Chapter - I

Introduction
SULPHUR (S) has been recognised as an essential element for the growth of plants and animals. Its role in the synthesis of protein being a constituent of amino acids [cystine (27% S), cysteine (26% S) and methionine (21% S)], chlorophyll and oil of pulses and oilseeds. Further it plays an important role to improve nutritive value of forages. Sulphur also promotes nodulation in legumes and thus improves marketing quality by producing bold grain of the pulses and oilseeds.

Its significance as a fertilizer nutrient has not been given due recognition earlier due to primary reason (i) low yield subsistence agriculture has been exploiting the natural reserves of soil "S" and (ii) S is supplied to agro-ecosystems from the atmosphere through rain, dust and by gaseous absorption. Also, the irrigation water, manures and fertilizers (ammonium sulphate and single superphosphate etc.) contribute significantly for addition of S. Therefore, the need of S fertilizers was not felt for a long time.

Now, in modern agriculture, the replacement of ammonium sulphate with urea and single superphosphate with triple superphosphate/diammonium phosphate in intensive
cropping with high yielding varieties have exhausted nutrient reserves thus creating a large gap (-3.38 kg S ha⁻¹ on net basis, Tandon, 1991) in the soil system between the S supply and removals. This imbalance of nutrients in the soil, especially in high S demanding crops like pulses and oilseeds has shown its deficiency, which results not only consequent drop in yield and quality but also affect the efficiency and economic use of other applied nutrients.

Sulphur deficiency in plant resemble those of nitrogen, that is the appearance of pale yellow or light green leaves unlike N, S- deficiency symptoms appear first on the younger leaves, and will persist even after N application. Plants deficient in S are small and spindly with short slender stalks, growth is retarded, maturity in cereals delayed, nodulation in legumes may be poor and N-fixation reduced, fruits often do not mature fully and remain light green in colour. Sulphur deficiency also causes deterioration in quality due to reduction of the "S" containing amino acids (cystine, cysteine and methionine) and oil content in pulses and oil-seeds thus the proteins and oil in pulses, oilseeds and cereals creating malnutrition.

Pulses and oilseeds are more responsive to S. Its unit application in S deficient soil increases grain yield of mustard by 7 units, of groundnut by 5 units and oil content by 8.5 per cent in mustard, 5.1 per cent in
groundnut. 3.8 per cent in sunflower, 7.3 per cent in rai and 6.8 per cent in soybean. Sulphur also, increases the yard stick value by producing 7-8 tonnes of oilseeds equivalent to 3-3.5 tonnes of edible oil. The crop response also depends upon the sources of S of their preference and conditions. Single superphosphate and gypsum have an edge over others for groundnut because they contain calcium. Ammonium sulphate is a better source of S for application to standing crops and elemental S is an efficient source of S in certain calcareous soils.

Since, Soybean [Glycine max (Linn.) Merril] is a leguminous oilseeds crop. Its response to sulphur in the deep black soil has not been studied. Hence, the present investigation was undertaken with the following objectives:

1. To study the response of sulphur application on growth and yield parameters, i.e. the production potential of soybean crop.
2. To evaluate the effect of different levels of sulphur on chemical composition and nutrient uptake of soybean.
3. To evaluate the effect of different levels of S on the protein and oil content in soybean.
4. To evaluate the effect of S levels on uptake of other major nutrients.
5. To find out the optimum S levels for deep black soils of M.P.
6. To evaluate the best source of S application for deep black soil of M.P.

7. To find out the per cent utilization of fertilizer S in the deep black soils.

8. To find out yard stick and harvest index of soybean under different S levels.