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Soil and pasture P concentration in a Fraxinus excelsior L. silvopastoral system fertilised with different types of sewage sludge

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In Europe, sewage sludge should be stabilised before using as fertiliser in agriculture. Depending on the stabilisation process that is used, sewage sludge has different characteristics, nutrient contents and soil nutrient incorporation rates. Sewage sludge is usually applied on a plant-available N or total metal concentration basic, and therefore, P concentrations can be well above crop needs. Leaching of excess P can threaten surface and ground waters with eutrophication. In this context, recent studies have demonstrated that the implementation of agroforestry systems could reduce the P leaching risk compared with conventional agricultural systems due to the different localisation of tree and crop roots which enhance nutrient uptake. The aim of this study was to evaluate during three consecutive years the effect of municipal sewage sludge stabilised by anaerobic digestion, composting, and pelletisation on concentration of P in soil and pasture compared to control treatments (mineral and no fertilisation) in a silvopastoral system established under Fraxinus excelsior L. in Galicia (Spain). The results showed that at the beginning of the study, the fertilisation with mineral increased more the total and available P in soil than the fertilisation with sewage sludge probably because the sludge nutrient release rate is slower than those from mineral fertilisers. The increment of soil available P caused by the mineral fertiliser implied an improvement of the P concentration in the pasture. However, in the last year of the experiment it was observed a positive effect of the fertilisation with pelletised sludge on the concentration of P in pasture compared with the composted sludge and the mineral fertiliser probably due to the annual application of this type of sludge. Therefore, the establishment of silvopastoral systems and their fertilisation with pelletized sludge should be recommended because the pelletized sludge increases the concentration of P in the pasture and reduces the application and storage costs due to its lower proportion of water than the other types of sludge tested. At the same time, the integration of trees in agricultural areas decreases the problem of environmental impact resulting from addition of organic and inorganic fertilisers on soils.