PLANT NUTRITION TODAY

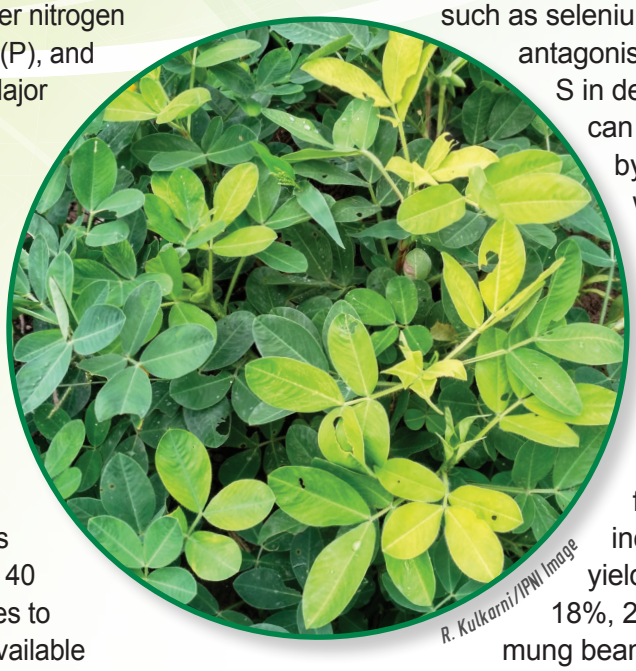
2018 ISSUE 3, NO. 5

SULFUR MANAGEMENT IN INDIA: WHERE DO WE STAND?

Dr. Sudarshan Dutta
Deputy Director, South Asia Program
sdutta@ipni.net

There is a need for farmers in India to increase their focus on sulfur (S) management. Sulfur is now recognized as the fourth most important plant nutrient in the country after nitrogen (N), phosphorus (P), and potassium (K). Major soil types such as alluvial soils and the highly weathered and leached lateritic soils will commonly show low S availability. Recent soil fertility surveys performed across India have found 40 to 46% of samples to be low in plant-available S. When the survey data was organized into regions, the incidence of S deficiency was highest in southern India (63%) followed by its western (45%), northern (42%), and eastern (35%) regions. It was reported that the S deficiency was more severe in the rain-fed zones of India compared to those that were irrigated since irrigation water is an important source of S.

The need for S is partly determined by crop type. In general, S concentration is highest for oilseeds > legumes > forages > pulses > cereals. Generally, plant S uptake is similar to P uptake on an elemental basis. For example, if crop P uptake was equal to 100 parts, then S uptake would commonly be 180 parts for rapeseed mustard, 135 parts for perennial grass, 75 parts for a pulse crop, and 60 parts for a cereal.



Typical S deficiency in groundnut shown as yellowing of younger leaves. The soil analysis revealed low plant-available S.

Optimized S application enhances all nutrient uptake and use efficiency through synergism, and it suppresses the uptake of potentially undesirable elements such as selenium (Se) through antagonism. Application of S in deficient Indian soils can increase rice yields by about 17% and wheat yields by 25%. For mustard, groundnut, and soybean, yield increases have been up to 30%, 32%, and 25%, respectively. Sulfur fertilization has increased the grain yield of chickpea by 18%, 28% in lentil, 20% in mung bean, 20% in urd bean, 22% in pigeon pea, 32% in field pea, and 33% in cowpea.

Field studies on calcareous soil growing a rice-maize cropping system; as well as on lateritic and alluvial soils growing rice-rice, consistently find higher yields (and profitability) if S is applied (**Table 1**).

Sulfur application also enhances crop quality. Sulfur application increases oil content in seed, starch content in tubers, fiber strength of cotton and jute, and baking quality of wheat flour. A study from Punjab State reported an

PLANT NUTRITION TODAY is a monthly publication of compiled scientific information developed by the International Plant Nutrition Institute (IPNI). Website: http://www.ipni.net/pnt

“Better crop yields and improved nutrient use efficiency are best ensured by providing enough plant-available S early in a crop’s growing season.”

Treatment	Yield, t/ha						Gross return over fertilizer cost, ‘000 INR/ha					
	Calcareous soil		Lateritic soil		Alluvial soil		Calcareous soil		Lateritic soil		Alluvial soil	
	Rice	Maize	Rice[1]	Rice[2]	Rice[1]	Rice[2]	Rice	Maize	Rice[1]	Rice[2]	Rice[1]	Rice[2]
With S	6.8a	9.8a	5.7a	7.1a	6.1a	7.9a	91a	125a	76a	96a	82a	107a
Without S	6.4b	9.0b	5.1b	6.9b	5.8b	7.7b	86b	115b	68b	93b	78b	104b

Rice[1] = rainy season crop; Rice[2] = summer season crop. Values within columns followed by different letters are significantly different ($p \leq 0.05$). 1 US$ ≈ INR 71 (Indian Rupee).

increase of 15 to 30% in oil yield for a range of crops receiving S fertilizer.

Evidence suggests this increase in oil yield happens because S improves both seed yield as well as oil content in the seed.

A wide range of S-containing or straight-S fertilizers are available for farmers in the Indian retail market. Fertilizers containing primary nutrients such as single superphosphate (SSP), potassium sulfate, ammonium sulfate, ammonium phosphate sulfate, are good sources of S. Less soluble forms like gypsum, phosphogypsum, and elemental S are also commonly applied. Easily soluble forms of S such as ammonium sulfate, potassium sulfate, and sodium sulfate are preferable in neutral to slightly alkaline soils, or S-deficient calcareous soils, since they are immediately plant available.

The right rate of S application depends on crop type, crop rotation, soil S (and other nutrients) status, crop yield potential, cropping intensity, crop management, and environmental factors. Optimum rates for sulfate-S sources can vary from 10 to 100 kg S/ha.

Sulfur is primarily applied to the main crop in a cropping system and the residual effect is relied upon for any following crop. The right rate is crucial to supply the succeeding crop with an adequate supply of S. Physiological functions such as photosynthesis, enzyme activities, etc. are severely affected by S deficiency especially in the initial growth stage of the plants. Better crop yields and improved nutrient use efficiency are best ensured by providing enough plant-available S early in the crop’s growing season.

References

Tandon, H.L.S. 2011. Fertiliser Development and Consultation Organisation, New Delhi, India. pp 204.

IPNI International Plant Nutrition Institute

5550 Triangle Parkway, Suite 300, Peachtree Corners, GA 30092-6515 U.S.A.
Phone: 770-447-0335 | Fax: 770-448-0439 | www.ipni.net