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Sustainable Release of Macronutrients to Black Oat and Maize Crops from Organically-Altered Dacite Rock Powder

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Abstract

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By-products from the dairy industry and mining activities represent a great environmental overload, which justify research for value-added reuse of these by-products (dairy sludge and dacite rock powder). Dairy sludge is generated at a rate of about 0.2–10 l per liter of processed milk, and dacite powder, from rock mining extraction and processing, is generated for about 52,400 m^3 per year in Nova Prata city, Southern Brazil. For both by-products, the compositions of calcium (Ca), magnesium (Mg), potassium (K) and phosphorous (P), arsenic (As), cadmium (Cd), chromium (Cr), mercury (Hg), and lead (Pb) were determined by using appropriate analytical techniques. A greenhouse experiment was conducted to determine release of macronutrients, such as Ca, K, Mg, and P, from by-products to support black oat (Avena strigosa) and maize nutrition. Twelve by-products doses were blended with a typic Hapludox soil and were applied to pots with five replications each. Black oat (first cultivation) and, sequentially, maize (second cultivation) were cultivated for 70 days each. Ameliorations in soil chemical attributes, leaf dry matter yield, and plant nutritional status were evaluated at the end of each cultivation. There was a significant ($p < 0.05$) increase in all parameters evaluated in a dose of 7251 kg ha^{-1} of dacite rock powder and 20,594 kg ha^{-1} of dairy sludge. Compared to the control treatments, both crops grew well better on all mixtures. The presence of potentially toxic elements in both by-products was irrelevant, indicating that effective blending of dacite rock powder along with dairy sludge could be a potential source of Ca, K, Mg, and P in agriculture without posing a risk of contamination to the environment. © 2021, International Association for Mathematical Geosciences.

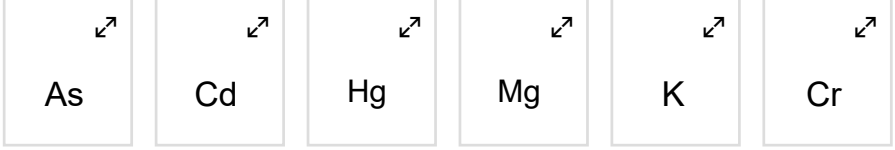
SciVal Topic Prominence

Topic: Feldspars | Syenite | Potassium Fertilizers

Prominence percentile: 77.579

Chemistry database information

Substances



Author keywords

By-products | Dacite rock powder | Dairy sludge | Soil fertilization

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