IFA AGRICULTURE CONFERENCE

Kunming, China – 27 February – 2 March 2006

Optimizing Resource Use Efficiency for Sustainable Intensification of Agriculture

Identification and correction of Zinc Deficiency in Turkey- A Success Story

Ismail Cakmak

Sabanci University, Faculty of Engineering and Natural Sciences, Istanbul, Turkey

Previously, wheat growing in many places of Central Anatolia was low yielding and had necrotic patches on leaves. Even, in some areas, grain yields obtained were not economic. The reason for such growth and yield disorders were not known until early 1990. To identify the underlying cause of the disorders in wheat production and clarify the role of micronutrient deficiencies in low wheat yield, a long-term and multi-institutional project has been prepared and submitted to the NATO-Science for Stability programme, and the project was approved in March 1993.

Soil survey studies and field trials in different parts of Central Anatolia showed that Zn deficiency is a critical constraint to wheat production in the region. In certain areas (DTPA-Zn: around 0.1 mg kg^{-1} soil), cereal production was not economic with grain yields of nearly 0.25 kg ha^{-1}. Application of Zn fertilizers on such Zn-deficient soils resulted in impressive increases in grain yield (e.g., increases from 0.25 tons ha^{-1} up to 2 tons ha^{-1}). Wheat was generally responsive to Zn fertilization when DTPA-Zn was less than 0.4 mg kg^{-1} soil, especially durum wheat. In the past, in many lands with extremely low Zn in soils (DTPA-Zn less than 0.1 mg Zn kg^{-1}) crop production was not possible. Today, following identification of Zn deficiency problem, these soils are being used for production of cereals and other crops. Plants become more sensitive to Zn deficiency under rainfed compared to irrigated conditions. Among the Zn application methods, seed Zn-coating or use of Zn-enriched seeds were also highly effective in increasing grain yield.

Such spectacular effects of Zn fertilizers on wheat growth and yield elicited a growing interest in the project results among the farmers and the fertilizer industry. First, in 1995, fertilizer industries in Turkey, especially Toros Company, started producing Zn-containing NP and NPK fertilizers and tested under farmer's field conditions. The reaction of the farmers to the Zn fertilizers was so positive that in the following years increasing amounts of Zn-containing fertilizers were produced and applied in Turkey. Today, 10 years after Zn deficiency has been identified as an important constraint to wheat production, the total amount of Zn-added NPK fertilizers applied in Turkey is at a record level of 300 000 tones. Besides these Zn-enriched NPK fertilizers, also increased amounts of $ZnSO_4$, ZnO and Zn-containing foliar fertilizers are applied in Turkey, but there is no available statistic about the amount of these Zn fertilizers applied. It seems that use of all Zn-fertilizers including Zn-enriched NPK fertilizers represents an annual turnover of about 100 000 USD.

As Zn deficiency is an important micronutrient deficiency in humans in Turkey, increases in grain Zn concentration by Zn fertilization have obvious implications for human health. Applying Zn to wheat in Central Anatolia was effective to increase grain Zn concentration by 2- or 3-fold. Providing Zn-dense grain to poor in Turkey should lead to improvements in their health and productivity.