Introduction
During animal waste composting, organic matter transformation leads to emissions of environmentally harmful gases like NH$_3$, N$_2$O, CO$_2$ and CH$_4$ (Houghton et al., 2001). An experimental design (Fig. 1) was built with the four main factors responsible for gaseous emissions: biodegradable N and C (as % of total N or C), water content and free air space in the pile. The results given in this poster concern the influence of biodegradable N and C.

Results
In favourable conditions of free air space and humidity CH$_4$ emission is very low (Table 1). The N$_2$O emission is low (1 to 6 % of that of NH$_3$). The NH$_3$ emission can be described with four parameters (Paillat et al., 2005) (Fig. 3): the highest emission rate (ER), the time taken to reach this value (TR), the emission duration (ED) and the cumulative emission (CE). TR depends mainly on the initial microflora (A, B and C piles with manure); ER depends mainly on C biodegradability (E vs G and F vs H) but also on microflora (C); ED depends mainly on available N (N- vs N+); CE depends on N and C biodegradability (Eq. 1).

Materials and Methods
Eight different mixtures of wheat straw, sawdust, pig slurry and manure, molasses, urea and water were made, in order to create a wide range of N and C biodegradability (Fig. 2). The eight compost piles (1.4 m$^3$) were checked during the thermophilic composting phase: emissions of NH$_3$, N$_2$O, CO$_2$, CH$_4$ and H$_2$O were measured with sensors and analysers from each compost pile.

![Available N (%)](image)

Fig. 1. Different composting situations within the four parameters studied.

![Biodegradable C (%)](image)

Fig. 2. Classification of mixtures from their available N (SN/TN) and biodegradable C (SH-VS/DM) fractions; SN and TN are soluble (4°C during 12 h in water) and total nitrogen, SH-VS are soluble and hemicellulose-like Van Soest fractions, DM is dry matter.

![NH$_3$-N emitted at 56 d](image)

Fig. 3. Kinetics of NH$_3$-N emission for the eight piles (A to H) as influenced by microflora, N availability and C biodegradability of the initial substrate.

![Table 1](image)

Table 1. Gaseous emissions after 56 days of composting, ranked according to NH$_3$-N emission.

**Discussion**
From the pile constitution, the ammonium pool in the solution is rapidly increased with the ammonification of easily degradable nitrogen compounds, depending on the initial microflora. Thereafter, volatilisation rates in two consumption fluxes, nitrification and immobilisation in the microbial biomass (Kirchmann and Witter, 1989). The nitrification is a weak flux because the temperature in the pile is too high for the nitrifying bacteria (Schlegel, 1993) and the pile is saturated with CO$_2$ in the first stage of composting. So N$_2$O production, which is a by-product of nitrification and denitrification, remains low. The immobilisation is a major flux which depends mainly on the C biodegradability and on the effective microflora (Hellmann et al., 1997).

**NH$_3$-N emitted at 56 d**

$N=8; P<0.05; R^2 = 0.82$

$N=8; P<0.01; R^2 = 0.84$

with NH$_3$-N expressed in g kg$^{-1}$ TN, CO$_2$-C in g kg$^{-1}$ TC, SN and SH-VS en g kg$^{-1}$ DM, NH$_3$.