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ROLE OF ZINC IN CROPS AND HUMAN HEALTH

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Zinc deficiency in soils and crops

Zinc has emerged as the most widespread micronutrient deficiency in soils and crops worldwide, resulting in severe yield losses and deterioration in nutritional quality. It is estimated that almost half of the soils in the world are deficient in zinc. Since cereal grains have inherently low concentrations, growing these on the potentially zinc deficient soils further decreases grain zinc concentration. India is not an exception. About 50 per cent soil samples analysed for available zinc were found deficient in India. There is a significant response to applied zinc in the soils deficient in zinc. In India, zinc is considered the fifth most important yield limiting nutrient after N, P, K & S in upland crops whereas in lowland crops like rice, it is next to N. The reasons responsible for the increase of incidences of zinc deficiency include large zinc removals due to high crop yields and intensive cropping systems, lesser application of organic manures, use of high analysis fertilizers and increased use of phosphatic fertilizers resulting in P induced zinc deficiency Prasad 2006. Diagnosis of Khaira disease in rice in Tarai soils of Pantnagar is the first catalogued zinc deficiency in India by Dr. Y.L. Nene in 1965. Since then, there has been considerable research in India on zinc under the All India Coordinated Research Project on Micronutrients of the Indian Council of Agricultural Research (ICAR). The zinc deficiency in India is expected to increase from the present level of around 50 per cent to 63 per cent in 2025 if the trend continues. This is also because more and more areas of marginal lands are brought under intensive cultivation without adequate micronutrient supplementation.

Zinc – Essential for life

Zinc is an essential nutrient for human health. There is no life without zinc. Recently, zinc deficiency - especially in infants and young children under five years of age - has received global attention. Zinc deficiency is the fifth leading cause of death and disease in the developing world. According to the World Health Organization (WHO), about 800,000 people die annually due to zinc deficiency, of which 450,000 are children under the age of five. It is estimated that 60- 70 per cent of the population in Asia and Sub-Saharan Africa could be at risk of low zinc intake. There is a high degree of correlation between zinc deficiency in soils and that in human beings. It is estimated that about one third of the world's population suffers from zinc deficiency. Zinc is vital for many biological functions in the human body Das and Green 2011. The adult body contains 2-3 grams of zinc. It is present in all parts of the body, including: organs, tissues, bones, fluids and cells. It is vital for more than 300 enzymes in the human body, activating growth - height, weight and bone development, growth and cell division, immune system, fertility, taste, smell and appetite, skin, hair and nails, vision. Some of the reported symptoms due to zinc deficiency in humans, especially in infants and young children, are diarrhoea, pneumonia, stunted growth, weak

immune system, retarded mental growth and dwarfism, impaired cognitive function, behavioural problems, memory impairment, problems with spatial learning, and neuronal atrophy.

Zinc malnutrition - Possible solution

The possible solution to zinc malnutrition in the humans may be, i) Food Supplementation, ii) Food Fortification, and iii) Biofortification. The former two programmes require infrastructure, purchasing power, access to market and health care centres and uninterrupted funding, which have their own constraints. In addition, such programmes will most likely reach the urban population, which is easily accessible, especially in the developing countries. Alternatively, the latter programme, biofortification - fortification of crops especially cereals crops with zinc - is the best option for alleviating zinc deficiency. It will cater to both the rural and urban populations. It could be achieved through two approaches, Genetic Biofortification and Agronomic Biofortification. There is a developing field of research on the biofortification of plant foods with zinc. This involves both the breeding of new varieties of crops with the genetic potential to accumulate a high density of zinc in cereal grains (genetic biofortification) and the use of zinc fertilizers to increase zinc density (agronomic biofortification). Although the plant breeding route is likely to be the most cost effective approach in the long run, the use of fertilizers is the fastest route to improve the zinc density in diets. In order to replenish the zinc taken up by the improved cultivars, higher and sustainable use of fertilizers is inevitable.

Zinc in balanced fertilizer use – Challenges

• Availability of zinc fertilizers at the time of need of the farmers
• Quality of zinc fertilizers available in the market
• Soil – plant – animal – human continuum study on zinc
• Lack of awareness of the extension and promotional workers
• Lack of awareness of the farmers – last mile delivery

Way forward

• Balanced fertilizer use with micronutrients including zinc is inevitable for higher crop yields
• Urgent need to increase awareness among farmers and extension workers for increased use of zinc fertilizers
• Fertilizer industry to ensure timely availability of quality zinc fertilizers at the time of need of the farmers

Zinc deficiency in crops and humans is a critical issue and a global challenge. We need to ensure food security and nutritional security. The viable solution in addressing zinc deficiency is – higher use of zinc fertilizers.

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