

# **Application of an agro-environmental decision support system to evaluate the pesticide leaching in North - Italy**

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In this study the decision support system SuSAP - Supplying Sustainable Agriculture Application (LIFE98/ENV/000010) has been applied to the area of the Basin draining in the Venice Lagoon (Northern Italy), in order to estimate the vulnerability of soils to selected herbicides.

SuSAP is a system, integrating existing database (soil, climate, crop, pesticides) and a leaching model in a GIS to help the decision makers to assess the environmental risk of pesticides. The core of the system is the database, storing data and defining the complex relationships relating the different datasets.

Basic soil data have been previously surveyed at scale 1: 50,000 (Soil Taxonomy classification USDA). Several representative soil profiles have been characterised by field and laboratory analysis in order to collect specific hydrological parameters necessary for calibration modelling applications.

Rainfall, temperature, wind, solar radiation, relative humidity, evapotranspiration of 4 meteorological stations covering the area were collected and analysed in order to obtain spatial patterns of rainfall and temperature. The analysis of soil and meteorological data allowed to identify 4 macro-areas defined by a reference meteorological station and characterised by homogeneous climatic conditions.

The lay of the study area, intensively cultivated with maize, is flat and mainly characterised by Pleistocenic glacio-fluvial and Holocenic fluvial deposits. The area is characterised by a mean annual temperature of 13 – 14 °C, a mean temperature in summer of 23 – 24 °C and 2 – 3 °C in winter. The annual mean rainfall amount ranges from 1,000 mm in the North till 800 mm in southern zones; precipitations are more concentrated during the autumn (October and November) and spring (April and May). Amounts, dates and type of irrigation is calculated by means of CropSyst 2.02 (Stöckle *et al.*, 1999) on a standard maize crop applied to a combination of 5 soil scenarios and 4 macro-areas resulting in a number of homogeneous irrigation scenarios. The irriga-

tion practices are distributed in the period June – August, the total amount of water is about 150 mm/year in three times.

PELMO 3.0 (PEsticide Leaching MOdel - Klein *et al.*, 1995) is integrated in SuSAP to estimate the leaching potential of pesticides through distinct soil horizons based on an extended cascade hydrological calculation approach; processes considered include the estimation of the pesticide degradation, sorption and volatilisation, and the potential evapotranspiration. The above model has been selected among those indicated and validated by the FOCUS (FORum for the Coordination of pesticide fate models and their USE), jointly established since 1993 by the European Commission and the European Crop Protection Association to provide guidance to the Member States in EU pesticide registration process. PELMO 3.0 has been run for a period of 12 years and for the selected herbicides, so describing a wide panel of different meteorological conditions, potentially occurring in the area. The 80<sup>th</sup> percentile of the solute concentration, output of the model, each referred to soil-meteorological combination is extracted, ranked in five concentration classes and mapped using the Geographic Information System Arcview 3.2 (ESRI inc.), showing the vulnerability of soils to pesticide leaching. Looking at these results, strong differences could be observed from a compound to an other, according to their physical and chemical behaviour and the variability of agro-environmental scenarios.

The obtained maps should be considered as an important tool to describe the vulnerability of soil to specific pesticides, so contributing to locate potentially critical areas for groundwater resources.