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Evaluation of nutritional properties and toxicity levels in commercial fertilizers sold in Sri Lankan market

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When plants cannot absorb adequate nutrients from the soil, the plant growth becomes retarded. Plants require nutrients in optimum levels in order to continue normal growth. To meet this requirement, fertilizers are used as an external source to provide nutrients plants need in correct proportions at the right times. In this study, seven brands of mineral fertilizers sold in the Sri Lankan market as NPK fertilizers were investigated over a period of six months in 2017 to determine their nutritional properties and other physicochemical parameters. A parallel study was conducted to investigate the dissolution properties of these commercial fertilizers in a soil matrix in order to identify their leaching kinetics. In addition to that, a quantitative study was carried out to determine the toxic metal levels of these commercial fertilizers. According to the experimental results, the nitrogen (N), phosphorous (P), and potassium (K) percentages in commercial fertilizers varied from 4.5 - 9.9%, 3.2 - 5.7%, and 2.6 - 18.1%, respectively. The release patterns of nitrogen from commercially available fertilizers sold in Sri Lanka (10 g) in a soil matrix (200 g) were investigated using columns with deionized water (pH 6.7). Control reactions were carried out with urea in a soil matrix and a soil matrix alone. Each experiment and analysis was carried out in triplicate. According to the experimental results, within 24 hours, more than 80% of the nitrogen was eluted from urea. But, nitrogen elution within 20 days varied from 30% to 78% in commercially available fertilizers in the soil matrix due to different dissolution kinetics. The concentration levels of Cd (0.44 - 0.93 mg/kg), Pb (6.2 - 17.8 mg/kg), Cr (5.2 - 9.9 mg/kg), Cu (1.9 - 37.9 mg/kg) and Fe (116.1 - 457.8 mg/kg) were found in the commercial fertilizers. The findings obtained from above study can be used in further studies to determine the relationship between heavy metal contents in fertilizers and health effects caused by exposure to these fertilizers.

Keywords: Commercial fertilizers, leaching kinetics, nutritional properties, toxicity levels