EFFECTS OF CRUSHING AND DRYING ORGANIC PRODUCTS ON THEIR NITROGEN AND CARBON MINERALIZATION IN SOIL INCUBATIONS

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Introduction

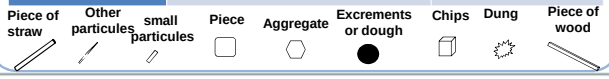
Project PROLAB aims at studying the transposition of measurements carried out in controlled conditions towards the context of field. The study aims at evaluating the effects of drying and crushing organic products prior to start of incubation on C and N mineralization in soil incubation.

Materials et Methods

Experiments in controlled conditions have been settled up to follow C and N mineralization of seven waste organic products.

Description of organic products

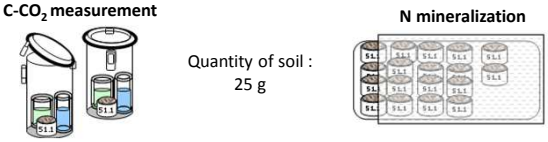
Products	Characteristics	Feature
Municipal solid waste compost	Solid ; heterogeneous (sludge + ligneous co-substrate), high N and N-NH4 contents, soil improver	
Co-compost of sewage sludge and greenwastes	Solid ; homogeneous, powdery, willing to N immobilization, often moderatly stabilized	
Sewage sludge	Doughy ; quite homogeneous ; high N content, organic fertilizer, biodegradable	
Solid digestate issued of dry mesophilic batch process	Solide; heterogeneous (piece of fresh straw + faeces); high N and NH4 contents, usually quite stabilized through digestion	
Raw liquid digestate issued of liquid mesophilic continuous process	Liquid + small particles ; high N and NH4 contents, usually quite stabilized through digestion	
Cattle manure	Solid ; heterogenous (straw + faeces), soil improver but often biodegradable, willing to N immobilization ; various N and NH4 contents	
Poultry manure	Solid ; heterogenous (excrement + chips) ; high N and NH4 contents	



Conditions of the incubations :

- *Temperature* : 28°C
- *Duration of incubation* : 6 months
- *Days of measurement :*
  - **Carbon :** 1, 3, 7, 14, 21, 28, 49, 70, 91, 112, 133, 154, 175 days
  - **Nitrogen :** 0, 3, 7, 14, 28, 49, 91, 175 days
- *Number of replicates :* 4
- Clay-loam soil (clay =198 g kg^{-1}, silt = 706 g kg^{-1}, sand = 94 g kg^{-1}, CaCO3 = 3 g kg^{-1}, pH = 7.8, organic C = 9.7 g kg^{-1}, organic N = 1.11 g kg^{-1})

Experimental device with recommended standardized method (AFNOR) (dried and crushed products)



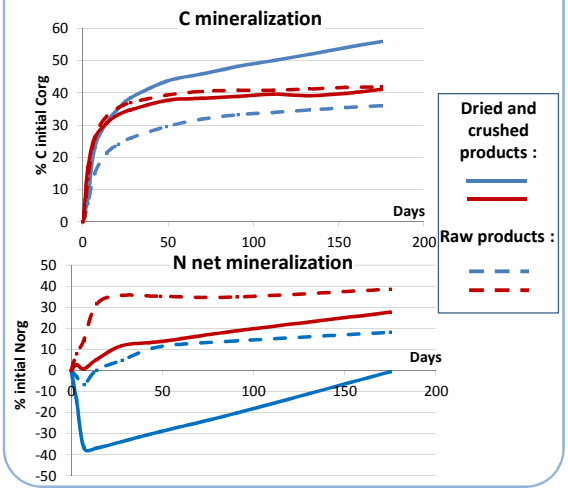
- Boll with « bare soil » or « soil and product » + water added to adjust soil humidity (pF 2.5)
- Water to maintain constant moisture
- NaOH to trap CO2 evolved
- Rubber joint to make the jars airtight (C measurement device)
- Pierced plastic film to reduce water losses in the tray

Experimental device with raw products (differences from the standardized method)

- Quantity of soil : 500 g
- $C\text{-}CO_2$: 3 L hermetic jars, NaOH traps removed periodically
- N-min : sample of 100g, extraction with 200 ml of KCl
- Measurement and soil moisture adjustment at each sampling date

Results

C and N mineralization : examples of results for the **poultry manure** and **co-compost of sewage sludge and greenwastes**



Effects of the way of preparation on C and N mineralization (differences between dried and crushed products and raw products) :

Product	$C\text{-}CO_2$		Net N mineralized
	rate	duration	rate
Municipal solid waste compost	+	7 days	0
Co-compost of sewage sludge and greenwastes	++	50 days	- -
Sewage sludge	++	7 days	-
Solid digestate	0	7 days	- - -
Raw liquid digestate	+	3 days	- -
Cattle manure	-	5 days	-
Poultry manure	0	3 days	- -

+++	> 25 %
++	from 15 to 25 %
+	from 5 to 15 %
0	from -5 to + 5%
-	from -5 to -15 %
- -	from -15 to -25 %
- - -	< -25 %

➔ **For carbon,** we obtained three types of response:
- No effect (solid digestate and poultry manure)
- Mineralization is higher with dried and crushed products (solid waste compost, co- compost of sewage sludge and greenwastes, sewage sludge et liquid digestate)
- Mineralization is higher with raw product (cattle manure)

➔ **For Nitrogen** : net mineralization is higher for raw products

Conclusion

The results of the project make it possible to understand and quantify how sample preparation modifies the kinetics of potential mineralization. The results will be used to determine transposition factors from laboratory to field conditions. These transposition factors will take into account the particle size, the heterogeneity of the mixture and the availability of nitrogen. This will allow to improve the way to integrate the kinetics of mineralization of organic products in decision-making tools to calculate additional mineral fertilization for crops receiving organic products.

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