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Influence of compost properties on organo-mineral fertilizers composition

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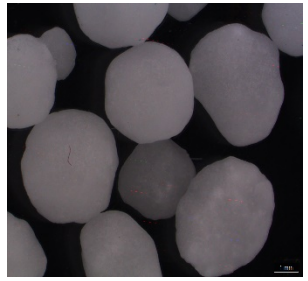
Introduction

Organo-mineral fertilizers (OMF) are made by combining an organic fraction with one or more mineral fertilizers to get a product that unites characteristics of inorganic and organic fertilizers (Smith et al., 2020). However, organic materials can present high variability in their properties that could be transferred to the OMF. There is no clear answer to the ideal parameters of an organic fraction to produce a high-quality OMF. Therefore, we analyzed chemical and physical properties of organic materials to understand which variables can predict the requirements of mineral fertilizers to achieve 15% N and 8% P_2O_5 in an OMF with 7.5% of organic C.

Ammonium sulfate



Urea

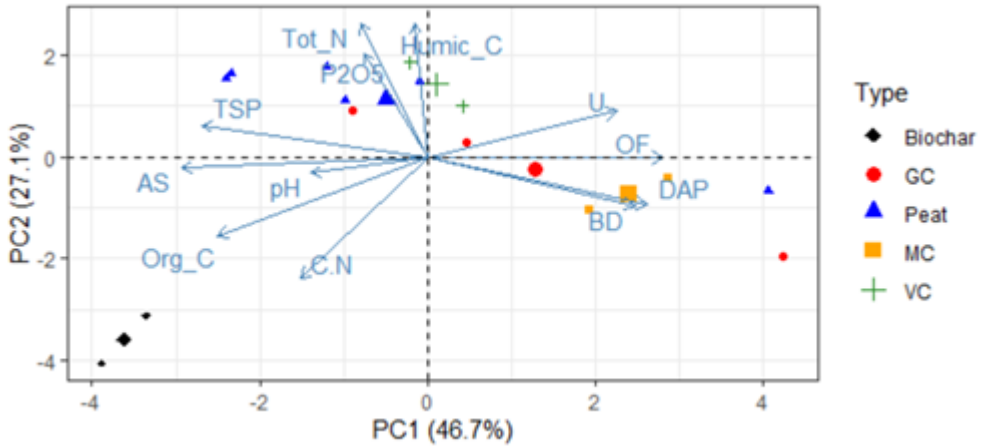
Materials and Methods

Sixteen organic compounds, grouped as green compost, mixed compost, vermicompost, biochar, and peat, were characterized chemically and physically.

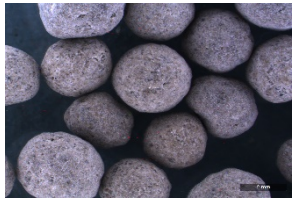
Values of organic C, P_2O_5, and N were used to determine the fractions of organic material (OF), triple superphosphate (TSP), diammonium phosphate (DAP), ammonium sulfate (AS), and urea (U) to create an OMF with a C-N-P formulation in the percentage of 7.5-15-8. Values of bulk density, pH, organic C, humic C, total N, P_2O_5, and C/N ratio were used in a principal component analysis (PCA) with OF, TSP, DAP, and AS values to determine the best compost indicator for the OMF formulation.

Results

The analyzed organic materials presented a high variability in their composition, which affected the theoretical OMF. On the OMF the composition would be of 0.49, 0.31, 2.72% of organic N, P and humic C (sd = 0.15, 0.14, 0.62%). GC-fung, a material with less than 10% of organic C, did not achieve the ideal final concentration of 15% of N in the OMF. With the PCA, 77% of the variance is explained by the two first factors; 50 and 27%. The first factor is influenced mainly by the OMF fractions, while the second is influenced by Humic C and N and P_2O_5 concentration in compost.



PCA biplot showing variability from the first two components, and contribution of variables and samples



Triple superphosphate

Organo-mineral fertilizer

Conclusions

The organic C concentration in compost works as the best indicator of the fractions needed to create an OMF. If the compost has low organic C, a higher amount of compost is required to achieve the OMF C target; it is also necessary to use rich N mineral sources as U, and DAP, reducing the use of AS and AS. The concentration of N and P in the OF does not influence mineral fertilizers proportions because they count for less than 1% of the total OMF.

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