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K Vilakar
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Hyderabad, Telangana, India

S Harish Kumar Sharma
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Hyderabad, Telangana, India

P Ravi
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Hyderabad, Telangana, India

P Madhukar Rao
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Hyderabad, Telangana, India

P Revathi
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Hyderabad, Telangana, India

Corresponding Author
K Vilakar
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Hyderabad, Telangana, India

Soil fertility status of sesame growing soils of Northern Telangana zone

K Vilakar, S Harish Kumar Sharma, P Ravi, P Madhukar Rao and P Revathi

Abstract
Sesame is an important oilseed crop predominantly grown in Adilabad, Nizamabad and Karimnagar districts of Telangana state. Investigating the fertility status of sesame growing soils is required to under pin future land use planning. A survey was carried out in major sesame growing soils of Northern Telangana Zone of Telangana state. 30 representative surface soil samples (0-15 cm) were collected and analysed for their salient characteristics *viz.*, pH, EC, OC, available N, P_2O_5, K_2O. Results revealed that, soil pH ranged from 5.35 to 8.41 (slightly acidic to slightly alkaline). The soils were non-saline to slightly saline (0.16 to 0.92 dSm^{-1}). The organic carbon ranged from 0.15 to 0.75 g kg^{-1} (low to medium). With regard to available nutrients, the values varied from 115.25 to 239.55 kg ha^{-1} for nitrogen, 28.25 to 75.63 kg ha^{-1} for phosphorus, for potassium 292.15 to 452.82 kg ha^{-1}.

Keywords: soil fertility, growing soils, phosphorus

Introduction
Soil - a nature's marvel is one among the vital natural resources of the earth, on whose health, the survival of all living organisms depends. The soil must be in harmony with its in born attributes and productivity to maintain sustainable soil health. Continuous mono cropping, use of high yielding varieties / hybrids and imbalanced application of fertilizers causing native soil health and production potential of soil

Oilseed crops play the second important role in the Indian agricultural economy next to food grains in terms of area and production. The Indian climate is suitable for the cultivation of oilseed crops; therefore, large varieties of oilseeds are cultivated here. Among the oilseed crops, sesame (*Sesamum indicum* (L.)) is well known and is one of the oldest crops in the world (Gayatri *et al.*, 2017). It is known variously as til, gingelly, simsim, gergelim etc. Sesame is one of the world's oldest cultivated oilseed crop. It is better known as "Queen of oilseeds" by virtue of its quality edible oil and protein content, as it contains 50 percent oil and 18-20 percent protein. Sesame oil has long shelf life and rich in linoleic acid (Unde *et al.*, 2017). India ranks first (16.73 Lakh ha) in area, production (6.5 Lakh tonnes) and productivity (391 kg ha^{-1}) and export of sesame in the world. Sesame ranks third in terms of total oilseed area and fourth in terms of total oilseed production in India. Madya Pradesh, Rajasthan, Gujarat and Andhra Pradesh are major sesame growing states in India. In Telangana nearly 2.75 Lakh hectares being cultivated every year. It is the major crop for Adilabad, Nizamabad, Karimnagar, Nalgonda, Medak and Mahbubnagar.

Soil fertility is a major constraint to its productivity. Low organic matter content coupled with low and imbalanced application of nutrients limits its full potential yield and is the main yield barrier (Bellakki *et al.*, 1999) [1]. Nutrient level is decreasing continuously in Indian soils due to extensive agriculture while meeting the food demand of escalating population growth. Inventory of the physico-chemical properties, available macronutrient status of the soils helps in demarcating the areas where the application of particular nutrient is needed for profitable crop production. Also, it is already well known that the properties of a soil are the basic attributes that influence directly on the soil response to any specified use. Though sporadic information is available on characterization and classification of soils in Adilabad, Nizamabad and Karimnagar districts detailed and systematic investigation on the properties of soils, specifically in sesame growing soils is meagre. Hence, the present study was taken up in the major sesame growing soils of Northern Telangana Zone with an objective to understand and update the knowledge on the potentials and limitations of these soils in enhancing the

productivity of sesame. This paper deals with nutrient status (physico-chemical and chemical properties) of sesame growing soils of Adilabad, Nizamabad and Karimnagar districts.

Materials and Methods

Study Area and Sample Collection

The soil survey was carried out 30 sesame growing soils of Adilabad, Nizamabad and Karimnagar districts under Northern Telangana Zone of Telangana. 30 soil samples (0-15 cm depth) were collected before the commencement of sesame planting. Surface soil samples were collected randomly in a zig-zag way to make a composite sample (500 g) by using quartering technique. The composite soil samples were packed and labeled properly in polythene bags and brought to the laboratory for further analysis

Table 1: Survey locations of Adilabad district

S. No.	Name of the district	Name of the mandal	Name of the village
1	Adilabad	Tiryani	Ginnedari
2	Adilabad	Jannaram	Malyal
3	Adilabad	Manadamarri	Chirrukunta
4	Adilabad	Khanapur	Kothapet
5	Adilabad	Manchrial	Gudipet
6	Adilabad	Khanapur	Iqbalpur
7	Adilabad	Kotapally	Algaon
8	Adilabad	Mandamarri	Sarangapalle
9	Adilabad	Manchrial	Hajipur
10	Adilabad	Luxettipet	Laxmipur

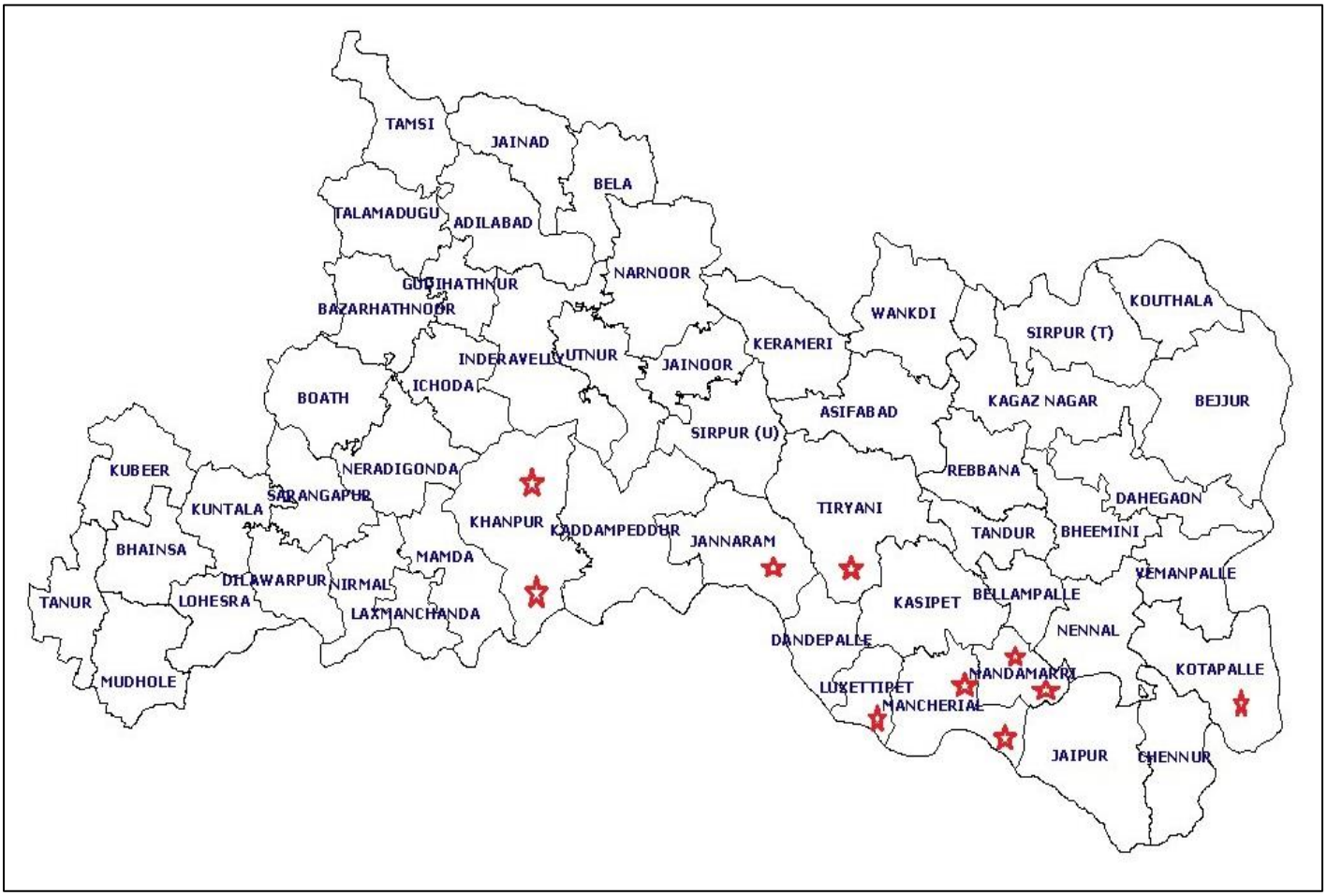

Fig 1: Location of soil samples collected in Adilabad district

Table 2: Survey locations of Karimnagar district

S. No.	Name of the district	Name of the mandal	Name of the village
1	Karimnagar	Gangadhara	Kondaipalle
2	Karimnagar	Illanthakunta	Kandikatkoor
3	Karimnagar	Korutla	Peddapur
4	Karimnagar	Metpalli	Chowlamaddi
5	Karimnagar	Dharmapuri	Donthapur
6	Karimnagar	Jagtial	Anantharam
7	Karimnagar	Siricilla	Peddur
8	Karimnagar	Siricilla	Sardapur
9	Karimnagar	Jagtial	Buggaram
10	Karimnagar	Huzurabad	Chelpur

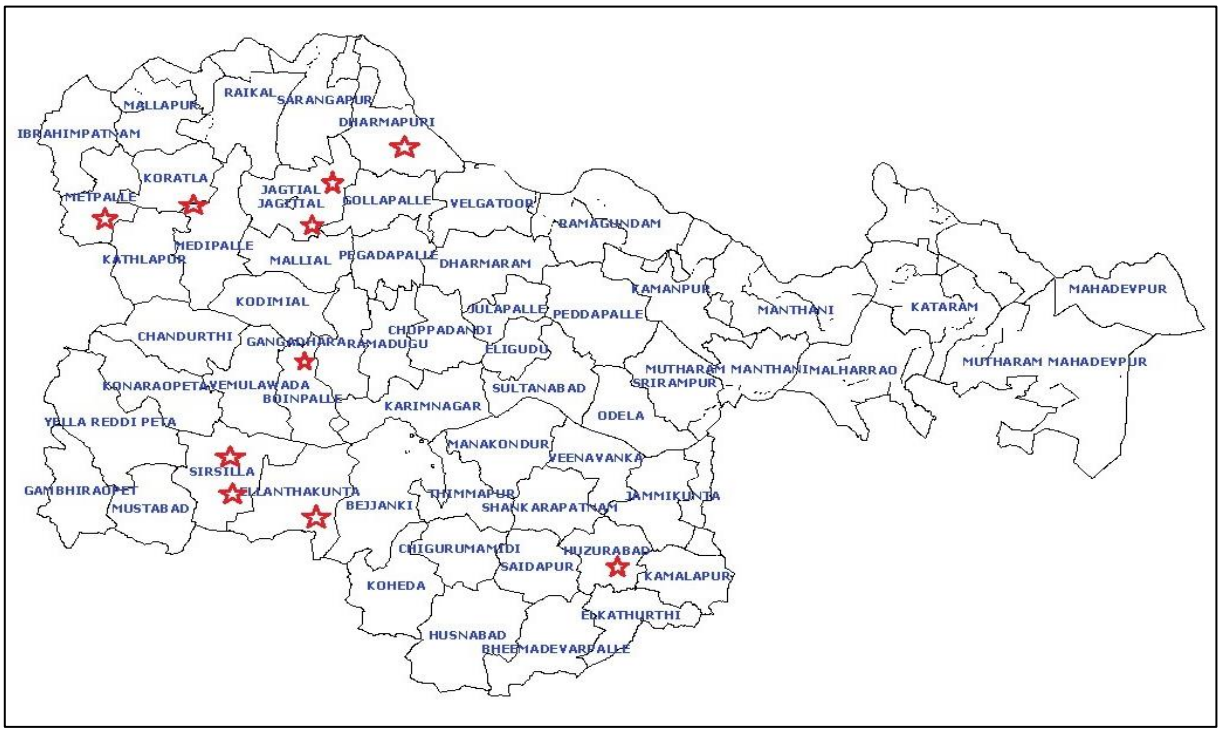

Fig 2: Location of soil samples collected in Karimnagar district

Table 3: Survey locations of Nizamabad district

S. No.	Name of the district	Name of the mandal	Name of the village
1	Nizamabad	Armoor	Degaon
2	Nizamabad	Dichpally	Narsingapoor
3	Nizamabad	Bheemgal	Devanpalle
4	Nizamabad	Armoor	Ankapur
5	Nizamabad	Kammarpalle	Narsapur
6	Nizamabad	Armoor	Komanpalle
7	Nizamabad	Dichpalle	Dichpalle
8	Nizamabad	Kammarpalle	Konapur
9	Nizamabad	Bheemgal	Gongappul
10	Nizamabad	Morthad	Morthad

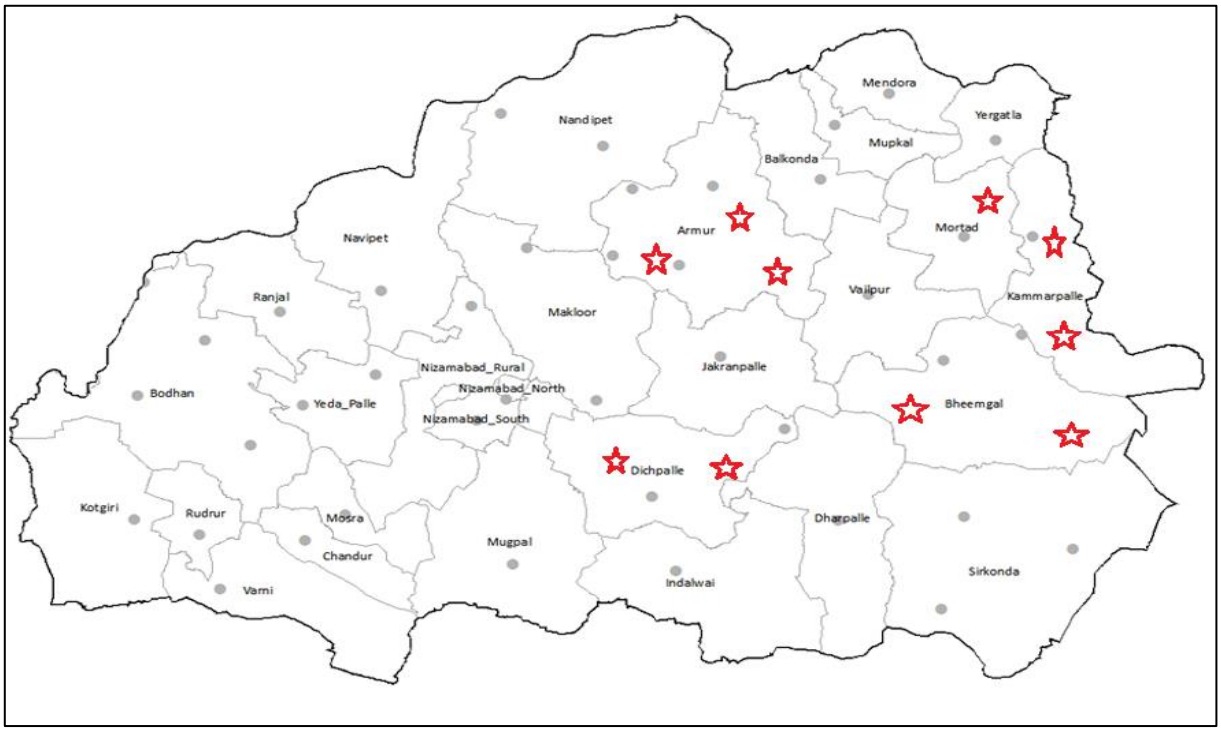

Fig 3: Location of soil samples collected in Nizamabad district

Laboratory Analysis

All the soil samples were air dried, grounded and passed through 2mm sieve for chemical analysis. Soil pH and electrical conductivity (EC) were determined by pH meter and conductivity meter using 1:2.5 soil water suspensions. The representative soil samples were analysed for organic carbon by Walkley and Black (1934) [14] method, available nitrogen by alkaline permanganate method (Subbaiah and Asija, 1956) [12]. Available P_2O_5 measured using sodium bicarbonate ($NaHCO_3$) as an extractant (Olsen *et al.,* 1954) [5]. Available K_2O determined using neutral normal ammonium acetate extractant method [Jackson (1967) [2]].

Table 4: Soil fertility status of Karimnagar district

S. No.	pH	EC (ds m^{-1})	OC (g kg^{-1})	Available N (kg ha^{-1})	Available P (kg ha^{-1})	Available K (kg ha^{-1})
1	7.53	0.16	0.45	133.25	60.25	393.78
2	7.67	0.37	0.43	162.49	51.24	292.15
3	6.96	0.46	0.42	175.75	33.48	397.16
4	8.21	0.41	0.41	170.17	36.25	414.01
5	7.97	0.41	0.22	220.51	58.96	371.80
6	8.15	0.39	0.36	201.65	70.22	384.70
7	8.41	0.42	0.45	176.44	45.63	437.64
8	7.31	0.56	0.62	195.39	40.25	399.18
9	5.35	0.67	0.37	182.76	38.77	358.86
10	8.24	0.36	0.29	115.25	45.66	400.55

Table 5: Soil fertility status of Adilabad district

S. No.	pH	EC (ds m^{-1})	OC (g kg^{-1})	Available N (kg ha^{-1})	Available P (kg ha^{-1})	Available K (kg ha^{-1})
1	7.24	0.49	0.48	158.38	45.25	375.29
2	7.92	0.56	0.36	239.49	35.24	402.16
3	7.61	0.53	0.40	182.77	30.27	392.30
4	6.94	0.42	0.25	220.55	35.01	408.34
5	7.52	0.61	0.64	233.10	40.18	394.82
6	8.19	0.59	0.44	145.71	33.28	441.25
7	7.62	0.22	0.33	192.50	28.25	396.22
8	8.26	0.49	0.32	142.46	39.57	452.82
9	7.35	0.59	0.15	185.75	34.04	402.02
10	8.18	0.62	0.35	182.78	32.08	363.53

Table 6: Soil fertility status of Nizamabad district

S. No.	pH	EC(ds m^{-1})	OC (g kg^{-1})	Available N (kg ha^{-1})	Available P (kg ha^{-1})	Available K(kg ha^{-1})
1	8.18	0.26	0.20	239.55	35.68	410.69
2	7.16	0.69	0.32	212.44	61.24	399.34
3	7.95	0.42	0.75	182.70	75.63	373.51
4	7.85	0.55	0.45	220.55	51.28	392.10
5	6.85	0.20	0.44	233.11	49.62	452.56
6	8.12	0.56	0.15	145.77	55.61	403.87
7	7.19	0.45	0.49	220.53	48.51	373.58
8	7.71	0.92	0.64	120.55	39.45	390.32
9	6.92	0.56	0.70	195.30	66.17	410.60
10	7.31	0.57	0.20	182.57	48.22	384.75

Results and Discussion

Soil Reaction

Soil reaction (pH) of the surface soils ranged from 5.35 to 8.41 indicating that, these soils are slightly acidic to alkaline in reaction.

Electrical Conductivity

Electrical conductivity (EC) of surface soils ranged from 0.16 to 0.92 dSm^{-1} indicating that, these soils were non-saline to slightly saline in nature.

Organic Carbon

With regard to the status of organic carbon (%) it did not vary much in surface soils. The values found to vary from 0.15 to 0.75g kg^{-1}. The reason for low organic carbon content in most of the soils may be attributed to the prevalence of semi-arid condition, where the degradation of organic matter occurs at a faster rate coupled with little or no addition of organic manures and low vegetation cover on the fields, there by leaving less chances of accumulation of organic carbon in the soils. Intensive cropping is also one of the reasons for low organic carbon content in soils. The similar results were also reported by Nalina *et al.* (2016) [4].

Available Nitrogen

The available nitrogen content of the soils ranged from 115.25 to 239.55 kg ha^{-1}. These soils were very low (<140 kg ha^{-1}) to low (140-280 kg ha^{-1}) in available nitrogen. The low available N could be attributed to soil management, varied application of FYM and fertilizers to previous crops. Another possible reason may also be due to low organic matter content in these areas and high temperature which facilitate faster degradation and removal of organic matter leading to N deficiency (Karthikeyan *et al.,* 2014) [3]. Similar results were reported by and Patil *et al.* (2016) [7].

Available Phosphorus

The available phosphorus content of the soils exhibited

extreme variation between 28.25 to 75.63 kg ha^{-1}. The soils found to have high (>25.6 kg ha^{-1}) phosphorus content. Continuous application of DAP to crops without soil testing might have resulted in phosphorus build up and led medium to high available phosphorus status in these soils (Sathish *et al.*, 2018) [10]. Another reason for higher P in surface soils might possibly due to P confinement to the rhizosphere due to its immobile nature in soils (Rajeshwar and Mani, 2014) [8].

Available Potassium

The available potassium content of the soils varied from 292.15 to 452.82 kg ha^{-1}. These soils recorded medium (110-280 kg ha^{-1}) to high (>280 kg ha^{-1}) available potassium. These soils were able to maintain a sufficient or even high level of exchangeable K and provide a good supply of K to plants for many years. The medium to higher content of available K_2O may be due to the predominance of K-rich micaceous and feldspar minerals in parent material. Similar results were observed by Srikant *et al.* (2008) [11]. Further, high available K status in surface soils could be attributed to release of labile-K from organic residues, application of K fertilizers and upward translocation of K from lower depths along with capillary rise of ground water. Similar results were reported by Pal and Mukhopadyay (1992) [6].

Conclusion

Most of the soil's pH condition is slightly acidic to slightly alkaline in nature, non-saline, low in organic carbon and available nitrogen, medium to high in phosphorous and potassium. So, it can be suggested that application of organic manures needs to be encouraged in sesame growing soils of Northern Telangana Zone apart from crop residue incorporation. Excess use of phosphatic fertilizers need to be discouraged as there is phosphorus build up in surface soils.

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