



## Available Sulphur Status in Soybean Growing Areas of Northern Telangana Zone

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### Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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### ABSTRACT

The black soils of Adilabad and Nizamabad districts of Northern Telangana zone most prominent for the cultivation of soybean. From this region of soils, sixty soil samples were collected and analysed for available sulphur and its fractions. The results indicated that available sulphur content ranged from 5.9 mg kg<sup>-1</sup> to 52.6 mg kg<sup>-1</sup> with a mean of 13.8 mg kg<sup>-1</sup>. The available sulphur content was low to medium in status. The extent of sulphur deficiency of soybean growing areas of Adilabad and Nizamabad are 50 and 43.4 per cent respectively. The water-soluble sulphur ranged from 5.4 mg kg<sup>-1</sup> in rural samples of Nizamabad to 7.3 mg kg<sup>-1</sup> in sonala soils of Adilabad district. Whereas KH<sub>2</sub>PO<sub>4</sub> and Heat soluble sulphur content ranged from 19.2, 29.6 mg kg<sup>-1</sup> in Armour village to 28.7, 37.3 mg kg<sup>-1</sup> in Sonala village respectively. The highest total sulphur content was recorded in soils of Adilabad district.

**Keywords:** Available sulphur; sulphur fractions; water soluble sulphur; KH<sub>2</sub>PO<sub>4</sub> and heat soluble sulphur; total sulphur.

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## 1. INTRODUCTION

Green revolution brought up with improved crop productivity by adopting high-yielding varieties, excess usage of fertilizers and multiple cropping systems, for these fertilizer uses has become a key role for obtaining higher yields and quality of the crops. Sulphur is one among the essential plant nutrients for sustainable crop production, for legume & oilseed crops sulphur requirement is more than cereal grains. The amount of Sulphur required to produce one ton of seed is about 3-4 kg Sulphur for cereals (range 1-6); 8 kg Sulphur for legume crops (range 5-13); and 12 kg Sulphur for oil crops (range 5-20). In general, oil crops require about the same amount of Sulphur as, or more than, phosphorus for high yield and product quality [1]. Sulphur is perceived as the fourth major plant nutrient after nitrogen, phosphorus and potassium [2]. The importance of sulphur in agriculture is being increasingly emphasized and its role in crop production is well recognized [3]. Sulphur is essential for physiological and metabolic activities of the plants. It is an integral part of certain vitamins and enzymes which are important to the life cycle of plants. Sulphur is a structural constituent of organic compounds, some of which are uniquely synthesized by plant, providing human and animal with essential amino acids (methionine and cysteine). It is involved in chlorophyll formation, activation of enzymes and is a part of vitamins biotin and thiamine [4].

Sulphur deficiency is becoming widespread in tropical and subtropical climatic regions throughout the world and especially in India it is more because of high temperature based oxidation of soil organic matter, use of high analysis low S fertilizers, low sulphur returns through organic sources and crop residues, high yielding varieties, intensive agriculture, declining use of sulphur containing chemicals and reduced atmospheric input caused by strict emission regulations [5]. Sulphur deficiency in soils of Indian states varied from 5 to 83 per cent with an overall mean of 41 per cent [6]. Results of TSI-FAI-IFA study confirmed that sulphur deficiencies national wide are dramatic and the sulphur requirement is gigantic. A timely and precise appraisal of sulphur deficiency is necessary for measures to obtain the best crop yields as well as to increase the fertilizer use efficiency and obtain better returns from the costly inputs.

Soybean (*Glycine max*) is an important global crop, providing oil and protein. It contains about 20 per cent oil and 40-43 per cent high-quality protein with a good amount of minerals, salts and vitamins. Soybean is the richest, cheapest and easiest source of best quality proteins and fats have a vast multiplicity of uses in the food and industrial products. The cultivation of soybean crop is increased at a faster rate and is extensively grown in Adilabad, Nizamabad, Medak and some parts of Karimnagar districts of Telangana state. The available status of sulphur in these districts database is meagre and not done in a systematic manner hence this work was carried out as my researchable topic.

## 2. MATERIALS AND METHODS

To delineate the available sulphur status in soybean growing soils of Northern Telangana Zone, representative sixty surface (0-15 cm) soil samples were collected from different mandals of Adilabad and Nizamabad districts. The soil samples were air-dried under shade, processed and screened with the help of 2mm sieve and analyzed for soil properties following standard procedures. Soil pH, EC (1:2.5) described by [7]. Mechanical analysis as outlined by [8], Organic carbon content by [9], available nutrients like N by alkaline permanganate,  $P_2O_5$  by 0.5M  $NaHCO_3$  (pH 8.5) and  $K_2O$  using 1N  $NH_4OAC$  as described by [7].

The contents of different fractions of sulphur were also determined. Total-S by [10]. inorganic sulphate sulphur by turbidimetrically [11]. by using 0.15 per cent  $CaCl_2$  [12]. and 500 ppm  $KH_2PO_4$ .

## 3. RESULTS AND DISCUSSION

### 3.1 Physical, Physic-Chemical and Chemical Properties of Soybean Growing Soils Northern Telangana

Data related to physical, physic-chemical and chemical properties (Table 1) of soybean growing soils in two districts of Northern Telangana indicated that the texture of the soils under study varied from sandy loam to clay loam. Two soils of Neredigonda and sonala are clay loam in texture and remaining are sandy loam. Bulk density of selected soils ranged from 1.25  $Mg\ m^{-3}$  (Sonala) to 1.49  $Mg\ m^{-3}$  (Nizamabad

rural). The soil reaction (pH) was neutral to slightly alkaline in condition, whereas electrical conductivity was non-saline in nature and organic carbon content in the soils ranged from 4.1 g kg<sup>-1</sup> to 6.7 g kg<sup>-1</sup> it indicates that low to medium in status.

The available nitrogen content in the soil under the study ranged from 172 kg ha<sup>-1</sup> (Jakranpalli) to 252 kg ha<sup>-1</sup> (Armoor) it indicates that available nitrogen content was low in status. Available phosphorus was low to medium in status and available potassium was medium to high in status.

### 3.2 Available Sulphur Status

Data illustrated in Table 2, the available sulphur content of soils belongs to two districts of soybean growing areas of Northern Telangana varied from 5.9 to 52.6 mg kg<sup>-1</sup> with the mean value of 13.8 mg kg<sup>-1</sup>. The lowest value of available sulphur content was recorded in the soils from Nizamabad district as compared to Adilabad. The extent of sulphur deficiency of soybean growing areas of Adilabad and

Nizamabad are 50 and 43.4 per cent respectively.

### 3.3 Forms of Sulphur in selected soils of Northern Telangana

Various forms of sulphur and their interrelationship with soil properties decide on the sulphur supplying power of the soil, their influence on its release pattern and dynamics in soils [13]. In the selected soils, fractions of sulphur (water-soluble sulphur, CaCl<sub>2</sub> extractable Sulphur, KH<sub>2</sub>PO<sub>4</sub> extractable Sulphur, Heat soluble sulphur and total sulphur) were analysed and expressed in mg kg<sup>-1</sup> of soil. The data about different fractions of sulphur is presented in Table 3, the water-soluble sulphur ranged from 5.4 mg kg<sup>-1</sup> in rural samples of Nizamabad to 7.3 mg kg<sup>-1</sup> in sonala soils of Adilabad district. However, KH<sub>2</sub>PO<sub>4</sub> and Heat soluble sulphur content ranged from 19.2, 29.6 mg kg<sup>-1</sup> in Armoor village to 28.7, 37.3 mg kg<sup>-1</sup> in Sonala village respectively. The highest total sulphur content was recorded in soils of Adilabad district. The lowest water soluble sulphur and sulphate sulphur was also reported by [14].

**Table 1. Physical, physico-chemical and chemical properties of selected soils of soybean growing areas of Northern Telangana Zone**

1. Physical Properties							
S. No	District	Mandal & Village	Sand (%)	Silt (%)	Clay (%)	Soil texture	Bulk density (Mg m <sup>-3</sup> )
1	Adilabad	Neredigonda	45.6	31.2	23.2	Clay loam	1.31
2	Adilabad	Sonala	44.1	27.6	28.3	Clay loam	1.25
3	Nizamabad	Jakranpalli	72.1	19.9	8.0	Sandy loam	1.42
4	Nizamabad	Nizamabad (rural)	64.2	16.9	18.9	Sandy loam	1.46
5	Nizamabad	Armoor	68.4	21.6	10.0	Sandy loam	1.39
2. Physico-chemical Properties							
S. No	District	Mandal & Village	pH	E.C (dS m <sup>-1</sup> )	OC (g kg <sup>-1</sup> )		
1	Adilabad	Neredigonda	7.58	0.51	6.7	-	-
2	Adilabad	Sonala	7.55	0.31	5.4	-	-
3	Nizamabad	Jakranpalli	7.39	0.41	4.5	-	-
4	Nizamabad	Nizamabad (rural)	7.42	0.24	4.1	-	-
5	Nizamabad	Armoor	7.45	0.24	5.3	-	-
3. Chemical properties							
S. No	District	Mandal & Village	N (kg ha <sup>-1</sup> )	P <sub>2</sub> O <sub>5</sub> (kg ha <sup>-1</sup> )	K <sub>2</sub> O (kg ha <sup>-1</sup> )	S (mg kg <sup>-1</sup> )	
1	Adilabad	Neredigonda	242	18.2	257	9.3	-
2	Adilabad	Sonala	194	25.5	171	9.4	-
3	Nizamabad	Jakranpalli	172	14.1	210	8.4	-
4	Nizamabad	Nizamabad (rural)	230	16.4	193	7.8	-
5	Nizamabad	Armoor	254	18.2	358	7.2	-

**Table 2. Available sulphur status in soybean growing areas of Northern Telangana Zone**

S.No.	Available sulphur (mg kg <sup>-1</sup> )				
	District	Number of Soil Samples	Range	Mean	PSD
1	Adilabad	30	5.9 -52.6	16.6	50
2	Nizamabad	30	6.3-18.2	10.9	43.4

**Table 3. Sulphur fractions in selected soils of soybean growing areas of Northern Telangana Zone**

S. No.	District	Mandal & Village	Water soluble	CaCl <sub>2</sub> extractable sulphur	KH <sub>2</sub> PO <sub>4</sub> extractable sulphur	Heat soluble sulphur	Total sulphur
1	Adilabad	Neredigonda	6.9	9.3	26.8	36.4	291
2	Adilabad	Sonala	7.3	9.4	28.7	37.3	297
3	Nizamabad	Jakranpalli	5.9	8.4	21.6	32.2	284
4	Nizamabad	Nizamabad (rural)	5.4	7.8	24.5	31.3	271
5	Nizamabad	Armoor	5.6	7.2	19.2	29.6	263

Among inorganic fractions of sulphur the highest was recorded in black soils of Adilabad district, the reason might be soils having a medium to high in organic carbon content, and heavy textured soils having a higher rate of adsorption, the similar results were found [15].

#### 4. CONCLUSION

The present investigation discloses that most of the soils from above two districts of Northern Telangana are low to medium in available sulphur. It indicates that the crops of Northern Telangana zone adversely affect by sulphur nutrient. Intensive cropping systems without sulphur fertilizer may lead to further depletion of sulphur in these soils. Above research strongly suggest that an integrated cropping system and site-specific nutrient approaches reduced the deficiency of sulphur and also it improves the sustainability of soils in this zone.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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