# Impact Study on the Application of Vinasse to Cambisol and vertic Luvisol in Ethiopia.

Frédéric Feder1 and Julie Sansoulet2

1 CIRAD, UPR « recyclage et risque », Dakar, SÉNÉGAL

2 Unité Mixte Internationale Takuvik, CNRS et université Laval, Québec, CANADA

To study an impact on the application of vinasse to Cambisol and vertic Luvisol in Ethiopia, we used HP1 an hydrogeochemical models to assess the medium-term risks of the use of that agricultural practice by a Sugar Factory. The three water input scenarios tested play a major role in soil function and simulated soil changes after a vinasse input. There is always drainage in all three types of soil; it varies from slight (50 mm/yr) to fairly substantial (1000 mm/yr). However, the latter value is related to a scenario (i) that does not take rainfall into account in irrigation management and (ii) that ignores losses of water before it reaches the soil. Overall the conditions seem optimal, strictly from the water supply standpoint, for limiting the risk of salinization. Under the initial conditions, the irrigation water used was not heavily loaded with salts (ca. 4.5 mS/cm) and the soil exchange complex was 80% saturated with calcium because of the calcareous origin of the parent rock. The behaviour of the three soils is fairly similar overall. The input of vinasse, at a dose equivalent to 340 kg/ha of potassium, causes a significant increase in the concentrations of chemical elements in the soil solution but also greater leaching of these chemical elements out of the soil profile. Over time, the distribution of cations in the CEC does not change very much and appears to settle on noncritical values. Sodium, then potassium, partially replaces magnesium and calcium in the CEC, but ultimately the change is slight. The percentage of calcium in the CEC never falls below 75%. Saturation indices determine whether the physico-chemical conditions are such that minerals (halite, calcite, gypsum, etc.) will precipitate out and cause salinization. Our simulations show that when vinasse inputs are done at a normal dose (equivalent to 340 kg/ha of potassium), the risk of precipitation of minerals is nil, especially when water inputs are properly calculated (low drainage). However, when the inputs are doubled (equivalent to 580 kg/ha of potassium), several minerals are near supersaturation and therefore liable to precipitate out. The volumes of water supplied are also immaterial, since when drainage is slight, anhydrite and gypsum are the substances liable to precipitate out, and when it is greater, K-jarosite will. Therefore, whatever the water input scenario tested, we recommend against vinasse inputs at a dose equivalent to 580 kg/ha of potassium. On the other hand, for all three types of soil, vinasse inputs at a dose equivalent to 340 kg/ha of potassium present no medium-term risk of soil salinization. Moreover, at these same doses, no parameter (chemical composition, breakdown of elements in the CEC, SI, etc.) tends toward a critical threshold.