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Physical and chemical properties of pomegranate growing soils of Challakere taluk, Karnataka

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Abstract

A study was carried out to assess the fertility status of soils under pomegranate orchards of Challakere taluk of Chitradurga district, Karnataka during the year 2023-24. Soil samples were collected at two depths (0-20 and 20-40 cm) from different pomegranate growing orchards across Challakere taluk. The soil samples were analysed for various soil fertility parameters. The results indicated that at 0-20 cm depth, soil reaction was found to be slightly acidic to alkali (5.90 to 9.20), electrical conductivity (EC) ranged from 0.45 to 3.50 dS m⁻¹ and soil organic carbon (SOC) was low to medium in these soils and ranged between 1.50 to 7.20 g kg⁻¹. At 20-40 cm depth, soil reaction was found to be slightly acidic to alkali, EC varied from 0.41 to 2.80 dS m⁻¹ and SOC was low in status. The soil texture varied from sandy to sandy clay and the sand content in surface soil ranged from 41.80-86.30 per cent and in subsurface it was between 40.00 to 85.70 per cent whereas the clay content ranged between 6.10 to 39.10 per cent in surface and 6.61 to 39.70 per cent in subsurface. Bulk density ranged between 1.31 to 1.48 Mg m⁻³ in surface and 1.37 to 1.53 Mg m⁻³.

Keywords: Pomegranate growing soils, fertility status, soil analysis

1. Introduction

Pomegranate (*Punica granatum* L.) is an important fruit crop in arid and semiarid regions of the world. Pomegranate is a light-loving plant and reacts negatively to excessive shading. However, direct sunlight and considerable heating often have harmful effects on fruits, leading to sunburns. The optimal conditions for pomegranate cultivation include annual 18-55 cm precipitation and mild winters. However, the best quality fruits are produced in arid regions with long, hot, dry summers. Good-quality pomegranate fruits are produced in the Deccan Plateau between 270 and 900 m altitudes above mean sea level. It is well known that arid regions have vast potential for intensive cultivation and quality fruit production with assured irrigation. It can easily withstand temperatures up to 45-48 °C in combination with dry, hot winds. Its cultivation in India spans more than 2.78 lakh hectares, with Maharashtra leading national production. They are cultivated across three main flowering seasons: Ambe bahar, Mirg bahar and Hasta bahar, ensuring continuous production throughout the year under suitable climatic conditions. Pomegranate cultivation provides higher cash incomes per unit of land compared to cereals and supports human health, environmental quality, and aesthetic value, making it a valuable crop in agricultural and nutritional contexts.

India is one of the leading countries in pomegranate acreage and production worldwide. India is one of the largest producers of pomegranate in the world. During 2020-21, pomegranate was cultivated over 2.78 lakh ha with an annual production of 31.87 lakh MT and productivity of 11.46 tons ha⁻¹ in India (Annon, 2021). At present, Maharashtra is the leading state in total area under pomegranate in the country. Other major pomegranate-growing states are Karnataka, Gujarat and Andhra Pradesh. In recent years, pomegranate cultivation has also been started in Rajasthan, Orissa, Chhattisgarh, Uttarakhand and Madhya Pradesh on a small scale.

Karnataka stands as the second largest pomegranate-producing state in the country with an area of 27,693 ha, production of about 3.02 lakh tons and productivity of 10.92 tons per hectare. The major producing districts are Chitradurga, Vijayapura, Tumkuru, Dharwad, Bagalkote and Koppal. In the Chitradurga district of Karnataka, pomegranate is being grown on a commercial

scale. The area under pomegranate in the Chitradurga district is 4,629 ha as per 2021-22 data. The Challakere taluk consists of a 1.384 ha area with a production of 1.38 thousand tons and a productivity of around 10.92 tons ha⁻¹.

2. Material and Methods

The present study was carried out to characterize the pomegranate-growing soils of Challakere taluk, Chitradurga district, Karnataka. The soil samples were collected from major pomegranate-growing soils of Challakere taluk, which include four hoblis viz., Challakere, Nayakanahatti, Parashurampura and Thalaku.

2.1 General description of the study area

The study was conducted in Challakere taluk of Chitradurga district, which comes under Agro-climatic zone IV of Karnataka, i.e., Central Dry Zone of Karnataka. The study area has semiarid climatic conditions. The Challakere taluk is located between latitudes 14° 04' 17.80" N and 14° 37' 26.8" and east longitude 76° 27' 15.1 and 77° 0' 31.8" E and it received actual rainfall of 327 mm (2023) as against its average rainfall of 485 mm and its elevation from mean sea level is 585 m. The taluk has a total area of 2075 km². It is the largest taluk of the Chitradurga district. The district receives scanty and unevenly distributed rainfall and has shallow and poor soils. The Challakere taluk recorded an annual monthly maximum mean temperature of 34.42 °C and a minimum of 17.44 °C.

2.1.1 Geology of Study Area

The geology of Chitradurga district in Karnataka is characterized by its ancient Precambrian rock formations, predominantly belonging to the Dharwar Craton. This craton features a variety of metamorphic and igneous rocks, including granites, gneisses, and schists. These rocks are notable for their age, with some dating back over 2.5 billion years. The district's geological structure is marked by a series of complex folds, faults, and fractures, which contribute to its varied topography. Economically, Chitradurga is significant for its mineral resources, particularly iron ore, manganese, and bauxite, which have historically supported mining activities. The region also

exhibits a range of soil types, including red soils that are well-suited for agriculture. Mineral resources found here are Iron ore, Manganese ore, Limestone ore and also non-metallic minerals like Kyanite, Feldspathoids, Fuchsite, quartzite and many more.

2.2 Collection and preparation of soil samples

For the study, one hundred soil samples were collected from two depths, i.e., 0-20 and 20-40 cm. Soil samples were collected from major pomegranate-growing areas of Challakere taluk, Chitradurga district. The collected soil samples were processed for further analysis (dried under shade, powdered by using a wooden pestle and mortar, and passed through a 2 mm sieve). The 2 mm sieved air-dried samples were stored in polythene bags for analysis.

2.3 Methods of soil sample analysis for physical and chemical properties of soil

2.3.1 Particle size distribution analysis

The relative proportion of sand, silt and clay particles present in the soil sample was determined by the international pipette method using sodium hexametaphosphate as a dispersing agent (Piper, 1966) [13]. The bulk density of soil was determined by a field moist method using core samplers. The core samples of known volume were used to collect the soil core from moist soil. The bulk density was calculated by dividing the oven-dry weight of soil by the corresponding volume of core samplers (Black, 1965) [9]. The pH of soils was determined in 1:2.5 soil water suspensions, potentiometrically using a pH meter (Jackson, 1973) [11]. Electrical conductivity (EC) was determined in the soil water supernatant solution (1:2) by using a conductivity meter (Jackson, 1973) [11], after pH estimation. The results were expressed as of dS m⁻¹ at 25 °C. Organic carbon was estimated by Walkley and Black's (1934) [18] wet-oxidation method. In this method, soil was oxidized using a known excess of 1 N potassium dichromate in the presence of concentrated sulphuric acid, using the heat of dilution of sulphuric acid. The excess of K₂Cr₂O₇ (Potassium di-chromate) not reduced by organic matter was determined by titration with standard ferrous ammonium sulfate in the presence of a ferroin indicator.

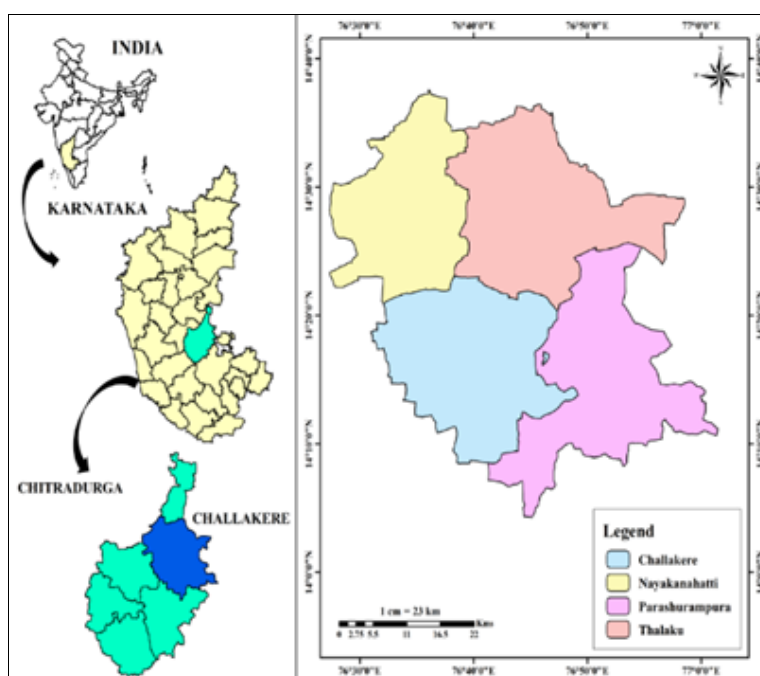


Fig 1: Map of the Study area

3. Results

3.1 Physical properties of soil under pomegranate growing soils of Challakere taluk

3.1.1 Texture and Bulk density (BD)

Results presented in Table 1 indicates, texture (Sand, silt, Clay) and bulk density (BD) of samples in g m^{-3} , from pomegranate orchards of Challakere, Parashurampura, Nayakanahatti and Thalaku Hobli of Challakere taluk at two different depths.

The results from Challakere hobli indicated that, for the top layer (0-20 cm) the mean percentages of sand, silt and clay were 58.85 ± 7.61 per cent, 14.30 ± 3.97 per cent and 26.83 ± 6.76 per cent respectively. This suggests that sand predominates, designating the texture in many samples as sandy clay loam (scl). The sand content ranged between 45.11 percent to 67.77 percent, 9.32 per cent to 22.42 per cent for silt and 17.54 per cent to 39.10 per cent for clay. For the subsurface, the mean percentage of sand, silt and clay were 58.16 ± 7.92 per cent, 14.51 ± 4.01 per cent, and 27.32 ± 7.13 per cent respectively. The bulk density for surface soil varied from 1.35 to 1.45 Mg m^{-3} with a mean value of $1.39 \pm 0.02 \text{ Mg m}^{-3}$ and for the subsurface, it ranged from 1.38 to 1.51 Mg m^{-3} with a mean value of $1.43 \pm 0.03 \text{ Mg m}^{-3}$.

The sample particle size distribution in Parashurampura indicated the range of textures from sandy loam (sl) to clay (cl). For the top 0-20 cm in depth, the mean percentages of sand, silt and clay were 60.70 ± 9.27 per cent, 14.29 ± 4.25 per cent and 25.01 ± 8.07 per cent respectively. The mean values were slightly lower for the 20-40 cm depth, with 59.59 ± 10.07 per cent sand, 15.01 ± 4.20 per cent silt and 25.41 ± 8.30 per cent clay. The analyzed samples for sand content ranged between 40.00 percent to 75.73 percent, silt content was 7.60 percent to 26.45 percent, and clay content was 12.15 percent to 39.28 percent. The bulk density for

surface soil varied from 1.31 to 1.45 Mg m^{-3} with a mean value of $1.40 \pm 0.03 \text{ Mg m}^{-3}$ and for subsurface, it ranged from 1.39 to 1.49 Mg m^{-3} with a mean value of $1.44 \pm 0.02 \text{ Mg m}^{-3}$.

The results from Nayakanahatti indicated that, in two-depth intervals, the bulk density (BD) and particle size distribution of soil samples from pomegranate orchards of Nayakanahatti hobli, Challakere taluk, was found to be varied in both surface and subsurface. The composition of the top 0-20 cm layer with a mean value of 63.80 ± 4.53 per cent sand, 15.99 ± 3.81 per cent silt and 20.21 ± 3.95 per cent clay, with a slightly lower sand content in the subsurface with a mean value of 62.29 ± 5.96 per cent, 16.41 ± 4.01 per cent silt and 21.30 ± 5.58 percent clay in the 20-40 cm layer. A predominance of sandy loam and sandy clay loam textures was indicated by the sand content, which varied from 58.00 per cent to 76.28 per cent in the surface layer and from 49.85 per cent to 76.73 per cent in the deeper layer. The bulk density for surface soil varied from 1.34 to 1.44 Mg m^{-3} with a mean value of $1.39 \pm 0.02 \text{ Mg m}^{-3}$ and for subsurface, it ranged from 1.37 to 1.47 Mg m^{-3} with a mean value of $1.42 \pm 0.02 \text{ Mg m}^{-3}$.

The data from Thalaku indicated that, in two-depth intervals, the bulk density (BD) and particle size distribution of soil samples from pomegranate orchards in Thalaku hobli, Challakere taluk was found to be varied. The composition of the top 0-20 cm layer with a mean value of 67.29 ± 7.76 per cent sand, 11.96 ± 2.98 per cent silt and 20.75 ± 5.93 per cent clay, with a slightly lower sand content in the subsurface with a mean value of 65.65 ± 7.56 per cent, 12.85 ± 2.69 percent silt and 21.50 ± 6.18 percent clay in the 20-40 cm layer. The bulk density for surface soil varied from 1.34 to 1.48 Mg m^{-3} with a mean value of $1.40 \pm 0.03 \text{ Mg m}^{-3}$ and for subsurface, it ranged from 1.39 to 1.53 Mg m^{-3} with a mean value of $1.44 \pm 0.03 \text{ Mg m}^{-3}$.

Table 1: Texture and bulk density of pomegranate growing soils of Challakere taluk

Hobli	Parameter	Depth (cm)	Sand (%)	Silt (%)	Clay (%)	BD (Mg m^{-3})
Challakere	Range	0-20	45.11-67.77	9.32-22.42	17.54-39.10	1.35-1.45
	Mean	0-20	58.85 ± 7.61	14.30 ± 3.97	26.83 ± 6.76	1.39 ± 0.02
	Range	20-40	42.34-67.57	10.04-23.49	16.69-39.70	1.38-1.51
	Mean	20-40	58.16 ± 7.92	14.51 ± 4.01	27.32 ± 7.13	1.43 ± 0.03
Parashurampura	Range	0-20	41.80-75.63	7.60-24.80	12.15-39.10	1.31-1.45
	Mean	0-20	60.70 ± 9.27	14.29 ± 4.25	25.01 ± 8.07	1.40 ± 0.03
	Range	20-40	40.00-75.73	9.10-26.45	13.89-39.28	1.39-1.49
	Mean	20-40	59.59 ± 10.07	15.01 ± 4.20	25.41 ± 8.30	1.44 ± 0.02
Nayakanahatti	Range	0-20	58.00-76.28	11.34-25.79	12.11-29.36	1.34-1.44
	Mean	0-20	63.80 ± 4.53	15.99 ± 3.81	20.21 ± 3.95	1.39 ± 0.02
	Range	20-40	49.85-76.73	11.43-26.24	11.84-36.88	1.37-1.47
	Mean	20-40	62.29 ± 5.96	16.41 ± 4.01	21.30 ± 5.58	1.42 ± 0.01
Thalaku	Range	0-20	60.34-86.30	4.51-16.79	6.10-25.67	1.34-1.48
	Mean	0-20	67.29 ± 7.76	11.96 ± 2.98	20.75 ± 5.93	1.41 ± 0.03
	Range	20-40	56.18-85.70	6.21-16.54	6.61-28.61	1.39-1.53
	Mean	20-40	65.65 ± 7.56	12.85 ± 2.69	21.50 ± 6.18	1.44 ± 0.03

3.2 Chemical properties of soil under pomegranate growing soils of challakere taluk

Results presented in Table 2 indicates the chemical properties (pH, EC and organic carbon) of soil samples collected from pomegranate orchards in Challakere, Parashurampura, Nayakanahatti and Thalaku hobli of Challakere taluk.

Soil pH, electrical conductivity (EC), and soil organic carbon (SOC) results were presented for Challakere hobli i.e., for 0-20 cm and 20-40 cm depth. The pH values ranged from 7.20 to 8.20 with a mean value of 7.80 ± 0.26 in the 0-20 cm depth and 7.85 ± 0.29 in the 20-40 cm depth. The EC values ranged from 0.63 to 3.5 dS m^{-1} , with a mean of $1.80 \pm 0.63 \text{ dS m}^{-1}$ in the 0-20 cm

depth and $1.35 \pm 0.53 \text{ dS m}^{-1}$ in the 20-40 cm depth. The EC values were higher in the surface layer, indicating the presence of soluble salts. However, the EC levels were not high enough to cause salinity problems for pomegranate growth. The SOC values ranged from 3.30 to 5.70 g kg^{-1} with a mean of $4.41 \pm 0.72 \text{ g kg}^{-1}$ in the 0-20 cm depth and the mean value of $2.23 \pm 0.92 \text{ g kg}^{-1}$ in the 20-40 cm depth.

The data from Parashurampura revealed that, for soil pH, electrical conductivity (EC) and soil organic carbon (OC) at two depths i.e., 0-20 cm and 20-40 cm for Parashurampura hobli. The pH values recorded in the study area indicating a predominantly alkaline soil environment. The mean pH value for the top layer

(0-20 cm) was 7.88 ± 2.31 , while the subsoil (20-40 cm) had a mean pH value of 7.77 ± 0.36 . The observed EC value ranged from 0.45 to 3.48 dS m⁻¹, with a mean value of 1.85 ± 0.75 dS m⁻¹ for the 0-20 cm depth and 1.40 ± 0.56 dS m⁻¹ mean value for the 20-40 cm depth. Soil organic carbon content is a vital indicator of soil fertility and soil health. The SOC values in the study ranged from 0.90 to 6.30 g kg⁻¹, with a mean of 4.56 ± 1.08 g kg⁻¹ for the top layer and 2.13 ± 1.10 g kg⁻¹ for the subsoil.

Results from Nayakanahatti indicated that soil pH, electrical conductivity (EC), and organic carbon (OC) content at two depths i.e., 0-20 cm and 20-40 cm for Nayakanahatti hobli. The chemical properties of soils in pomegranate orchards of Nayakanahatti hobli in Challakere taluk were analyzed for 29 samples. The soil pH ranged from 6.90 to 8.73 with a mean value of 7.93 ± 0.32 in the 0-20 cm depth and 7.87 ± 0.38 in the

20-40 cm depth. The EC values with a mean value of 1.80 ± 0.57 dS m⁻¹ in the surface soil and 1.46 ± 0.49 dS m⁻¹ in the subsurface soil. The organic carbon content ranged greatly with mean value of 4.63 ± 1.24 g kg⁻¹ in the 0-20 cm layer and 2.21 ± 0.99 g kg⁻¹ in the 20-40 cm layer.

The provided data presents the chemical properties of soils collected from pomegranate orchards in Thalaku hobli, Challakere Taluk. The pH values ranged from 5.74 to 9.3, with a mean value of 7.81 ± 0.54 for the 0-20 cm depth and 7.92 ± 0.56 for the 20-40 cm depth. The EC values ranged from 0.41 to 3.39 dS m⁻¹ with a mean value of 1.67 ± 0.90 dS m⁻¹ for the 0-20 cm depth and 1.18 ± 0.60 dS m⁻¹ for the 20-40 cm depth. The SOC values ranged from 0.90 to 6.00 g kg⁻¹, with a mean value of 4.32 ± 0.84 g kg⁻¹ for the 0-20 cm depth and 2.23 ± 1.09 g kg⁻¹ for the 20-40 cm depth.

Table 2: Chemical properties (pH, EC and SOC) pomegranate growing soils of Challakere taluk

Hobli	Parameter	Depth (cm)	pH	EC (dS m ⁻¹ at 25 °C)	SOC (g kg ⁻¹)
Challakere	Range	0-20	7.20-8.20	0.63-3.50	3.30-5.70
	Mean	0-20	7.80±0.26	1.80±0.63	4.41±0.72
	Range	20-40	7.34-8.40	0.42-2.20	0.90-3.60
	Mean	20-40	7.85±0.29	1.35±0.53	2.23±0.92
Parasurampura	Range	0-20	7.43-8.30	0.45-3.48	1.50-6.30
	Mean	0-20	7.88±2.31	1.85±0.75	4.56±1.08
	Range	20-40	6.88-8.50	0.41-2.80	0.90-4.20
	Mean	20-40	7.77±0.36	1.40±0.56	2.13±1.10
Nayakanahatti	Range	0-20	6.90-8.73	0.91-3.50	1.80-7.20
	Mean	0-20	7.93±0.32	1.80±0.57	4.63±1.24
	Range	20-40	7.04-8.70	0.51-2.39	0.90-4.50
	Mean	20-40	7.87±0.38	1.46±0.49	2.21±0.99
Thalaku	Range	0-20	5.90-9.20	0.64-3.39	2.70-6.00
	Mean	0-20	7.81±0.54	1.67±0.90	4.32±0.84
	Range	20-40	5.74-9.30	0.41-2.60	0.90-4.20
	Mean	20-40	7.92±0.56	1.18±0.60	2.23±1.09

4. Discussion

4.1 Particle size distribution of soil

Analyzed samples from Challakere taluk's pomegranate orchards show notable differences between sites and soil depths concerning the particle size distribution. The findings point to a preponderance of sandy textures, especially sandy clay loam and sandy loam. The mean sand content in the top 0-20 cm depth was ranged between 58.85 to 67.29 per cent and in the subsurface it ranged between 58.16 to 65.65 per cent across the pomegranate growing hobli's of Challakere taluk. The sand content ranged between 41.80 to 86.30 per cent with the mean value of 62.78 per cent in surface soil and the mean sand content for subsurface was 61.51 per cent which ranged between 40.00 to 85.70 per cent. The proportion of clay content ranged from 6.10 to 39.10 per cent with a mean value of 22.97 per cent for surface soil and for subsurface, the mean value of clay was 23.66 per cent which was slightly higher than surface soils. The silt content ranged between 4.51 to 26.45 per cent with mean values of 14.25 and 14.89 per cent for subsurface, which indicated an increase in silt content with depth but this trend was not similar for all samples. This indicated a suitable environment for pomegranate production, as sandy soils often allow for improved root penetration and drainage.

Variation in sand content with depth has not shown any regular trend this might be due to tillage operations which make finer particles move down to the subsurface layer leaving coarser particles on the surface and without tillage operations the coarse particles will not move to the surface as it was confirmed by

Loganathan and Krishnamurthy (1976)^[12].

Soil texture is influenced by the area's geological composition as this region's soils were developed from granite and basalt parent material. Sand fractions in soil profiles were higher in sandy soils due to their origin from weathered granite, sandstone or other sandy parent materials. These soils have a high sand content because of the physical and chemical weathering of rocks, which were broken down into small sand-sized particles. It is especially noticeable in places with strong wind activity where lighter soil components can be washed away by wind and water erosion, which can remove finer particles (silt and clay) and leave behind coarser sand particles. Because this might be due to less vegetation to anchor the soil and more exposure to wind and water erosion, this process may speed up in arid or semi-arid areas. These results are in line with the findings of Satyanarayana and Biswas, 1970^[15].

4.2 Bulk density of soil

Soil samples collected from pomegranate orchards in Challakere, Parasurampura, Nayakanahatti, and Thalaku hobli were measured for bulk density (BD), which provides important information on the properties of the soil at different depths. The BD varied from 1.31 to 1.48 Mg m⁻³ for surface soils, with a mean value of 1.40 g cm⁻³. In contrast, the subsurface soils showed a wider range from 1.37 to 1.53 Mg m⁻³, with a mean value of 1.43 Mg m⁻³. These results show a general tendency of increased bulk density with depth. The uniform mean values at several sites indicated that soil compaction may be a prevalent

problem in these pomegranate-growing soils, potentially impacting nutrient availability and water retention, both of which are essential for the best possible fruit production. These variations suggested that the physical properties of the soils were influenced by several key factors, particularly organic matter content, as well as the proportions of sand and clay. Higher organic matter levels typically contribute to lower bulk density by improving soil structure and porosity, while the relative amounts of sand and clay play a crucial role in determining bulk density. Similar results were found by Veerangappa *et al.*, 2013^[17].

4.3 Chemical properties of soil under pomegranate growing soils of Challakere taluk

4.3.1 Soil pH

The pH values across the sampled sites in Challakere taluk indicated that a predominant alkaline soil environment, which ranged from 5.74 to 9.3 and mean values of 7.86 ± 0.36 and 7.86 ± 0.41 for the 0-20 cm and 20-40 cm depths, respectively. In Thalaku hobli specifically, pH levels reached up to 9.20 in the subsurface layer. These alkaline pH levels suggested that these soils were suitable for pomegranate cultivation, as the species thrives well in alkaline conditions (pH 6.0 to 8.2).

The consistent pH readings across depths indicated that, the soil profile was uniform, which was beneficial for root development and nutrient availability. The higher pH values in the surface layer compared to the subsurface in some samples might be due to the dominance of $\text{CO}_3^{2-} + \text{HCO}_3^-$ of Ca^{2+} and Mg^{2+} ions, providing OH^- ions, after evaporation in the surface layer. The results confirm that the majority of soil samples lie within the normal to alkaline range, primarily due to the accumulation of bases, especially Na^+ , and other salts under low rainfall conditions, leading to an alkaline soil reaction. These findings are in conformity with previous studies conducted by Fida *et al.* (2011)^[10], Bhatnagar and Singh (2014)^[8], Rathod *et al.* (2016)^[14] and Yadav and Gupta (2018)^[19].

4.3.2 Electrical Conductivity (EC)

The EC values measured in the soil samples ranged from 0.45 to 3.50 dS m^{-1} , with higher values observed in the surface layer (0-20 cm). The mean EC was $1.85 \pm 0.75 \text{ dS m}^{-1}$ in the surface layer of Parasurampura and $1.67 \pm 0.90 \text{ dS m}^{-1}$ in Thalaku in the top layer found to be the lowest mean value. For the subsurface, the highest and lowest mean values recorded were $1.46 \pm 0.49 \text{ dS m}^{-1}$ and $1.18 \pm 0.60 \text{ dS m}^{-1}$, across the taluk respectively. These values are indicative of the presence of soluble salts. However, the recorded EC levels were not high enough to pose salinity issues for pomegranate growth, as they fall below the threshold that could adversely affect plant development. The elevated electrical conductivity (EC) values observed in the surface layer (0-20 cm) suggested a potential accumulation of salts resulting from evaporation. These higher EC levels might be due to the significant evaporation demands of the arid ecosystem, characterized by higher temperature and low rainfall, coupled with the use of poor-quality underground water for irrigation. Such conditions can lead to increased salinity in the topsoil, which could adversely affect plant health. Similar observations have been reported in studies by Singh and Kumar (2012)^[16], Rathod *et al.* (2016)^[14], and Yadav and Gupta (2018)^[19].

4.3.3 Soil organic carbon (SOC)

Soil organic carbon (SOC) content is a vital indicator of soil fertility and soil health, during the study across the sites of Challakere taluk it was found that, the soil OC ranged from 0.9

to 7.2 g the mean SOC in the topsoil (0-20 cm) ranged between $4.32 \pm 0.84 \text{ g kg}^{-1}$ to 4.63 ± 1.24 and in the subsurface, it ranged between 2.13 ± 1.10 to $2.23 \pm 1.09 \text{ g kg}^{-1}$ across four hobli's of the taluk. The higher SOC levels in the topsoil are advantageous as they enhance soil structure, moisture retention and nutrient availability, all of which are crucial for optimal pomegranate growth. Conversely, the lower SOC values found at the 20-40 cm depth indicated a reduction in organic matter content with a depth. From the results, it is confirmed that the organic carbon content in these soils low to medium in the majority of samples it is due to the scarcity of water, which significantly limits vegetation growth and leads to minimal input of organic materials into the soil. The dry conditions prevalent in arid regions also accelerate the decomposition of organic matter, as the warm temperatures and low moisture levels favor microbial activity. Additionally, the coarse texture of arid soils, which often consists of sands and sandy loams, does not retain moisture well and has larger pores that allow water to drain quickly, further exacerbating the lack of moisture necessary for organic matter retention and accumulation. The results of the study were in line with the findings of Singh and Kumar (2012)^[16], Bhatnagar and Singh (2014)^[8] and Yadav and Gupta (2018)^[19] who also reported low soil organic carbon content in arid soils, and suggested that mulching such soils may help in increasing organic carbon content.

5. Conclusion

Soil characteristics such as texture, bulk density, pH, electrical conductivity (EC) and organic carbon content are vital for the successful cultivation of pomegranate crops. An ideal soil texture, particularly sandy loam supports optimal drainage and root development, while appropriate bulk density ensures adequate aeration and nutrient accessibility. The pH level influences nutrient availability, with slightly acidic to neutral conditions being most favorable for pomegranates. Electrical conductivity is important for assessing salinity, which can adversely affect plant growth if levels are too high. Lastly, organic carbon enhances soil fertility and structure, promoting a healthy microbial ecosystem. By carefully monitoring and managing these soil properties, like by practicing green manuring, mulching and intercropping with pulses they can improve the soil properties which create an environment conducive to robust pomegranate growth, leading to higher yields and better fruit quality.

Application of research: Study of Soil Physical and chemical properties in pomegranate growing areas of Challakere taluk, Karnataka.

Research Category: Soil Physical properties (Soil texture, bulk density) and chemical properties like soil pH, Electrical conductivity (EC) and Soil organic carbon.

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Study area / Sample Collection: Challakere taluk.

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