

Promotion of Zinc Fertilizer Use for Sustainable Food and Nutrition Security

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The population of Bangladesh is still well short of the recommended Daily Allowance (RDA) of food intake for the key nutrients. The prevalence of subclinical vitamin A deficiency was 20.5% in the preschool age children. The prevalence in the school age children in the slums was 27%. The prevalence of anemia in the preschool age children was 33.1%. The national prevalence of iron deficiency was 10.7% in the preschool age children. The national prevalence of zinc deficiency was 44.6% in the preschool age children. The amount of consumption of zinc was well below the recommended daily amount. Of the total consumption majority comes from plant origin.

Bumper production from limited lands through exploiting hybrids and high yielding varieties (HYV) has led to widespread soil fertility depletion in Bangladesh. The situation worsened by fertilizer nutrient imbalance and serious nutrient gap between plant use and fertilizer application and mining out scarce native soil nutrients to support increasing yield of food crops. Furthermore, farmers mainly use N, P, K and S fertilizers and reluctant to apply micronutrients e.g. zinc, boron etc. which are essential for plant growth. This imbalanced use of fertilizers caused nutrient deficiencies in soils, crops and public health is the ultimate victim for this havoc. About 93% of Bangladesh soil are deficient in zinc and for the pervasive effect of zinc deficiency in soils and crops about 55% of the population have zinc deficiency problem which ranks Bangladesh on the top of zinc deficient nations. The zinc deficient soils are also behind the low-zinc diets of the country which is responsible for stunting growth of about 50% of the population particularly the children. While deficiencies of macronutrients are easily visible, the micronutrient deficiency is invisible which is colloquially termed as “hidden hunger”. Among the micronutrients zinc (Zn) is the forefront. Next to nitrogen (N) and phosphorus (P) deficiency, Zn deficiency is now considered the most widespread nutrient disorder affecting the required levels of



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zinc content in the edible portion of crops in Bangladesh. The lower content of zinc in the edible portion of crops have pushed the nation to suffer from severe malnutrition and also dictated the researchers of the world including Bangladesh to take innovative measures on biofortification of crops through balanced fertilizer applications as well as molecular breeding techniques. Recently, Bangladesh Rice Research Institute (BRRI) released four zinc-rich rice varieties in collaboration with international research institutes to boost zinc intake of the mass. Bangladesh Agricultural Research Institute (BARI) has also been working on releasing zinc-rich varieties especially cereals, pulses and innovative technologies to address food and nutrition security. Zn deficiency



Md Jalal Uddin, Director (Research), BARI speaking at an inception workshop

can also be corrected by promoting Zn compounds to the soil. It is also necessary to sort out zinc fertilizers and application methods with a view to enhancing high zinc accumulation in edible portion of crops.

Zinc nutrition for crops and public health

Metabolic processes are entirely linked to zinc-dependent enzymes for most of plants and animals. Its essentiality was established in 1869 for plants, in 1934 for animals in 1961 for humans. After the discovery of zinc deficiency as a human health problem, interest in zinc nutrition for different biochemical and clinical aspects has increased sharply. It is vital in several body functions such as vision, taste perception, cognition, cell reproduction, growth, immunity. Zinc deficiency is a common health problem in many communities including Bangladesh. Nearly half of the world's population is at risk due to inadequate zinc intake, suggesting that public health programs are urgently needed to reduce zinc deficiency. According to the nutrition experts, zinc is an essential component for human body especially for the pregnant women as its deficiency can cause a serious health hazard for the pregnant women and new mothers. Zinc also supports normal growth

system. In plants zinc is involved in many physiological functions and its inadequate supply reduces crop yields. Zinc deficiency is the most widespread micronutrient deficiency problem, almost all crops and calcareous, sandy soils, peat soils, and soils with high phosphorus and silicon. Zinc deficiencies affect plant by stunting its growth, decreasing number of tillers, chlorosis and smaller leaves, increasing crop maturity period, spikelet sterility and inferior quality of harvested products. Since its first discovery in an Iranian male in 1961, zinc deficiency in humans is now known to be an important malnutrition problem worldwide. It is more prevalent in areas of high cereal and low animal food consumption. The diet may not necessarily be low in zinc, but its bio-availability plays a major role in its absorption. Phytic acid is the main known inhibitor of zinc. As compared to adults, infants, children, adolescents, pregnant, and lactating women have increased requirements for zinc. Epidermal, gastrointestinal, central nervous, immune, skeletal, and reproductive systems are the organs most affected clinically by zinc deficiency. Clinical diagnosis of marginal Zn deficiency in humans remains problematic. So far, blood plasma/serum zinc con-

and development during pregnancy, childhood, and adolescence and is required for proper sense of taste and smell. Daily intake of zinc is required to maintain a steady state because the body has no specialized zinc storage

centration, dietary intake, and stunting prevalence are the best known indicators of zinc deficiency.

National micronutrient status in Bangladesh

The major micronutrients deficiency problems affecting Bangladesh are Vitamin A, Iron, Zinc and iodine according to a survey to assess the Micronutrient deficiency problems affecting Bangladesh. The population of Bangladesh is still well short of the recommended Daily Allowance (RDA) of food intake for the key nutrients. The prevalence of sub-clinical vitamin A deficiency was 20.5% in the preschool age children. The prevalence in the school age children in the slums was 27%. The prevalence of anemia in the preschool age children was 33.1%. The national prevalence of iron deficiency was 10.7% in the preschool age children. The national prevalence of zinc deficiency was 44.6% in the preschool age children. The amount of consumption of zinc was well below the recommended daily amount. Of the total consumption majority comes from plant origin.

Activities of Soil Science Division, BARI

Soil science division of Bangladesh Agricultural Research Institute (BARI) has been dealing with balanced fertilizer management for crops and cropping patterns since its inception. In course of time it upgraded its strategies to emphasize on micronutrient aspects of soil management as most of the soils are becoming deficient in micronutrient. People are suffering from zinc malnutrition due the pervasive effect of zinc deficiency in soil and crops. Keeping pace with the demand of the age, new strategic research initiatives has been chalked out to attain food and nutritional security through promotion of zinc fertiliz-



er use, biofortification of crops etc. International Zinc Association (IZA) and Zinc Nutrient Initiative (ZNI) have extended their cooperation to strengthen the on-going research activities of soil science discipline in BARI through institutional collaboration. It took steps for fine tuning of the existing fertilizer management technologies keeping the following objectives in mind:

To find out suitable zinc fertilizer that enhance high zinc accumulation in edible portion of crops

To find out zinc application methods that facilitates high zinc accumulation in edible portion of crops

To know optimum dose of zinc fertilizer for high yield and zinc uptake by different crops and cropping patterns

Field trials: In collaboration with the International Zinc Association (IZA) and Zinc Nutrient Initiative (ZNI), Soil Scientists of BARI would conduct a handsome number of field trials in zinc deficient soils of Bangladesh.

Experiment on single crop:

“Effect of different sources of zinc fertilizers for higher zinc accumulation in rice, wheat and maize” which will be conducted in Barishal, Rangpur and Jessore regions respectively.

“Performance of zinc-urea briquette and zinc-cored urea granule on yield and zinc uptake by maize and rice”. Those field trials will be accomplished in farmers’ field of Nilphamari and Bogra, respectively.

Experiment on cropping pattern:

“Effect of zinc fertilizer application on yield and zinc accumulation in edible parts of crops in different rice based cropping patterns”. The cropping patterns included in the project are as follows:

Name of the pattern	Location
Wheat-Mungbean-T. Aman rice	Kishoreganj
Potato-Maize-T. Aman rice	Nilphamari
Lentil-Mungbean-T. Aman rice	Jessore
Potato-Mungbean-T. Aman rice	Rangpur
Cauliflower-Cucumber-T. Aman rice	Bogra
Wheat-T. Aus rice-T. Aman rice	Bhola

Expected outcome:

Comparative efficacy of zinc fertilizers will be observed for high yield and zinc accumulation in the edible portion of maize, rice and wheat crops.

Effect of zinc core urea granule and zinc-urea briquette will be measured for high yield and zinc uptake in rice and maize.

Evaluation of zinc application methods will be carried out.

Zinc requirement for high yield and nutritional uptake will be measured for Wheat-Mungbean-T. Aman rice, Potato-Maize-T. Aman rice, Lentil-Mungbean-T. Aman rice, Potato-Mungbean-T. Aman rice, Cauliflower-Cucumber-T. Aman rice and Wheat-T. Aus rice-T. Aman rice cropping pattern.

Residual effect of different cropping patterns will also be monitored.

Conclusion

Bangladesh attained food security for its burgeoning population particularly in cereal grains by dint of relentless efforts of the researchers, extension personnel and above all, the indomitable farmers. To support the ever-growing population of the country the soils are losing their strength to supply adequate nutrients which is the doctrine of necessity for increased yield and nutrient-rich produces. Alongside the on-going research activities of crop biofortification,

emphasize should be given on balanced fertilization especially by promotion of zinc fertilizer use in agriculture for not only sustain food security but also alleviate malnutrition. Government and non-governmental organizations should come forward to render help to the noble initiatives.