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Micronutrients : Macro Issues

Eight elements *viz*. iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), nickel (Ni), boron (B), molybdenum (Mo) and chlorine (Cl) have been established to be the essential micronutrients. Based on the form of absorption by plants, these are further grouped as cationic (Fe, Zn, Mn, Cu and Ni) and anionic (B, Mo and Cl) micronutrients. Micronutrients are no way micro in terms of their role. Required in small quantities these are as essential as macronutrients because one million atoms of nitrogen are of no use if one molybdenum atom is not present. Micronutrients are indeed playing a macro role in augmenting crop yields and addressing the problem of malnutrition in human beings and livestock.

Micronutrient deficiency in soils and crops is increasing and has become a growing concern worldwide. Global study by Sillanpaa in 1982 indicated the occurrence of deficiencies of zinc and boron in almost every country. Reports of *khaira* disease in rice due to zinc deficiency as early as in 1965, gave impetus to micronutrient research in India. Green Revolution era witnessed the progressive appearance of the micronutrient deficiencies in the sequence of zinc, iron, boron, manganese and molybdenum. Following GPS-based grid sampling approach the ICAR - All India Coordinated Research Project on Micro-and Secondary Nutrients and Pollutant Elements in Soils and Plants has reported 43.4, 20.3, 14.4, 7.9 and 6.1% of 1,27,751 soil samples to be deficient in available zinc, boron, iron, manganese, and copper, respectively.

Zinc and iron pose critical nutritional issues as their deficiencies cause severe impairment of animal/ human health. In human nutrition, deficiencies of zinc and iron occupy 5th and 6th place, respectively among top ten leading causes of illness and diseases in low income countries. From plant, animal and human nutrition point of view, zinc, boron and iron have become critical in the country. A systematic study on zinc in soil-plant-animal/human continuum has suggested a strong link of soil zinc status with grain/ seed zinc density and zinc levels in animal/human blood serum. In addition, location-specific manganese deficiencies in wheat in coarse textured low organic matter soils under rice-wheat system and also those of molybdenum on leguminous crops on tropical acid soils cause loss in productivity of food-grain crops.

Responses to the application of micro-nutrients in severely deficient soils are at times so spectacular that the content of the applied nutrient in produce becomes less than that in the control plots, referred to as the dilution effect. Dose optimization in case of boron and molybdenum is particularly important as difference in rate of application producing optimum and reduced yields is very narrow.

Problems of micronutrient nutrition in human beings are more complicated. For example, zinc deficiency occurs in plants if its concentration in the tissues is less than 25 ppm. But for human nutrition, optimum zinc concentration in edible grain should range between 40-60 ppm. Thus healthy plants may produce grains typically sub-optimal in zinc content for humans. Poor translocation of iron from the straw to edible endosperm complicates the iron nutrition in humans. Enrichment of crops, especially cereals with micronutrients at the source itself (bio-fortification) is the best option for alleviating their deficiencies.

A variety of micronutrients carrying fertilisers are available in the country. These include 17 straight micronutrient fertilisers, 23 fortified fertilisers with zinc and boron, 30 crop- and area- specific customized fertilisers, 204 state-specific micronutrient mixtures, and a number of 100% water soluble mixtures of fertilisers with secondary and micronutrients. Sulphate salts of zinc, iron, manganese and copper; borax and sodium/ammonium molybdate are the major micronutrient carriers. Zinc sulphate (available both as hepta and monohydrate) consumption is maximum (188,300 tonnes in 2015-16) followed by 21,200 tonnes of iron sulphate and 20,000 tonnes of borax. Chelated sources, although

agronomically more effective than the respective sulphate salts, have not found favor because of exorbitantly higher prices. Soil and crop specific micronutrient mixture fertilisers are notified by states but some of these grades have not been updated / revised in last 25 years.

Encouraging the production and use fertilisers fortified with micronutrients is the ideal strategy to overcome the problem of micronutrient deficiencies in Indian soils. However, fortified fertilisers have not come to the market because of price anomalies. For example, the zincated urea (2% Zn) was notified in FCO in 1992 but its commercial production has not started so far because the actual cost of coating urea with 2% zinc is about Rs. 2,500 per tonne but the government notified MRP of zincated urea allows recovery of just Rs. 540 per tonne.

The benefits of micronutrient application on foodgrain crops are enormous. Zinc fertilization alone has a potential of producing additional grains of worth more than Rupees 200 billion . Micronutrient use has not picked up the desired momentum despite their agronomic and nutrition advantages. There are a number of constraints which are inhibiting use of micronutrients. Inadequate extension and promotional activities continue to be the number one constraint. Inadequate facilities for testing of the soils for micronutrients further exacerbate the problem. Quality of micronutrient products remains a concern. Both sampling and analysis of micronutrients are not up to the standards.

Quality research, aggressive extension and promotional activities, and availability of quality products are below par. One of the reasons for the state of affairs is lack of conducive policy environment. Government of India has taken steps to promote micronutrient use under different schemes viz., National Food Security Mission (NFSM) (October 2007), Policy Guidelines for Customized Fertilisers (March, 2008), Policy for Fortified/ Coated Fertiliser (April, 2008), Nutrient Based Subsidy (NBS) Scheme, Soil Health Management under NFSM (April, 2014), and Soil Health Card (SHC) Scheme (February, 2015). All these schemes are for incentivizing the use of micronutrients but yet to yield desired results on the ground. There are several policy interventions required to bring about a change to promote adequate use of micronutrients.

Government policy of encouraging the production and use of fortified/coated fertilisers needs a review. Further micronutrients should attract lower rate of customs duty and GST at par with other fertilisers.

The fertilisers are classified under Chapter 31 of the First Schedule to the Customs Tariff Act, 1975 (Import Tariff). However, in case of micronutrients, the classification was changed from Chapter 31 to Chapter 28 (inorganic chemicals) with effect from 6th April, 2016. The change in classification has resulted in much higher rate of customs duty on import of micronutrients raw materials and products. This has increased the farmers price. All fertilisers listed in Fertiliser (Control) Order, 1985 should be kept in the Chapter 31 and micronutrient fertilisers should attract lower rate of customs duty and GST at par with other fertilisers.

Emerging multi-micronutrient deficiencies poses further challenge to policy makers. Precise monitoring of multi-nutrient deficiencies in soils and crops would be needed to evolve the corrective strategy. Use efficiency of applied micronutrients, continues to be abysmally low, ranging between 1-5%. Enhancing use efficiency of applied micronutrients needs two-pronged strategy of developing innovative products and optimum doses based on 4R Nutrient Stewardship to make the micronutrient use in Indian agriculture more attractive and remunerative. Results emerging from laboratory, green houses and field studies indicate that such a strategy will enhance the use efficiency of applied micronutrients into double digits.

Government policy of encouraging the production and use of fortified / coated fertilisers needs a review. Policy should at least allow for recovery of cost of micronutrients and coating/fortification to make it viable for manufacturers. Therefore, a multipronged approach should include research, technology transfer through extension, sampling and testing facilities and pricing policies of the government to address the issues at hand. Better partnership among all the stakeholders *i.e.* scientists, industry, government and farmers is the need of hour to address the problem of micronutrient malnutrition in soil-plant-animal-human system. ■