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Release Pattern of Available Sulphur and Sulphur Fractions Influenced by Elemental Sulphur and Poultry Manure in Different Soils of Norther Telangana

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ABSTRACT

The rate of release pattern of available sulphur from four levels of elemental sulphur with and without poultry manure in different soils of Northern Telangana was determinerd by in a laboratory study. Results revealed that levels of elememtal sulphur and poultry manure significantly influenced the available sulphur content. Four levels of elemental sulphur (0, 20, 40 and 60 kg S ha^{-1}) along with and without poultry manure (2.5 t ha^{-1}). Incubation study was conducted at field capacity up to 60 days to know the release pattern of available sulphur content. Application of poultry manure influences the release pattern of available sulphur content in different soils. At initial stage of 0 to 30 days the release pattern was rapid and after that it was constant up to 60days. The highest release pattern of sulphur at different Norther Telangana soils at 45 days of incubation with application of 60 kg S ha^{-1} along with poultry manure 2.5 t ha^{-1} order was neredigonda (25.6 mg kg^{-1}) > Kotagiri (24.7 mg kg^{-1}) > jakranpalli (24.3 mg kg-1) > alladurge (23.2 mg kg-1) > sonala (22.8 mg kg-1) > armor (20.9 mg kg-1) appajithanda (20.1 mg kg-1).

Key words: *elememtal sulphur, poultry manure, Incubation*

INTRODUCTION

Sulphate is the primary source of sulphur taken up by plants. Soil solution sulphate levels determine the amount of sulphur accessible to plant. The source of this solution supplied into the soil from weathering of rocks and minerals, mineralization from organic matter and addition of external organic and inorganic sources of sulphur[7].

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The release of elemental sulphur (S^0), sulphide sulphur ($S^=$) and other inorganic sulphur compounds occurred in soil is through to be biochemical in nature. The rate of release of available sulphur content in soils depends on the soil environmental conditions, characteristics of the sulphur sources and the microbial population in soils[6]. The oxidation and reduction of inorganic sulphur compounds are greater importance to uptake of the crops and it ultimately influenced the yields of the crop. Keeping this in view, a laboratory incubation study was conducted to assess the release pattern of sulphur in northern and southern Telangana soils (mainly oil seed growing areas).

MATERIALS AND METHODS

The experiment was conducted to study the release pattern of sulphur in different soils of northern Telangana. A prilimnary soil survey was conducted covering major soil groups in soybean areas from black soils of norther telangana (Adilabda and Nizamabhad) districts of Telengana. From this survey seven soil samples were selected based on available sulphur content in the soils. The selected soils were incubated to know the release pattern of available sulphur. Bulk surface soil samples (0-15 cm) were collected and the soil was processed in a wooded pestle and mortar and passed through a 2mm sieve. Four sulphur levels 0, 20, 40 and 60 kg ha^{-1} applied through elemental sulphur with and without poultry manure (0 and 2.5 t ha^{-1}). The experiment was laid out in a factorial completely randomized design. The soils were nutral to alkaline in nature with medium organic matter. The details of selected soils were given in table 1. Hundred grams of processed soils were incubated in plastic bottles under field capacity. Treatments were replicated thrice. Deionized water was added in plastic bottles from time to time to maintain desired moisture content throughout the incubation periods. Soil samples were drawn at an intervals of 1, 15, 30 45 and 60 days. Samples were air-dried, powdered and the sulphate sulphur (SO_4-S) was extracted from the soil by 0.15% $CaCl_2$ extractent (William and Steinbergs 1959) and analysed turbid metrically as per Chesnin and Yien[1].

RESULTS AND DISCUSSION

Effect of sulphur levels and poultry manure on release pattern of available sulphur content in soils

Results (Table 2) revealed that the sulphur release was followed same trend in all the soils. After addition of S as (elemental sulphur) and poultry manure in the soils at different rates, there was increasing in the available sulphur content of soil on average. However, the S release followed an increasing trend during the period 0 DAI to 60 DAI but the magnitude of increase was higher from 15 to 45 days. Similar results of higher release between 15-45 DAI reported by Clarson and Ramaswami[2]. Increase in available sulphur content was observed at all the levels of sulphur and poultry manure due to the release of S from the added sulphur and also from the poultry manure.

In neredigonda soils the highest available sulphur 23.1 mg kg^{-1} soil was observed in application of sulphur @ 40 kg ha^{-1} which was statistically at par with higher dose of sulphur (60 kg ha^{-1}) and the lowest was observed 10 mg kg^{-1} in control at 45 days of incubation. The available sulphur content was linear with increasing levels of sulphur @ 20, 40 and 60 kg ha^{-1} and the percentages increase over the absolute control was 49, 81 and 110. Whereas with application of poultry manure @ 2.5 t ha-1 along with above graded doses the increase of available sulphur content 101, 130 and 155 percentages respectively. Similar tred was observed in sonal soils also. (Table 2). Soils of

jakran palli, armor soils shown increasing trent in available sulphur content with graded levels of sulphur and poultry manure application. Whereas Medak soils shown highest release pattern with higher doses of sulphur and poultry manure application.

In all the block and mixed block soils the release of sulphur content was increased with increasing levels of sulphur. These results were agreement with Singh et al Singh[7]Murthy[4:]2004 reported that in shrink-swell soils sorption of sulphat from soils decreased with increasing levels of S application.

The soils of veravalli (yadadri bhongiri district), kothagadi and anantharan (Vikarabad district) shown significant variation in rlease pattern of sulphur. At intial stage to 15 days of incubation, sulphur content was sharply increased after that 30 to 45 days it was static then it was slightly decreased at 60 days.

Effect of incubation period on release pattern of available sulphur content in soils

The release of S was very slow at the beginning *i.e.*, up to 15 DAI and there after the release of S was rapid upto 45 days. It might be due to increase in the strength of mineralization and micro organisms activity increased in this period. These favorable conditions increase the release of sulphur. Sammi Reddy[6]sulphur mineralization in soils amended with organic and green manures followed an initial rapid rate upto 8 to 10 weeks and becom slow after 8 weeks.After 45 DAI, there was slight decrease in the available sulphur content, this might be due to starting of the immobilization and hampered the mineralization and due to reduced microbial activity. These results conform to the earlier finding of Pandian[5].

Effect of soil texture on release pattern of sulphur at different levels of sulphur and poultry manure

Soils of adilabad (neredigona, sonala) was clay loam in nature and clay content was higher (23.2 and 28.1). Clay content influenced the slow release of sulphur. This might be one of the reasons for increasing the available sulphur content up to 45 days These findings are agreement with the results obtained by Srinavasa rao[8] reported that incubation studies indicated that the amount of S release was higher in heavy textured (black vertisols) then light textured (Alfisols). The similar trend was followed by soils of alladurge and appajithanda of Medak soils and Anantharam of vikarabhad. These soils having the textural class of sandy clay loam.

Correlation of sulphur fractions with soil properties

Tha data pertaining to sulphur fractions in different soils norther telanagana has given table 3. Water soluble sulphur content was ranged from 6.9 mg kg^{-1} in Neredigonda soils to 8.4 mg ka^{-1} in Jakranpalli soils. Water soluble sulphur content was negatively correlated with clay content (r = -0.51*). Adsorbed sulphur ranged from 19.2 mg kg-1 in jakran palli soils to 28.7 mg kg^{-1} in sonala. Adsorbed sulphur was positively correlated with clay content (r = 0.78**), higher the clay content adsorption of sulphur also more. Heat soluble sulphur content was positively correlated with clay content (r = 0.83**) and total sulphur (r = 0.73**). Total sulphur content ranged from 263 mg kg^{-1} in Armoor soils to 308 mg kg^{-1} in alladurg soils. These findings are agreement with Biswas *et al.* and Das[2] reported that total sulphur and adsorbed sulphur was positive significantly correlated with clay content and organic matter.

Table 1: Physico chemical properties of selected soils for incubation study

S.No	District	Mandal	Village	Sand (%)	Silt (%)	Clay (%)	Soil textur	pH	E.C ($ds\ m^{-1}$)	OC ($g\ kg^{-1}$)	S ($kg\ ha^{-1}$)
1	Adilabad	Neredigondha	Neredigonda	45.6	31.2	23.2	Clay loam	7.58	0.51	6.7	9.3
2	Adilabad	Boath	Sonala	44.1	27.6	28.1	Clay loam	7.55	0.21	5.4	9.4
3	Nizamabhad	Jakranpalli	Jakranpalli	72.2	19.9	7.9	Sandy loam	7.39	0.41	6.5	8.4
4	Nizamabhad	Nizamabhad	Nizamabhad (Rural)	64.2	16.9	18.9	Sandy loam	7.42	0.24	5.4	6.3
5	Nizamabad	Armor	Amdapur	68.4	21.6	10	Sandy loam	7.65	0.24	5.3	7.2
6	Medak	Alladurge	Alladurge	58.2	15.8	26	Sandy clay loam	7.56	0.34	5.0	8.3
7	Medhak	Alladurge	Appajithanda	63.4	15.5	22.1	Sandy clay loam	7.06	0.32	6.0	7.9

Table 2: Release of sulphur ($mg\ kg^{-1}$) in incubated soils at 0 DAI and 15 DAI

S.No.	Village & District	0 DAI									15 DAI								
		T1	T2	T3	T4	T5	T6	T7	T8	CD (5%)	T1	T2	T3	T4	T5	T6	T7	T8	CD (5%)
1	Neredhi gondha, Adilabad	9.3	9.4	9.7	9.9	9.6	9.7	9.9	10.0	NS	9.3	10.1	11.2	12.4	9.7	12.2	13.5	14.0	2.1
2	Sonala Adilabad	9.4	9.9	10.0	10.1	10.3	10.7	11.0	11.3	NS	10.1	10.6	11.2	12.2	11.0	12.5	13.7	14.9	2.0
3	Jakranpalli, Nizamabhad	8.4	8.7	9.1	9.9	9.0	9.3	9.4	9.5	NS	8.4	9.1	10.6	11.2	8.8	12.4	12.9	13.5	2.1
4	Nizamabhad	7.8	8.2	8.7	9.1	8.4	9.3	9.4	9.6	0.9	7.9	9.6	10.0	12.8	8.5	10.9	12.4	13.7	1.7
5	Armoor, Nizamabhad	7.2	7.4	7.5	7.6	7.4	7.8	7.6	7.9	NS	7.8	11.6	13.1	14.0	8.4	16.6	18.7	20.3	1.9
6	Medak	8.5	8.6	8.8	9.0	8.7	8.9	8.9	9.3	NS	8.7	11.2	14.4	15.0	10.1	16.0	18.1	19.1	1.7
7	Appajithandha, Medak	7.9	8.1	9.1	9.7	8.8	9.7	9.9	10.0	1.3	8.5	10.3	12.6	14.9	9.0	14.4	16.3	19.1	2.7

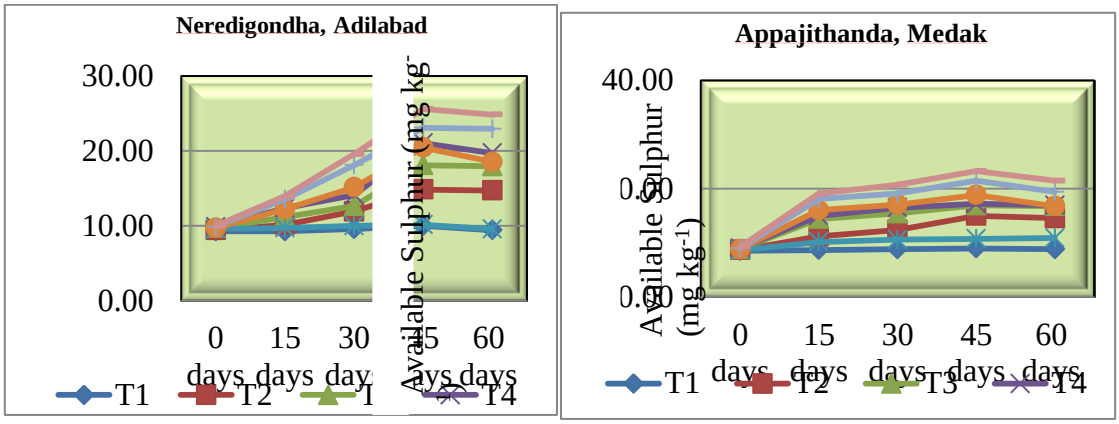
Table 3: Sulphur fractions in selected soils

S. No.	Village & District	Water soluble S	$CaCl_2$ Extractable Sulphur	KH_2PO_4 Extractable Sulphur	Heat soluble Sulphur	Total sulphur
1	Neredhi gondha, Adilabad	6.9	9.3	26.8	36.41	291
2	Sonala Adilabad	7.3	9.4	28.7	37.31	297
3	Jakranpalli, Nizamabhad	8.4	8.4	21.6	32.21	284
4	Nizamabhad	7.9	7.8	24.5	31.32	271
5	Armoor, Nizamabhad	7.5	7.2	19.2	29.56	263
6	Medak	7.8	8.5	27.3	39.71	308
7	Appajithandha, Medak	7.4	7.9	28.3	37.06	288

Table 4: Corrilation of sulphur fractions with organic carbon and clay content

	Water soluble S	CaCl2 Extractable	Adsorbel Sulphur	Heat soluble sulphur	Total Sulphur	Organic carbon	CLAY CONTENT
Water soluble S	1	0.05	-0.53	-0.25	-0.25	0.11	-0.51
CaCl2 Extractable		1	-0.074	0.37	0.13	0.39	0.15
Adsorbel Sulphur			1	0.66*	0.69*	-0.25	0.78**
Heat soluble sulphur				1	0.83**	0.28	0.83**
Total Sulphur					1	0.06	0.73**
Organic carbon						1	0.09
CLAY CONTENT							1

Fig. 1: Effect of sulphur levels and poultry manure on release pattern of soil



CONCLUSIONS

The release pattern of sulphur was highest up to 45 day of incubation period and after that it was constant. Increasing levels of sulphur and poultry manure significantly increased the available sulphur content in soils. Soil texture (clay content) was significantly influenced the release pattern of sulphur and higher the clay content release of sulphur content also higher and it influences the slow release in the soils.

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