 124.07 kg ha^{-1}, following a similar trend. Overall, available nitrogen status ranged from low to medium. Hiremallanakere (V3S5) which recorded the highest organic carbon content also showed the highest available nitrogen at both depths, indicating a positive association between soil organic carbon and nitrogen availability. The lower nitrogen content in subsurface soils might be attributed to the reduced accumulation of organic matter at greater soil depths.

Table 2: Status of organic carbon and available nitrogen in selected soils of the study area

Sl. No.	Village Name	Sample code	Organic Carbon (g kg^{-1})		Available Nitrogen (kg ha^{-1})	
			Surface	Subsurface	Surface	Subsurface
1	Huvina Hadagali	V_1S_1	4.10	2.80	137.94	106.93
2		V_1S_2	5.00	3.70	156.76	125.75
3		V_1S_3	3.50	2.20	122.26	91.25
4		V_1S_4	5.30	4.00	173.75	142.74
5		V_1S_5	5.41	4.11	173.81	142.80
6	Vinobhanagara	V_2S_1	3.20	1.90	125.41	94.40
7		V_2S_2	4.00	2.70	110.01	79.00
8		V_2S_3	5.32	4.02	178.14	147.13
9		V_2S_4	4.60	3.30	141.08	110.07
10	Hiremallanakere	V_3S_1	3.70	2.40	119.83	88.82
11		V_3S_2	4.90	3.60	151.20	120.19
12		V_3S_3	5.20	3.90	173.25	142.24
13		V_3S_4	4.50	3.20	139.05	108.04
14		V_3S_5	5.80	4.50	238.29	207.28
15	Basarahalli	V_4S_1	5.00	3.70	164.92	133.91
16		V_4S_2	5.55	4.25	194.22	163.21
17		V_4S_3	4.60	3.30	144.21	113.2
18		V_4S_4	4.72	3.42	149.40	118.39
19	Dasarahalli	V_5S_1	5.52	4.22	180.96	149.95
20		V_5S_2	5.63	4.33	184.23	153.22
21		V_5S_3	4.64	3.34	147.35	116.34
22		V_5S_4	4.30	3.00	136.16	105.15
23		V_5S_5	4.84	3.54	150.48	119.47
24		V_5S_6	4.20	2.90	130.96	99.95
25		V_5S_7	3.90	2.60	119.12	88.11
26		V_5S_8	5.70	4.40	203.11	172.1
27		V_5S_9	5.12	3.82	169.91	138.9
28		V_5S_{10}	4.10	2.80	109.72	78.71
29		V_5S_{11}	5.10	3.80	168.60	137.59
30		V_5S_{12}	5.06	3.76	158.25	127.24
Lowest			3.20	1.90	109.72	78.71
Highest			5.80	4.50	238.29	207.28
Mean			4.75	3.40	155.08	124.07

Available phosphorus

Available phosphorus in surface soils ranged from 11.42 to 22.84 kg ha^{-1} with a mean of 18.27 kg ha^{-1} (Table 3). The lowest value was recorded in Basarahalli (V4S3) and Hiremallanakere (V3S5), while the highest was observed in Hoovina Hadagali (V1S4). In subsurface soils, it ranged from 10.20 to 19.45 kg ha^{-1} with a mean of 14.66 kg ha^{-1}. The lowest value was recorded in Basarahalli (V4S3), whereas the highest was observed in Dasarahalli (V5S7) and Hoovina Hadagali (V1S4). Overall, available phosphorus status ranged from low to medium and decreased with increasing soil depth. This might be attributed to the surface application of phosphorus fertilizers, its limited mobility in soil and the contribution of organic matter to phosphorus availability (Verma, 2002) [9].

Table 3: Status of available phosphorus and available potassium in selected soils of the study area

Sl. No.	Village Name	Sample code	Available P_2O_5 (kg ha^{-1})		Available K_2O (kg ha^{-1})	
			Surface	Subsurface	Surface	Subsurface
1	Huvina Hadagali	V_1S_1	18.42	13.22	204.97	166.46
2		V_1S_2	19.84	16.27	247.42	211.80
3		V_1S_3	18.87	15.69	222.78	186.92
4		V_1S_4	22.84	19.45	198.25	137.32
5		V_1S_5	20.19	16.65	386.97	348.89
6	Vinobhanagara	V_2S_1	21.36	19.11	242.38	209.56
7		V_2S_2	19.05	16.23	257.95	229..44
8		V_2S_3	18.92	15.90	209.34	179.10
9		V_2S_4	17.62	12.70	401.08	354.11
10	Hiremallanakere	V_3S_1	18.42	13.94	208.22	177.53
11		V_3S_2	16.81	11.80	217.85	180.56
12		V_3S_3	16.02	11.59	231.63	188.28
13		V_3S_4	18.74	15.29	156.03	119.96
14		V_3S_5	11.42	10.20	345.42	308.46
15	Basarahalli	V_4S_1	15.72	11.59	238.46	204.97

16		V_4S_2	14.92	10.63	160.17	136.43
17		V_4S_3	11.42	10.20	140.68	112.57
18		V_4S_4	17.05	12.53	203.29	153.56
19	Dasarahalli	V_5S_1	18.75	15.62	248.20	213.36
20		V_5S_2	17.82	12.90	232.08	194.70
21		V_5S_3	18.42	14.76	295.62	236.22
22		V_5S_4	20.21	17.07	328.4	300.32
23		V_5S_5	18.31	13.28	357.18	319.56
24		V_5S_6	21.02	18.25	325.10	295.56
25		V_5S_7	22.84	19.45	363.34	340.23
26		V_5S_8	21.05	18.45	313.72	293.96
27		V_5S_9	18.15	13.22	213.04	179.21
28		V_5S_{10}	17.23	12.63	310.97	272.91
29		V_5S_{11}	16.23	11.59	206.65	170.59
30		V_5S_{12}	18.49	15.20	227.04	186.92
Lowest			11.42	10.20	140.68	112.57
Highest			22.84	19.45	401.08	354.11
Mean			18.27	14.66	256.47	216.41

Available potassium

Available K_2O in surface soils ranged from 140.68 to 401.08 kg ha^{-1} with a mean of 256.47 kg ha^{-1} (**Table 3**). The lowest value was recorded in Basarahalli (V4S3), while the highest was observed in Vinobhanagara (V2S4). In subsurface soils, it ranged from 112.57 to 354.11 kg ha^{-1} with a mean of 216.41 kg ha^{-1}, following a similar trend. Overall, available K_2O status ranged from low to high and decreased with increasing soil depth. This might be attributed to the weathering of K-bearing minerals, release of potassium from organic residues, limited leaching due to low rainfall and the application of potassic fertilizers (Srinivasan *et al*., 2013 [7]; Abdelrahman *et al*., 2016).

Conclusion

The maize-growing soils of Hoovina Hadagali taluk were neutral to alkaline with pH increasing with depth. Electrical conductivity was within the normal range, indicating no salinity problem. Soil organic carbon, available nitrogen, phosphorus and potassium decreased with increasing soil depth. Nitrogen and phosphorus status ranged from low to medium while potassium ranged from low to high. These findings highlight the need for soil test based balanced fertilization and regular application of organic manures to improve soil fertility and sustain maize productivity.

References

1. Abdelrahman N, Natarajan A, Srinivasamurthy CA, Hegde R. Estimating soil fertility status in physically degraded land using GIS and remote sensing techniques in Chamarajanagar district, Karnataka, India. Egyptian Journal of Remote Sensing and Space Sciences,2016:19(1):95–108.
2. Jackson ML. Soil Chemical Analysis. Oxford IBH Publishing House, Bombay,1973: p.38.
3. Kiran KM. Behaviour of potassium in soils under different land use systems,2008.
4. Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. USDA Circular,1954: p.939.
5. Rajesh NL, Satishkumar U, Wali VB, Basavaraj K, Rudramurthy HV, Desai BK. Variability in soil properties influencing pigeonpea (*Cajanus cajan* L.) yield, a multivariate statistical analysis. Research,2021:10(944):44.
6. Sathish A, Ramachandrappa BK, Devaraja K, Savitha MS, Gowda MN, Prashanth KM. Assessment of spatial variability in fertility status and nutrient recommendation in Alanatha Cluster Villages, Ramanagara District, Karnataka using GIS. Journal of the Indian Society of Soil Science,2018:66(2):149–157.
7. Srinivasan R, Natarajan A, Anil Kumar KS, Kalaivanan D. Distribution of available macro and micronutrients in cashew growing soils of Dakshina Kannada District of Coastal Karnataka. Madras Agricultural Journal,2013:100(1–3):113–117.
8. Subbaiah BY, Asija GL. A rapid procedure for the estimation of available nitrogen in soils. Current Science,1956:25:259–260.
9. Verma S. Studies on long term effects of chemical fertilizers and amendments on phosphorus dynamics and its budgeting in wet temperate zone soils of Western Himalayas. M.Sc. Thesis, C. S. K. Himachal Pradesh Krishi Vishvavidyalaya, Palampur, India,2002.
10. Walkley A, Black CA. An estimation method for determining soil organic matter and a proposed modification of the chromic acid titration method. Soil Science,1934:37(1):29–38.