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Repurposing Dairy Manure Solids as a Non- Polluting Fertilizer and the Effects on Nutrient Recovery in Tomatoes (Solanum Lycopersicum)

Authors : Devon Simpson

Abstract : Recycled Manure Solids (RMS), attained via centrifugation from Canadian dairy farms, were synthesized into a non-polluting fertilizer by bonding micronutrients (Fe, Zn, and Mn) to cellulose fibers and then assessed for the effectiveness of nutrient recovery in tomatoes. Manure management technology is critical for improving the sustainability of agroecosystems and has the capacity to offer a truly circular economy. The ability to add value to manure byproducts offers an opportunity for economic benefits while generating tenable solutions to livestock waste. The dairy industry is under increasing pressure from new environmental protections such as government restrictions on manure applications, limitations on herd size as well as increased product demand from a growing population. Current systems use RMS as bedding, so there is a lack of data pertaining to RMS use as a fertilizer. This is because of nutrient distribution, where most nutrients are retained in the liquid effluent of the solid-liquid separation. A literature review on the physical and chemical properties of dairy manure further revealed more data for raw manure than centrifuged solids. This research offers an innovative perspective and a new avenue of exploration in the use of RMS. Manure solids in this study were obtained directly from dairy farms in Salmon Arm and Abbotsford, British Columbia, and underwent physical, chemical, and biological characterizations pre- and post-synthesis processing. Samples were sent to A&L labs Canada for analysis. Once characterized and bonded to micronutrients, the effect of synthesized RMS on nutrient recovery in tomatoes was studied in a greenhouse environment. The agricultural research package 'agricolae' for R was used for experimental design and data analysis. The growth trials consisted of a randomized complete block design (RCBD) that allowed for analysis of variance (ANOVA). The primary outcome was to measure nutrient uptake, and this was done using an Inductively Coupled Plasma Mass Spectrometer (IC-PMS) to analyze the micronutrient content of both the tissue and fruit of the tomatoes. It was found that treatments containing bonded dairy manure solids had an increased micronutrient concentration. Treatments with bonded dairy manure solids also saw an increase in yield, and a brix analysis showed higher sugar content than the untreated control and a grower standard.

Keywords : aoecosystems, dairy manure, micronutrient fertilizer, manure management, nutrient recovery, nutrient recycling, recycled manure solids, regenerative agricugrlture, sustainable farming
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