Theme 2
Sustainable soil management for food security and better nutrition

Sustainable Soil Management for Nutrition-sensitive Agriculture in Bangladesh

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INTRODUCTION

Micronutrient deficiency is considered as one of the emerging challenges to food and nutrition security in Bangladesh. Soil health is directly related to human health. Current estimate suggested that almost half of the world population suffers from mineral deficiencies, primarily of iron and zinc.

Rice feeds almost 50-58% of the world's population and considered as a global grain but it is deficient in micronutrient (Bouis and Welch, 2010). Therefore, even a small increase in the nutritive value of rice can be highly significant for human nutrition (Zhang *et al.*, 2012). Since last three decades, commercialization of Bangladesh agriculture has increased productivity and cropping intensity by several times. According to the Soil Resource Development Institute (SRDI) in Bangladesh low to very low soil Zinc (Zn) status was increased by 28.71% to 78.84% and boron (B) increased by 25.99% to 30.78% in arable land since 2010-2020 (Hasan *et al.*, 2020). To increase the micronutrients like Zn and B content of soil and crop products, Sustainable Soil Management (SSM) is urgently needed for safe and quality food production.

METHODOLOGY

The yearlong study was conducted at three upazila viz., Chandina, Chuadanga and Baliadangi where T. *aman* rice (Binadhan-20) was the first crop. Cauliflower, Maize and Potato respectively were the second crops, and the third crop was Mungbean. The lay out was randomized complete block design (RCBD) comprised six fertilizer management treatments and replicated five times. The treatments were T1= Farmer's practice (From baseline survey); T2 = Recommended Fertilizer Dose of NPKS (RFD) with Zn as basal; T3= RFD with Zn as foliar spray; T4= RFD with Zn & B as foliar spray; T5= 50% RFD + 50% Organic manure- Cowdung; T_6 = 50% RFD + 50% Organic manure- Cowdung + Zn & B as foliar spray. Pre and post-cropping soil samples were collected to record soil nutrient status. Yield and crops data were collected following standard procedures. Statistical analyses were done following CropStat software, and the mean separations done using LSD at 5% level of significance.

Results

- The RFD (NPKS) as basal application with zinc and boron as foliar application (T_4) showed higher yield as compared to that of NPKS & Zn as basal (T_2) in all sites and for all crops (Fig. 1).
- Increment of organic matter content in soil was found in T_5 treatment compared to RFD, maximum after cover crop- mungbean (Fig. 2). Organic carbon in tropical soils appears to be more easily degradable than that of temperate soils (Derpsch and Moriya, 1998) and hence increasing SOC content of soils of the tropics and subtropics is not an easier task (Lal and Bruce, 1999).
- Foliar application of zinc (T_4) increased the zinc content of grain/edible parts (Fig. 3).
- Application of zinc and boron as foliar spray along with the recommended doses of NPKS (T4) can increase protein content of edible parts compared to farmers' practice (T1) (Fig. 4).

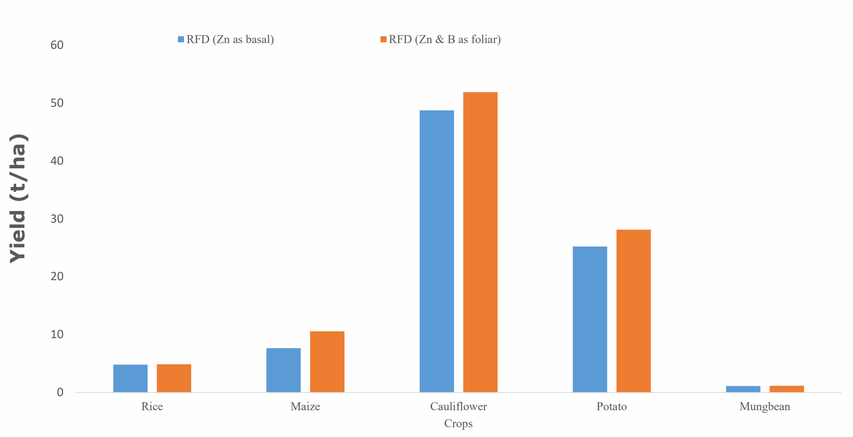
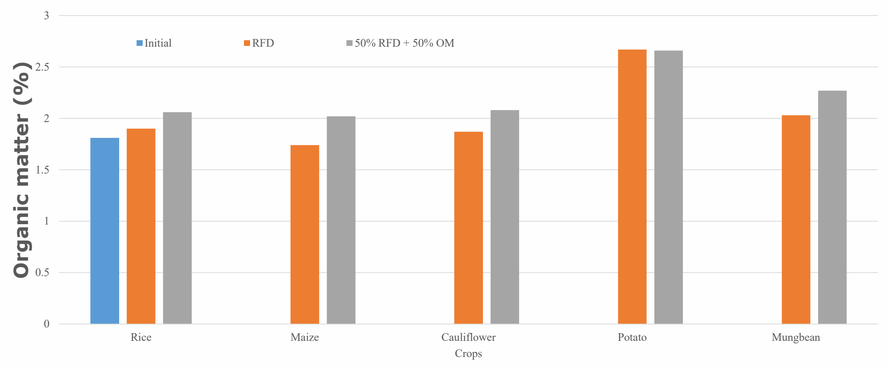


Fig. 1. Yield increment for foliar application of Zn & B than basal application of Zn.



RFD: Recommended Fertilizer dose having Zn as basal application

Fig. 2. Changes of soil organic matter for different crops.

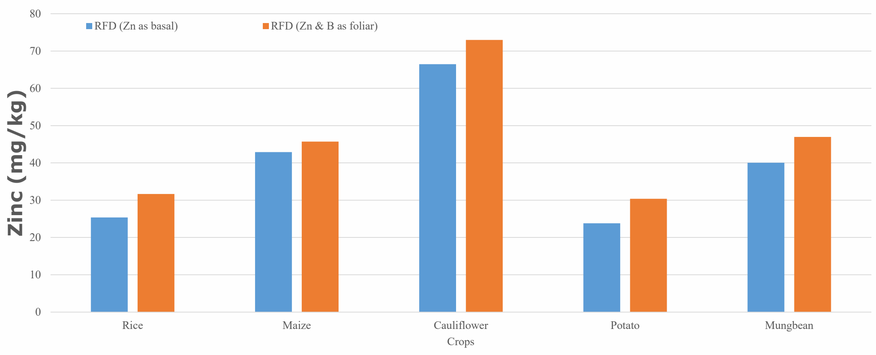


Fig. 3. Foliar application of Zn and B increased grain/edible parts zinc content of different crops.

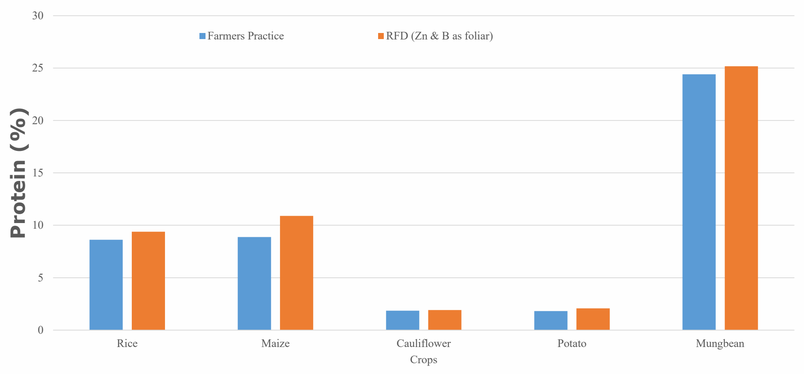


Fig. 4. Foliar application of Zn and B increased grain/edible parts protein content of different crops

CONCLUSIONS

Long term study throughout the country is necessary to implement a technology in the policy level. Our cropping pattern based one year study resulted the benefits of foliar application of zinc and boron along with NPKS to increase yield, improve soil health and increase micronutrient status of edible parts of studied crops.

Fertilizer management significantly affected soil organic matter and micronutrient content. Therefore, in every crop in the pattern it is necessary to apply organic manure to maintain the soil fertility and crop productivity.

REFERENCES

1. Bouis, H. E. and R. M. Welch. 2010. Biofortification – A sustainable agricultural strategy for reducing micronutrient malnutrition in the global South. Crop Sci. 50 (S1): S-20–S-32.
2. Lal, R. 2006. Enhancing crop yields in the developing countries through restoration of the soil organic carbon pool in agricultural lands. Land Degrad. Develop. 17(2): 197-209.
3. Derpsch, R. and K. Moriya. 1998. Implications of no-tillage versus soil preparation on sustainability of agricultural production. Adv. Geoecol. 31(II): 1179–1186.
4. Zhang, W., D. Y. Liu, C. Li, Z. L. Cui, X. P. Chen, Y. Russell and C. Q. Zou. 2015. Zinc accumulation and remobilization in winter wheat as affected by phosphorus application. Field Crops Res. 184: 155-161.

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