Struvite can substitute phosphorus needs in marigold soilless cultivation in regards to commercial fertilizers

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Abstract

Phosphorus (P), a critical plant macronutrient, is often limited in soils, posing a challenge often met with excessive and inefficient fertilization with mineral P fertilizers. Due to the increasing demand for P and the depletion of phosphate rock deposits, there is an urgent need for alternative P fertilizers. This includes the recovery of nutrients from wastewaters, in the form of struvite ($MgNH_4PO_4 \cdot 6H_2O$). The objective of this study was the assessment of struvite as a complete substitute to triple-superphosphate, for marigold (*Tagetes erecta* L.) substrate cultivation. Three rates (low, mid-normal, high) of conventional (CON) and modified struvite (STR) base dressing were applied in peat, including a blank with pure peat. Duplicates of these treatments were prepared, where plants received supplementary fertigation. Substrates with STR had equivalent N, K and electrical conductivity levels with CON, across corresponding fertilization rates. Under high STR, P was significantly increased, compared to the rest of fertilization treatments. At the end of cultivation, several parameters were evaluated. Marketability and plant fresh weight were relatively unaffected; however, flower number and fresh weight were increased with the increasing rates of fertilization. Elevated fertilization resulted in increased total chlorophylls content, with both CON and STR fertilizations exhibiting a similar positive trend. Total phenolics and antioxidants (DPPH, FRAP, and ABTS) were decreased with the use of CON and STR fertilization compared to the blank treatment, although the normal STR rate had slightly increased them. Increasing the base fertilization rate also increased the contents of H_2O_2 and MDA, signifying a more intense oxidative stress. Increased fertilization resulted in elevated leaf macronutrient content (N, P, K), although supplementary fertigation minimized these differences. These results suggest that struvite can be a competent alternative to conventional P fertilizers, exhibiting prospects for commercialization in soilless and container-based cultivation of ornamentals.

Keywords: wastewater, nutrient recovery, ornamentals, peat, *Tagetes erecta*

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