

## **ABSTRACT**

Soy bean varieties commonly grown in Kenya's acidic soils that contain aluminium are SB 97, SB 19, SB 20 and SB123. Soy bean grains have high protein content, vitamins and used to manufacture industrial products. Aluminium toxicity affect growth and physiology of plant growth. The effects of aluminium chloride solution on plant growth, uptake of mineral nutrients and distribution in vegetative parts of soy beans are still not fully understood. The objective of this study was to investigate the effects of aluminium chloride stress on four varieties of soy bean grown in Kenya with a view of identifying the tolerant varieties among them to be recommended for growing in areas prone to aluminium stress. The experiment was done under greenhouse conditions. Seeds were planted in 20 litre PVC pots filled with soil. Randomized Complete Block Design in a factorial way, with three replicates and five levels of 0 (control), 25 mg/l, 50mg/l, 75mg/l and 100mg/l aluminium chloride concentrations in tap water was used. Growth and physiological parameters; including mineral concentration in leaves, chlorophyll fluorescence and photosynthetic pigment contents were measured. The data was subjected to factorial Analysis of Variance and Tukey's HSD tests at 5% was used to separate treatment-Variety means. Growth parameters measured mostly showed clearly the tolerance difference levels of the varieties. Aluminium reduced water absorption hence decreasing productivity. Variety SB 20 concentrated more aluminium in leaves. Some varietal difference which were not significant were observed in mineral accumulation. This indicate that varieties could be behaving differently in absorption and accumulation of nutrients. Maximum quantum yield and effective quantum yield had the highest mean value in SB 20. Non-photochemical quenching was highest in SB 123. These implies that varieties behaved differently in PSII impairment activity. Major decrease in total chlorophyll with increased aluminium chloride concentrations was observed in SB 19, SB 97, and SB 123 suggesting selective chlorophyll photo bleaching showing that smaller amounts of energy was delivered for electron transport. There was a marked decrease in chlorophyll a/b ratio under aluminium chloride solution treatment. SB 123 had a larger mean value of carotenoids in comparison to SB 20, SB 19 and SB 97. Carotenoids concentration was more at 100 mg/l aluminium chloride concentration. It was to assist in transfer of energy and oxygen in accessory pigments. Tukey's HSD tests showed no significant difference ( $p \geq 0.05$ ) within varieties for physiological parameters measured. Variety SB 20 and SB 19 were identified to be more tolerant to aluminium stress and hence recommended for growing in aluminium prone soils. Mineral nutrients accumulation, photochemical parameters of PSII and photosynthetic pigments parameters measured were found to be sensitive to aluminium chloride treatments: the later two parameters showed that  $AlCl_3$  affects the overall rate of photosynthesis.