FORMULATING AND EVALUATING A FERTILIZER RECOMMENDATION FOR TOMATO (*Lycopersicum esculentum L.*) BASED ON A SYSTEMATIC APPROACH OF DIAGNOSING NUTRIENT DEFICIENCIES

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ABSTRACT

Tomato is a popular vegetable crop in Sri Lanka, which is well adapted for different climatic conditions, soil types and altitude. Though farmers use high yielding crop varieties in the country the potential yield of the crop is rarely reached, mostly due poor fertilizer management and inherent low fertility of Sri Lankan soils. The need to recommend fertilizers on a site-specific as well as a crop-specific basis, depending upon the soil nutrient status and the crop requirement, has been globally recognized. The present fertilizer recommendation by the Department of Agriculture (DOA) of Sri Lanka for annual short-term crops is either a blanket recommendation, that does not consider the soil variability in nutrient status, or a soil test based recommendation, which does not include secondary nutrients and micronutrients. The main objective of this study was to investigate the potential of adapting a systematic approach of formulating a fertilizer recommendation on a site-specific basis for tomato and to test this recommendation in the field. The systematic approach involves routine soil analyses for physical and chemical properties and available nutrient status, fixation experiments for P, K, Cu, Mn, Fe, Zn, S and B, a greenhouse nutrient survey to formulate the fertilizer recommendation and subsequent testing of the recommendation in a field trail.

The field trial was conducted on Immature Brown Loam (Inceptisol) soil at Dodangolla University Research Farm. A representative composite soil sample (0-30 cm) was analyzed for physical and chemical properties using standard methods. Available nutrient status was determined by a three step extraction method; extraction with ASI solution (0.25 *M* $NaHCO_3$+ 0.01 *M* EDTA+0.01 *M* NH_4F) for P, K, Cu, Fe,

Mn and Zn, 1 *M* KCl extraction for NH_4-N, Ca, Mg and Na, and 0.08 *M* $CaH_2(H_2PO_4)_2.H_2O$ extraction for B and S. A fixation study was conducted to identify the fixation capacity of the soil for P, K, Cu, Zn. Fe. Mn, S and B. The amount of fertilizer to be supplemented was calculated based on the initial nutrient values and, when deficient, the rates of P, K, Cu, Zn, Fe, Mn, S and B were adjusted based on the fixation capacity. The optimum fertilizer recommendation formulated was tested in the greenhouse using a modified missing element technique. The formulated recommendation was tested in the field using tomato (variety *Thilina*) for four seasons. Seventeen treatments consisting of the optimum fertilizer recommendation formulated by the systematic approach, twelve other treatments providing all nutrients at the optimum level with one nutrient either not applied or applied at higher or lower rates than the optimum, one treatment with both P and K levels higher than the optimum, one treatment with all N, P and K at higher levels than optimum, a treatment with DOA recommendation and a control treatment, were arranged in a Randomized Complete Block design with four replicates. Tomato yield, quality parameters and the net profit with each treatment were determined.

The routine analysis of experiment showed deficient levels of N, P, K, S, B and Zn in this soil when compared with the established critical levels. The soil had high fixing capacity for P, K, S and B, reflecting the need to use higher rates of P, K, S and B to reach up to respective critical level for the nutrient. The greenhouse nutrient survey confirmed the deficiencies of nutrients identified through soil analysis. Responses to nutrients were clearly indicated, with significantly low dry mater yields ($p \leq 05$) in most treatments that provided one nutrient at deficient level, as compared to the

optimum, which provided all nutrients at adequate levels. The calculated fertilizer rates based on the results of soil analysis and fixation study were adjusted as the calculated rates for P, K, S and B were very high due to high fixation capacity in this soil. Thus the optimum rate of fertilizer consisted of 220 kg N, 160 kg P, 250 kg K, 50 kg S and 1 kg B per hectare. The highest tomato yield in the field and the highest net profit were obtained with the treatment providing the highest level of N, P and K (330 kg N, 240 kg P, 375 kg K) per hectare while B and S were provided at the adjusted optimum level. The recorded tomato yield at these fertilizers levels was 44.9t/ha. The treatment that gave the highest yield was the most Profitable as well. The second highest yield was given by the optimum treatment providing all nutrients at the adjusted optimum rate. Thus providing the nutrients based on the systematic approach was beneficial in terms of tomato yield and profit. Since the treatment with the highest rates of nutrients was superior in this study both in terms of yield and profit, further studies are needed to investigate the change in yield and profit with further increase in the level of nutrients.