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Short Communication

RELEASE OF SULPHATE SULPHUR FROM GYPSUM AND ELEMENTAL SULPHUR IN SOIL UNDER SUBMERGED CONDITION

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Submergence of a soil creates unique chemical and biological environment which markedly affects sulphur transformations (Freney and Boonjawat, 1983). Few workers (Freney and Boonjawat 1983, Kamprath and Till 1983) have studied the sulphur transformations occurring in flooded soils as a whole and even fewer (Chaudhury and Cornfield 1967) have examined the reactions occurring in the aerobic or anaerobic zones. A measure of relative effectiveness of sulphate and elemental sulphur as plant nutrients on lowland and upland soils is needed. In this study release of sulphate sulphur from gypsum and elemental S in soil under submerged condition was observed in an incubation experiment.

Soil samples (0-15 cm depth) collected from Naraibag and Kalma series were silty loam and silty clay, pH being 6.7 and 7.7, organic matter, 2.05 and 0.94 per cent; total and available S, 32.9, 350 and 9.5, 210 ppm respectively. 10g (2 mm) soil sample was taken in each test tube (2.5 cm x 15 cm size) and mixed thoroughly with gypsum and elemental S each @ 0, 10, 20, 30 and 40 kg S/ha. A separate treatment containing calcium oxide (70.5 kg/ha) was also included in the experiment to compare the additional effect, if any, of calcium coming fromgypsum. The test tubes were kept submerged (3 cm water above soil surface) and covered with polythene film. The treated samples were incubated at 30°C$\pm$ 1°C. The treatments with three replications were randomized in block.

Soil samples were collected periodically at 0, 7, 15, 30 and 60 days of incubation to determine calcium dihydrogen phosphate (500 ppm P) extractable sulphate turbidimetrically following the method of Chesin and Yien (1950) modified by Sakai (1978).

The release of sulphate from gypsum and elemental S in Naraibag and Kalma soils during every sampling was statistically significant at 5 to 0.1 per cent level (Figs. 1 - 2). The data showed that amount of sulphate estimated varied with rates and sources of added S. However, the trend of sulphate release

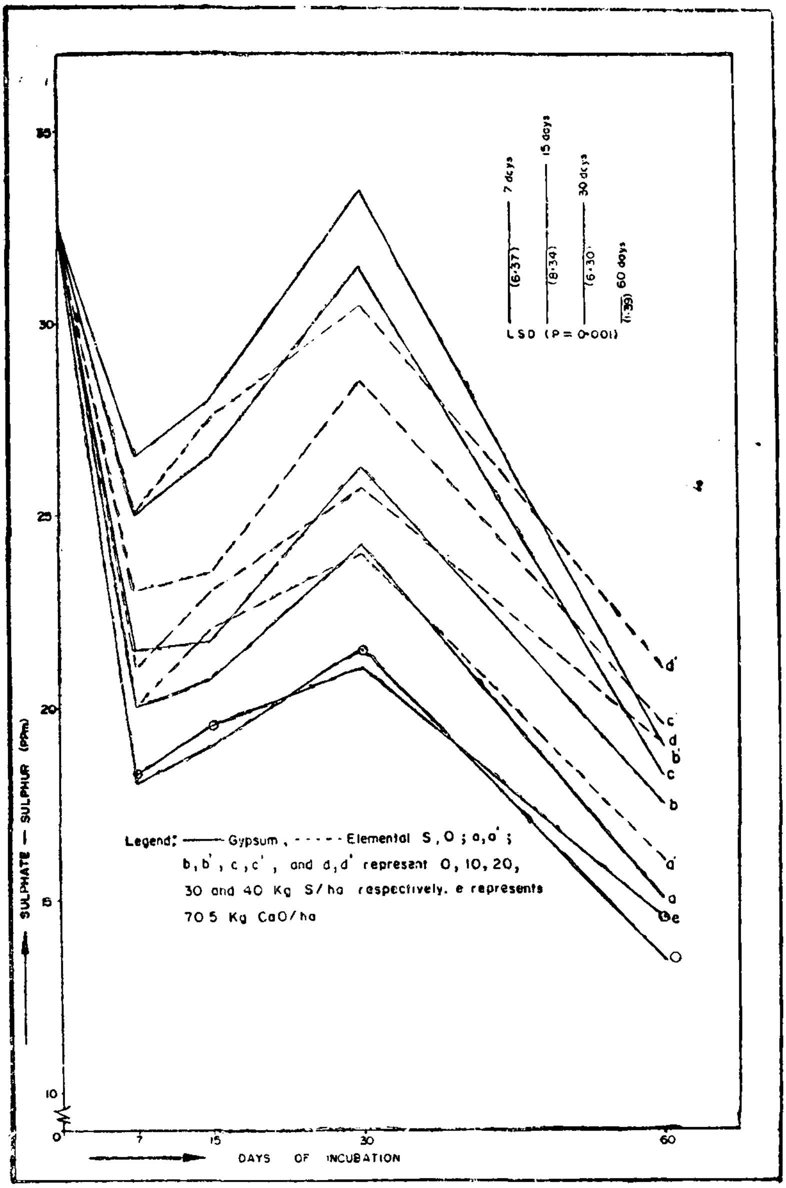
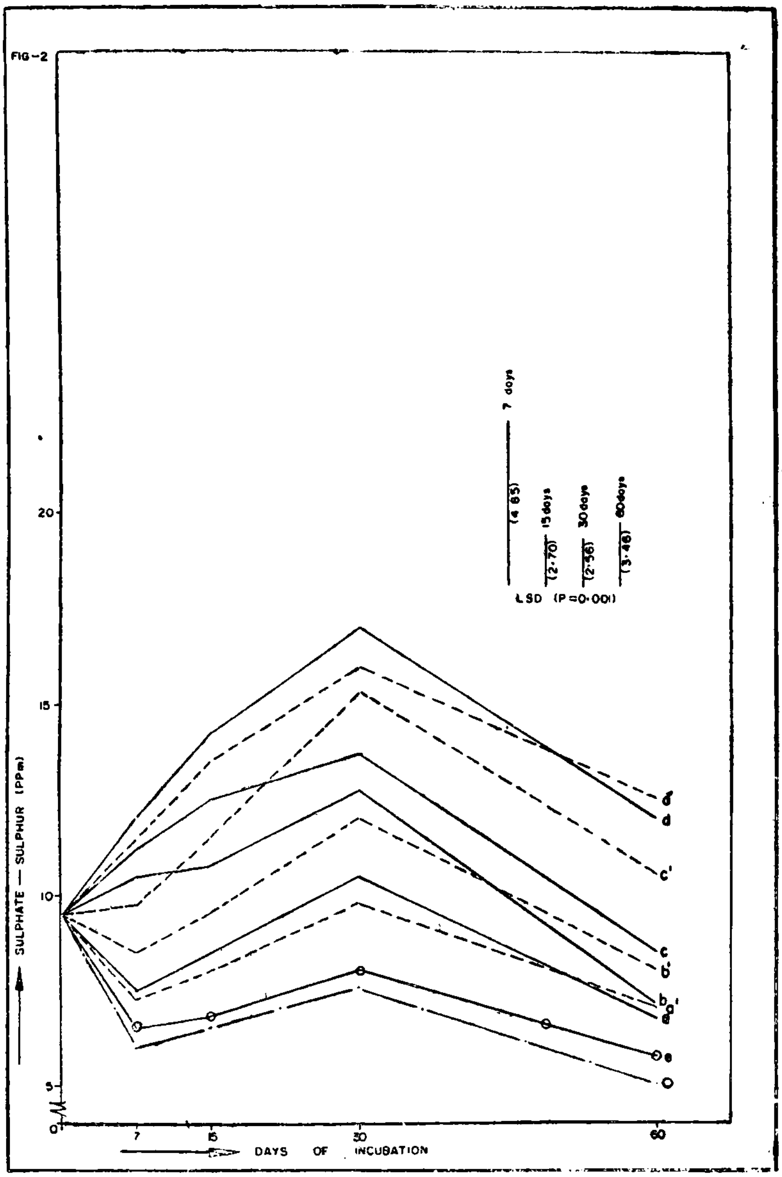


Fig. 1. Changes in extractable sulphate with time in Naraibag soil.
Legend : O; A, A'; B, B'; C, C'; and D, D' represent 0, 10, 20, 30 and 40 kg S/ha respectively. E represents 70.5 kg CaO/ha.



Days of incubation

Fig. 2. Changes in extractable sulphate with time in Kalma soil. Legend same as Fig. 1.

was similar in both the soils. The amount released from two sources did not differ very much. The release of sulphate increased gradually from 7 days of incubation with an initial immobilization upto 7 days in most of the treatments On reaching maximum the value decreased slowly with time. Sakai (1978) also reported from an incubation experiment the highest concentration of sulphate after 7 days. This was followed by gradual and sharp decline with time. Anaerobic incubation of soil caused an increased mineralization of sulphur as reported by a number of workers (Freney 1958; Barrow 1961; Williams 1967; Tabatabae and Bremner 1972).

It can be seen that in either of the soils maximum amount of sulphate recorded was at 30 days run. With time the concentration of sulphate decreased. This declining phase may be associated with microbial immobilization of S. Similar views were also expressed by Alexander (1961) who reported that the inorganic product of S is utilized by the microflora for cell synthesis.

On comparison of the sources, it may be seen that the amount of sulphate released from gypsum during 60 days run was significantly lower than from elemental S irrespective of the treatments in both the soils. However, the amount of sulphate measured during 30 days run was slightly higher from gypsum than from elemental S though not significantly. This suggested that assimilation of sulphate by soil population is favoured by gypsum.

It is noted that about 30 to 74 per cent and 23 to 66 pe cent of S was mineralized during 60 days incubation from Naraibag and Kalma soil respectively. Attoe and Olson (1965) reported that at the end of a 4-week incubation period, nearly 50 per cent of added sulphur had been oxidized. Though low, Zhu *et al.* (1982) also found that 3.8 to 15.6 per cent of the organic sulphur was mineralized during a 10-week incubation of soil under saturated conditions. Mineralization of only about 2 per cent of organic sulphur during two week incubation period was reported by Williams (1967). This variable rate of mineralization might be associated with soil properties and environmental conditions. The release of sulphate was generally higher in Naraibag soil as compared to Kalma soil irrespective of the treatments. This was probably due to higher organic matter content of the former soil.

Soil samples treated with calcium oxide showed no significant change in extractable sulphate in both the soils over control. This indicated that calcium in gypsum had either limited or no contribution on sulphate release from gypsum.

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