RESPONSES OF COTTON TO ZINC- A REVIEW

K.Ramesh and B.Chandrasekharan

Department Of Agronomy,
Tamil Nadu Agricultural University,Coimbatore -641003,India

ABSTRACT

Modern fertilizer technology and the increasing frequency with which micronutrients are involved in fertility problems emphasises the need for an appraisal of these nutrients in relation to cotton production. Among the micronutrients, zinc has assumed greater significance due to the wide occurrence of its deficiency. There are many reports indicating the favourable response of cotton to micronutrients. Application of zinc sulphate to zinc deficient soil improved fertilizer use efficiency and resulted in higher seed cotton yield. However, the work done on micronutrients in cotton was abysmally low and therefore, elaborate experimentation are yet to be made so as to prescribe site specific recommendations.

Modern fertilizer technology and the increasing frequency with which micronutrients are involved in fertility problems emphasises the need for an appraisal of these nutrients in relation to cotton production intensive and multiple cropping with high yielding varieties of cotton had resulted in the zinc deficiency in soil. Among the micronutrients, zinc has assumed greater significance due to the wide occurrence of its deficiency (Kanwar and Randhawa, 1974). It has now become one of the major constraints in getting higher cotton yields. But so far energy expended on the micronutrient nutrition in cotton had hardly matched the magnitude of demand. Hence, an attempt has been made to review the work done to find out the response of cotton to zinc.

Zinc deficiency in India: The alluvial soil of Madhya Pradesh (Gird region) is about 72 per cent deficient in zinc (Khamparia et al., 1984). Zinc is the most important limiting plant nutrient after NPK in the calcareous soil belt of north Bihar where major portions of the soils are deficient in available zinc (Sakal et al., 1985). Considering the entire state of Tamil Nadu, the deficiency of zinc is 52 per cent (Anon.1992). Under micronutrients, especially, zinc is the most limiting nutrient whose magnitude of deficiency in black soil region of Madhya Pradesh exceeds 41 per cent (Khamparia; 1996). In Punjab coarse textured soils are largely deficient in zinc (Singh and Nayyar, 1997).

Functions of zinc: Zinc is necessary for the normal functioning and growth of cotton. It functions as metal activator of enzymes and is believed to promote nucleic acids. It is a constituent of the enzyme carbonic anhydrase. It seems to be more important as it plays an important role in protein synthesis. It activates NADPH dependent dehydrogenase involved in fat synthesis (Gupta and Vyas, 1994). Zinc is actively involved in nitrogen and protein metabolism by controlling RNAse activity and carbohydrate metabolism (Sharma et al., 1981). Zinc is involved in photosynthesis and sugar transformation. It is required for the maintenance of membrane integrity. In addition, zinc is involved in the synthesis of Indole Acetic Acid, an important plant growth hormone.

Diagnosis of zinc deficiency: Diagnosis of zinc deficiency can be made based on leaf symptoms. Leaf symptoms may appear in the early seedling stage itself. The leaves may be smaller than normal. The deficient plants exhibit general bronzing of the first few leaves and often-pronounced interenal chlorosis. Leaf thickening and cupping upward of leaf edges occurs. The chlorotic area may develop brown patches and the plant become bushy in nature. It delays maturity, reduces the boll size, and ultimately affects the yield.
Generally, zinc deficiency can be expected in calcareous soil, high phosphate added soils, exposed sub soils and sands. Coarse textured soil and cool wet season also aggravates the deficiency. The critical level of zinc in soil is 1.2 ppm (DTPA extractable). Optimum level of zinc in soil at vegetative stage is 20- 30 ppm.

**Responses of cotton to zinc:** In areas of known zinc deficiency, the most widely used method of treatment is the application of zinc sulphate in soil/foliar spray of zinc sulphate or other zinc sources as a part of regular fertilization programme. The recommended rate ranges from 10 - 25 kg ha\(^{-1}\).

Response of cotton to zinc have been reported by Ohki (1976; a; b). Nageswararao (1976) found that the application of zinc as zinc sulphate @ 30 kg ha\(^{-1}\) in soil or 0.3 per cent foliar spray increased cotton yield 21 and 29 per cent respectively, subject to the seasonal influence. Zinc sulphate application to the soil @100 kg ha\(^{-1}\) resulted in significant yield increase in cotton MCU-5 in black soils of Kovilpatti, Tamil Nadu. Nevertheless, it was comparable with 0.5 per cent foliar spray, which was economical (Thiagarajan, 1980). Vin (1986) and Sharma et al. (1987) also reported the response of cotton to zinc. Randhawa (1988) reported the favourable response of cotton to micronutrients and concluded that application of Zinc sulphate to zinc deficient soil improved fertiliser use efficiency and resulted in higher seed cotton yield.

Addition of hydrated zinc up to 10 ppm to zinc deficient soil increased cotton yield and thereafter-additional zinc augmented negative response (Jai Kashyap et al., 1989). Takkar et al., (1989) concluded that response to zinc was more pronounced in medium deep black soils, with 220 kg ha\(^{-1}\) followed by alluvial soil with 120 kg ha\(^{-1}\) and also in deep black soil with 90 kg ha\(^{-1}\).

Sharma and Gupta (1990) reported that zinc sulphate application @ 25 an 50 kg ha\(^{-1}\) respectively gave 2.03 and 2.1 t ha\(^{-1}\) of cotton yield, whereas the control gave 1.71 t ha\(^{-1}\). Zinc application resulted in increased seed cotton yield, lint index and reduced fibre irregularity (Tandon, 1993). Namdeo et al. (1992) found that foliar spray of 'Micnef' (a balanced micronutrient combination containing zinc 46,000-56,000 ppm) at 30.65 and 95 DAS @ one per cent augmented higher seed cotton yield in cotton hybrid JK Hy 1.

Mangala Prasad and Rajendra Prasad (1994) reported that application of zinc sulphate 25 kg ha\(^{-1}\) along with NPK produced significantly more cotton bolls than control. But the quality parameters such as ginning out turn, lint/boll and seed index remained unaltered.

Venkatakrishnan (1994) concluded that application of 25 kg zinc sulphate ha\(^{-1}\) with various fertiliser levels registered higher fruiting branches per plant and flower production per plant over the control but the effect was not significant. Wankhade et al., (1994) concluded that foliar spray of 0.5 per cent zinc sulphate increased seed cotton yield, bolls/ plant, yield per plant and ginning percentage non-significantly.

Khurana et al. (1996) reiterated the improvement in seed cotton yield due to the application of zinc sulphate. Prasad and Prasad (1996) concluded that zinc sulphate 25kg ha\(^{-1}\) may be applied to obtain higher cotton production. Zeng qing fang (1997) reported that application of zinc to calcareous soil increased seed cotton yield 7.8 - 25.7 per cent.

From the foregoing review, it is evident that the work done on micronutrients in cotton was abysmally low. Therefore, elaborate experimentation are yet to be made so as to prescribe site specific recommendations, package techniques as applicable to various locations to circumvent the maladies of mal micronutrients’ supply to cotton production.
and to accomplish manifolding fruition in cotton growth and development.

Under the circumstances, the authors have attempted the above review. This will serve as a foundation to build up further work on management of micronutrients in cotton to achieve all desiderata in cotton production.

REFERENCES
