Soil acidification vulnerability

Soil acidification is a process in which soluble elements like calcium and magnesium are leached out by rainfall and replaced by hydrogen and aluminum. Increasing soil acidity makes some nutrients less readily available, makes aluminum and manganese (which are toxic to plants at pH values below 5.5) more readily soluble, and reduces the effectiveness of various herbicides (Gosselin et al. 1986).

Acid rain and the application of chemical fertilizers that have a decalcifying and acidifying effect (nitrogen fertilizers in particular) hasten the desaturation of the absorbing complex and the downward trend in pH (Wang and Coote 1981, Tran 1988), making it necessary to apply lime. With crops that need heavy doses of nitrogen fertilizer (such as corn and potatoes), acidification occurs more quickly (Tran 1988). The cost of soil acidification is computed from the quantity of lime required to keep soil pH at an optimal level for plant growth. It is noteworthy that the largest number of hectares affected by acidification are observed in the Richelieu-Saint-Hyacinthe agricultural region (Tabi et al. 1990).

The soil characteristics used in the vulnerability assessment model (Table 1) are surface layer texture class and whether limestone is present in the substratum (C horizon). Cation exchange capacity (CEC) is also a good indicator of soil acidification vulnerability, as it reflects a soil's buffering capacity relative to its clay and organic matter content. The most acidification-sensitive soils are soils that are vulnerable to leaching, soils with low buffering power, and soils that are subjected to heavy applications of nitrogen fertilizer. Intensively cultivated sandy soils are thus the most sensitive of all.

Table 1. Soil acidification vulnerability assessment model

Calcareous	**Surface layer (0-25 cm) texture class***			
Class	1 and 2	3	4 and 5	T
Non-calcareous	High	Moderate	Nil to low	Moderate
Calcareous	Moderate	Nil to low	Nil to low	Nil to low

*See Table 5 for a description of texture classes
After Wang and Coote (1981) and Martin and Nolin (1991)

The map provides a means of identifying the most vulnerable soils, which may entail additional costs because of outlays for minimization measures (liming, staggered applications of fertilizer, and so on). The spatial variation of soil acidification vulnerability is related to surface layer (0 - 25 cm) texture. Soils with nil to low vulnerability account for 48.8% of the study area. These are calcareous loamy soils and clay soils that are found in Chambly and Verchères Counties for the most part (e.g. Boucherville series). Moderately vulnerable soils account for 22.5% of the total area. These are essentially the calcarerous sands and non-calcareous loams that occur mainly in Richelieu and Saint-Hyacinthe Counties (e.g. Du Contour series). Lastly, highly vulnerable soils account for 28.7% of the study area. These are non-calcareous sandy soils (e.g. Michaudville series) that occur on Mount Saint-Bruno and Mount Rougemont, the sandy terraces of the Bois de Verchères and in Richelieu and Saint-Hyacinthe Counties.