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PHOSPHORUS LOADS IN LOMBARDY (ITALY)

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ABSTRACT

The objective of this paper is to give a first contribution in the evaluation of Phosphorus (P) loads in Lombardy in order to have a better understanding of the current situation and to define the possible actions and guidelines towards sustainability.

The first results show that in the intensive livestock areas the amount of P in manure is more than twice the crop uptake causing a build up in the soil and a potential environmental problem.

INTRODUCTION

The Phosphorus (P) release from agriculture is recognised as one of the main input to eutrophication. Agricultural practices are often aimed to control nitrogen release and, in Italy, there are no limitations to the amount of P that can be distributed. Therefore, when animal manure is utilised, the quantity of phosphorus contained in the manure may be much higher than crop requirements. The consequent build up of P in soil might cause an increase of P release in surface and ground water.

The objective of this work is to give a first contribution in the evaluation of P loads in Lombardy in order to have a better understanding of the current situation and to define the possible actions and guidelines towards sustainability.

MATERIAL AND METHODS

The evaluation is based on a mass balance of inputs and outputs at field level. The inputs are therefore chemical and organic fertilisers; the outputs are the crop uptakes. A further analysis will take into account the soil characteristics and the estimation of P movement from the soil to surface water (runoff) or ground water (leaching).

In order to perform this evaluation it has been necessary to produce an information system assembling data from different sources and to connect them to a GIS.

The analysis has been carried out based on the administrative boundaries of municipality that is the more detailed aggregation level that is possible to reach with the current availability of data.

The data handled to define the amount of P used in agriculture derive from the information related to livestock units and from the amount of chemical fertilisers sold in different areas.

The amount of manure and its P content have been calculated by using standard values for each category of animals and the number of heads.

The estimation of P uptake by crops has been carried out by using the data of the applications of the farmers to obtain financial support through the EU schemes. From these applications the land use at field level can be derived and the area used for each crop can be obtained. The crop uptakes have been based on the average crop yield and on the amount of P contained in the products removed from the field.

Data have been organised in a database in order to process them and to connect them to spatial information by using a GIS (Arcview - ESRI).

RESULTS AND DISCUSSION

Figure 1 shows P crop uptake at municipal level. In the northern part of the Region, in the mountain and hilly area, the total amount of P that leave the fields with agricultural product is low as the type of agriculture is extensive and the cultivated area limited.

The highest values are related to intensive farming in the central part of Lombardy where soils are well drained and a double cropping system can be practiced.

In the south-est, where soils are more clay, crop uptake is reduced by the difficulty of tillage and a different cropping system.

The P content in organic waste produced by livestock farm is displayed in figure 2. The intensive livestock area can be easily identified in the central and south-est area of the territory. The amount of P in manure is very high compared by crop uptake. In the high animal load area the amount of P spread is more then twice what is required by crops as can be observed in Figure 3 that show the difference between crop uptake and P spread to the land with manure.

The comparison of Figure 2 and 3 highlights that the problem of P excess is greater in the area where a high animal load is combined with low crop uptake that is generally referring to clay soils. Of course some of the P can be immobilised in the soil, but it seems that this can build up the soil P content and increase the release of P by runoff.

Therefore in this areas, although there will not be relevant pollution problem in the short term, the sustainability cannot be reached only by a better management practices but should involve territorial solutions like P removal treatments and transport of nutrients to other areas.

There are some municipality in the hilly and mountain area that seems to have some problem too. In this case, it can be noticed the possibility to have a better use of P in the surrounding area, that have moderate or no excess. Moreover, from Figure 4 reporting the total amount of P excess, it can be seen that the quantity of P surplus to be removed are limited in these municipalities while in high density livestock area, all the municipalities have more then 100 tonnes of P that is not uptaken by crops.

Figure 1 - P (as P_2O_3) crop uptake at municipal level referred to the cultivated area

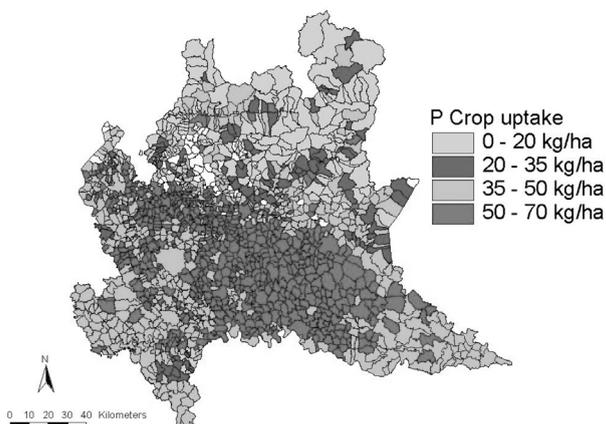


Figure 2 - P (as P_2O_5) contained in manure at municipal level referred to the cultivated area

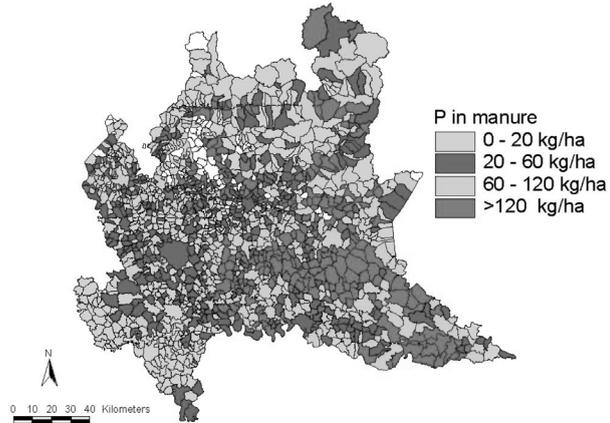


Figure 3 - P (as P_2O_5) in manure excess in relation to crop uptake at municipal level referred to the cultivated area

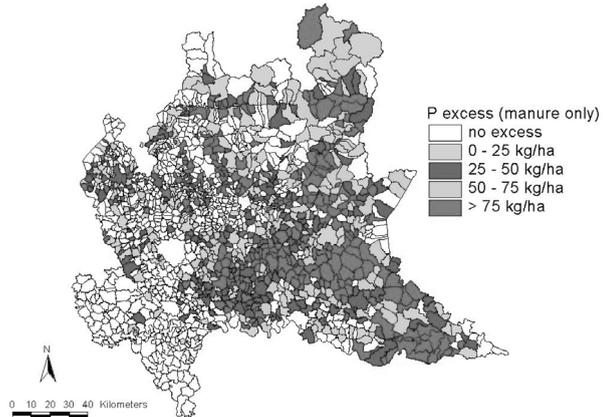
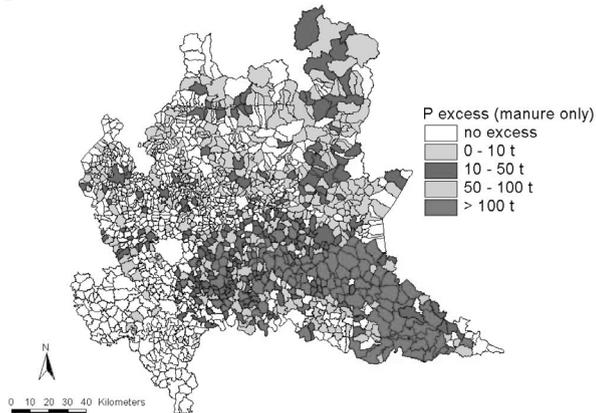


Figure 4 - Total amount of P (as P_2O_5) in manure excess in relation to crop uptake at municipal level.



These situation is worst if we consider also the chemical P fertiliser used by farmers. These increase the P surplus also in the areas where the crop uptake is much more then satisfied by organic P.

Therefore, a first priority is to improve technical assistance to farmer for a better use of manure as fertiliser and reduce the use of chemical P. A second priority is to find a policy to reduce the P surplus in livestock areas as, although it seems that the soil can still bound the excess of P, this cannot be considered a long term solution.

In this respect, suitable solutions as to be found and implemented. For this reason and to have a better understanding of the P release from the land to water, an evaluation of the environmental risk of P surplus based on a ranking system, is currently going on.

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