

IMPACT OF OUTDOOR PIG PRODUCTION ON SOIL PROPERTIES: P SORPTION AND RISK OF EUTROPHICATION OF WATERBODIES

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Introduction

The increase of soil available phosphorus (P) could be due to (i) the use of P fertilisers at higher rates than those required by crops in agricultural soils, and to (ii) the inputs of livestock production provided by the addition of feed and animals excreta to soils. In this latter case, there is also an increase of the soil organic matter (SOM). Several researchers reported the effect of the OM in preventing P sorption in agricultural soils and consequently the increase of P losses from soils to waterbodies by drainage and runoff waters.

Objectives

This work aimed at evaluate the effect of outdoor pig production on P sorption in soils enriched with OM.

Material and Methods

The experiment was done during two years, at an experimental area of outdoor pig production with 2.8 ha, at the Polytechnic Institute of Castelo Branco (Fig. 1.a). Soil samples were georeferenced and taken at 0.20 m depth and OM and Olsen P were evaluated. The initial SOM was 1.39 % and Olsen-P of 5 mg kg⁻¹. A soil P sorption experiment was carried out using the method of Fox and Kamprath (1970). The sorption data were fitted to the Langmuir isotherm.

Results

The results showed that on average from the beginning of the experiment till the end the level of soil organic matter increased from 1.8 (± 0.21) to 4.1 % (± 0.15) and the maximum soil P sorption capacity decreased from Q_{max}=147 (± 14) to Q_{max}=128 (± 3) mgkg⁻¹.

Fig. 1.b showed the variation (%) in the SOM and available P (Olsen-P) at the end of the experiment in relation to the initial soil value. The data showed a deep increase in the SOM (ranged between 85% to 376%) and overall, a significant increase in the soil Olsen-P level. The decrease in Olsen-P level observed in some samples highlighted the preferential transfer of P to areas outside the park due to the runoff waters and the soil erosion.

The linear model [Eq. 1] was obtained for soils with SOM > 2 % and highlighted the effect of SOM on the decrease of P sorption.

$$Q_{max} = -37.168SOM + 282.19 \quad R^2 = 0.73 \quad (p < 0.05) \quad [Eq. 1]$$

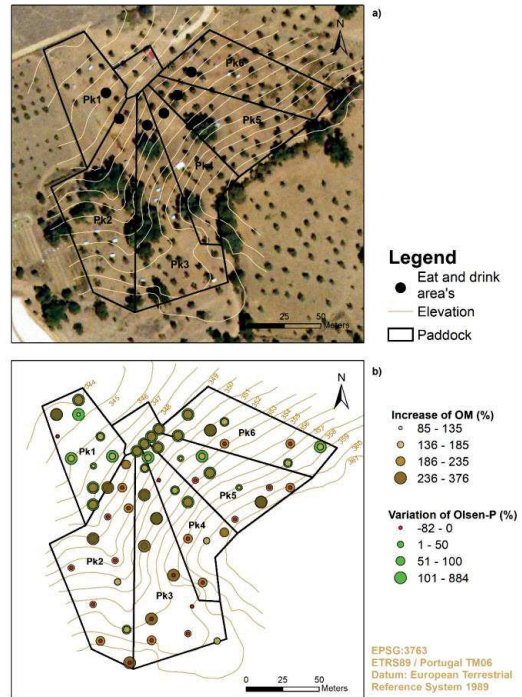


Fig.1 – Location of the experiment and soil properties.

Conclusions

- Outdoor pig production originates a significant increase in soil available P and SOM content provided by animal feed and excreta.
- The increase in soil SOM above 2 % decrease the capacity (Q_{max}) of the soil to sorb P.
- The decrease of soil P sorption capacity highlights the need to implement good management practices to prevent P losses from soil to the waterbodies increasing the risk of eutrophication.
- In outdoor pig production areas, the installation of crops which uptake soil P and provide food to livestock can be a good management practice.