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"Filling gaps and removing traps
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Effects of Emerging Crop Rotations and Changing Soil Aeration Status on B and Zn Availability and Vegetable Responses in Nepal

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Abstract

Since recently, the traditional rice-wheat rotation systems in Nepal are subject to drastic changes. Water shortages drive the replacement of the water-consuming lowland rice by maize, and progressing urbanisation drives a replacement of wheat by high-value vegetables. The changes in soil aeration status by integrating maize and the higher nutrient demand of vegetables compared to wheat are associated with changing demands of and responses to key micro-nutrients such as boron (B) and zinc, (Zn) which are highly deficient in the soils of Nepal. We compared the status of soil B/Zn availability and the responses of rice and maize (hot wet season) as well as of cauliflower, tomato and wheat (cold dry season) to added B and Zn in a greenhouse trial as well as in field validation trials at two sites in Nepal. The shift from rice to maize and concomitant changes in soil aeration status tended to increase the responsiveness of both vegetable crops to added B and Zn at both sites. The shift from wheat to high-value vegetables increased the overall demand for B and to a lesser extent for Zn, irrespective of the soils and sites. Thus, the addition of 4 kg ha^{-1} each of B and Zn increased crop uptake by cauliflower significantly. While biomass accumulation and yield of wheat were largely unaffected by B/Zn additions, both vegetables responded with 2-4-fold yield increases. At these effects lowland sites were generally more pronounced than at the mid-hill site, and response tended to be more in maize (aerobic) than with rice (anaerobic) based systems. It is concluded that in the inherently B and Zn deficient soils in much of Nepal, the application of B and Zn fertilisers improves the performance of the traditional rice-wheat rotations. Therefore, with the shift towards maize and high-value vegetable-based systems, B and Zn applications become essential. The demand for such nutrients as fertilisers is foreseen to dramatically increase with progressing urbanisation and associated system shifts.

Keywords: Boron, cauliflower, *Oryza sativa*, soil fertility, tomato, zinc

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