

This study investigated the effects of sulfur (S), calcium (Ca), and magnesium (Mg) supplementation on the bioactive compound profile of onions (*Allium cepa*) grown in two agro-climatic zones in Kenya. A Randomized Complete Block Design (RCBD) was employed across two sites (Kisaju-Kajiado and Koma-Machakos), with six treatment combinations including varying levels and combinations of S, Ca, and Mg. Bioactive compounds, including total flavonoid content (TFC), total phenolic content (TPC), anthocyanins, quercetin, and organosulfur compounds, were measured. The treatment with S, Ca, and Mg at 60 kg/ha produced the highest bioactive compound concentrations, with TFC of 243.33 QE/kg in 'White Lisbon,' TPC of 1024 GAE/kg, anthocyanin of 9 mg, quercetin of 39 mg, and organosulfur of 3.9 S/kg DM in 'Red Creole.' The results suggest that application of S, Ca, and Mg at 60 kg/ha can significantly enhance onion nutritional quality. It is recommended that farmers apply this treatment to improve bioactive compound content and marketability.