

## « Réseau PRO »: Establishing a method for the referencing of organic residues recycled in agriculture in a database

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### Abstract

In 2011, the Réseau PRO network has been created to centralize and share data acquired in field experiments conducted in France on the recycling of organic residues (OR) in agriculture. The Réseau PRO is also a consortium composed by professionals working on OR recycling in agriculture (i.e. research and teaching institutes, technical institutes, agricultural chambers, professionals of the OR treatment and valorisation). In 2011, a survey has been carried out to inventory the French field experiments studying effects of OR recycled in agriculture [1]. The survey showed that the terminology employed for the studied OR and the level of describing information (raw materials, composition, treatments, etc.) were very heterogeneous. In order to share a unique OR classification between professional partners of the Réseau PRO network at a national scale and to facilitate OR recognition and selection of data centralised into data bases, a method for the OR referencing has been developed. This method includes 3 steps organized into hierarchy and interdependent: first step, the description of the OR and its composition, secondly the description of the treatments applied to it and finally the specification of the OR storage conditions. This work will permit to compare the same types of OR studied on the field experiments inventoried in the Réseau PRO and in fine applied in agriculture.

### Introduction

Organic wastes recycled in agriculture are very diverse due to the large variety of raw materials and different treatments that can be performed (ex. composting, methanization, desiccation, etc.). The expected effects of OR applied in agriculture can thus vary greatly in terms of fertilisation and organic amendment efficiency. Nevertheless, in addition to the agronomic value of OR, there could be putative inputs of contaminants brought by OR due to the origin of raw materials (urban, industrial, farm, etc.). In 2011, the Réseau PRO network carried out a survey to inventory the French field experiments studying the agronomic value and the environmental and sanitary putative impacts of OR recycled in agriculture [1]. As shown in this inventory, terminologies employed to name or describe the studied OR and the level of describing information were very heterogeneous (i.e. nature of raw materials, composition, classification of final product, treatments and process characteristics, storage duration and conditions). Such observed diversity and disparity of terms was considered as a difficulty to identify OR and to compare the OR effects studied in field experiments. To overcome such heterogeneity in OR classification and description, the Réseau PRO network developed a methodology to homogenize the OR terminologies and to organize the OR into a unique classification at a national scale. In addition, this method was also developed to connect the OR describing information and analytical data stored in the same databases.

The objective of the present study was thus to propose a method to describe and classify the OR recycled in France which was established for the OR studied in the inventoried field experiments in the Réseau PRO network.

### Material and Methods

Using the inventory results [1], each studied OR in the inventoried field experiments, its origin, composition or even treatment have been listed and categorized. An Excel file has been then developed to describe the OR studied in the Réseau PRO network. This OR referencing method guarantees a characterization as detailed as possible and enables a good cross-checking between the asked information and the OR classification that is being established for the project. The Excel file is composed by tables and information lists for each step of the OR referencing: classification, origin, composition, treatments and storage conditions.

The lists of answers defined for the description of the studied OR were established with the expertise of professional partners of the Réseau PRO.

### Results: OR description and characterisation methodology

In the Excel file, the OR referencing method consists in the detailed description of the studied OR in terms of composition, treatments and storage conditions. In addition, each OR is referenced in respect to a classification or nomenclature established at the national scale. The chosen describing criteria were defined for their characteristics which may alter the expected effects of OR recycled in agriculture, for instance treatment and process characteristics, precise composition, duration and condition of storage before spreading. For each of them corresponds a list of answers that enables the homogenization of OR characterization between Réseau PRO partners. Nevertheless, those lists which are not fixed need to integrate future evolutions according to new OR treatments and/or new OR used in agriculture.

The first level of referencing consists in giving background information on the OR: contact details of the OR producer, OR regulatory status (certification standard, homologation, waste...), physical form (liquid, solid, etc.), and, if existing, commercial designation and N/P/K contents advertised.

Then, 3 steps, organized into hierarchy and interdependent, give information on the nature and the characteristics of the described OR. Those steps are described in the following paragraphs.

#### *Description and composition of the OR*

The first step of the OR referencing concerns the general description and the composition of the OR which is broke down into 3 sub-steps.

First, the user needs to choose the origin of raw materials among the following 4 origin classes: urban or industrial OR, livestock manures, other animal/vegetal OR and mixed OR (OR with a composition including organic matters from at least two of the three origins above). Then, the user defines the great type of the OR corresponding to the first OR classification class. The list of OR great types is dependent on the origin of the OR which has been chosen previously. The OR origins and corresponding great type lists are presented in table 2.

**Table 1: OR origins and corresponding OR great types lists proposed in the OR description methodology**

<b>OR origins</b>	<b>Corresponding OR great types</b>
<b>Urban or industrial OR</b>	Urban or industrial sludge Agro-industrial by-products Composted urban or industrial OR Digested urban or industrial OR
<b>Livestock manures</b>	Non-composted, non-digested livestock manures Composted livestock manures Digested livestock manures
<b>Other animal/vegetal OR</b>	Animal OR (bone flour, etc.) Vegetal OR (seaweeds, etc.) Composted animal or vegetal OR
<b>Mixed OR</b>	Non-composted, non-digested mixed OR Composted mixed OR Digested mixed OR

The next sub-step is to list raw material(s) composing the final product and to specify their proportions. The proposed list of raw materials depends on the chosen great type as shown in figure 1 which presents the 1<sup>st</sup> step of the OR referencing (i.e. description and composition).

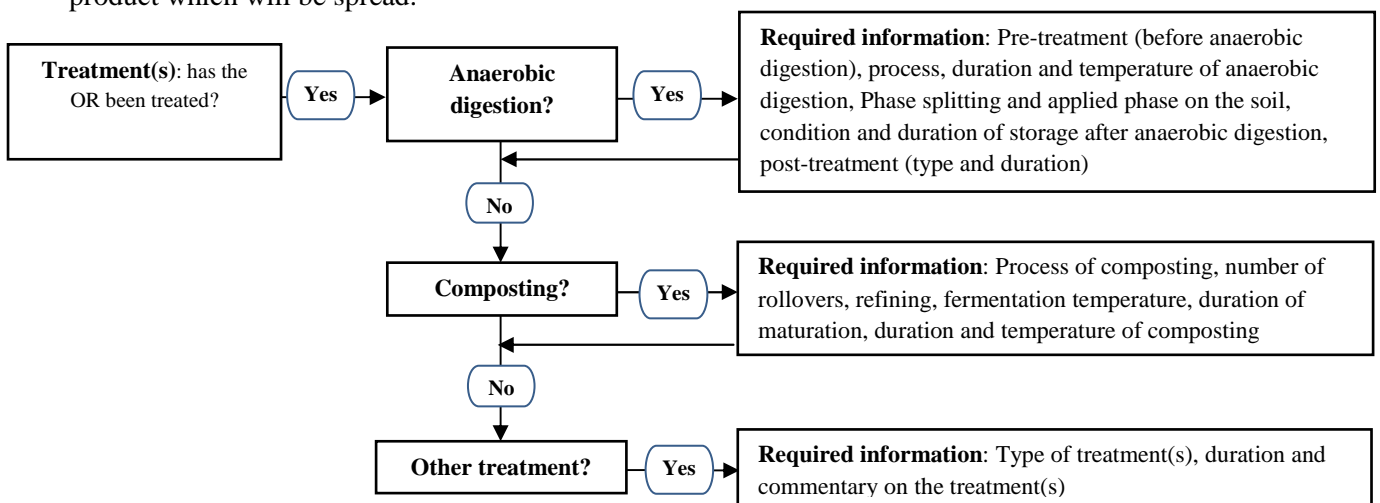
	A	B	C	D	E	F	G
1	<b>Studied OR n° 1</b>						
2	OR name	Sewage sludge		OR producer name			
3	OR origine	Urban or industrial		Address			
4	Great type of OR	Urban or industrial sludge		E-mail			
5	OR status			Tel			
6	Physical form						
7	Taux de MS du PRO (% de MB)						
8	Commercial designation						
9	N/P/K contents advertised						
10							
11	<b>1. OR COMPOSITION</b>						
12	Raw materials	Remark	Raw material proportion in the OR	Animal type	Litter	Litter quantity	Livestock building
13							
14	sewage sludge			The proposed list of raw materials depends on the chosen great type of OR			
15	paper sludge						
16	food-processing sludge						
16	PRO étudié: Si la MP						

**Figure 1: description of the OR composition**

In the livestock manures particular case, this first step includes description characteristics that have been identified as factors able to alter the actual agronomical value of OR as well as the putative impacts after spreading, for instance nitrogen fertilisation efficiency and putative risks of nitrate leaching. Those particularities concern the type of animal (for example for a cattle manure, the corresponding animals are dairy cows, weaned calf, young bull, etc.), the livestock building, the type of litter (straw, shaving, etc.) and the quantity of litter used for animals.

#### *Treatment(s) applied to OR*

After the description of the OR and its composition, the following step is to specify every treatment applied on the raw materials in order to produce the final OR. For each treatment, a list of characteristics have been defined due to their putative effect on OR agronomical value and putative impacts. Those characteristics and the corresponding list of answers proposed are related to the applied treatment. The figure 2 presents the flowchart of the second step of OR referencing corresponding to the description of the treatment(s) applied to the raw materials to obtain the final product which will be spread.



**Figure 2: sub-step for the description of the treatment(s) applied to the studied OR**

A list of answers is proposed for each required information.

In the case of no treatment had been applied to the OR, this step is skipped and the excel file user goes directly to the last step of OR referencing, i.e. storage.

#### *OR storage before soil application*

The third and last step of OR referencing consists in giving details on the OR storage conditions and duration before spreading. Indeed, condition of storage and duration can alter OR properties, for instance maturation degree of OR which is known to modify OR behavior after spreading.

Among all the criteria listed in the three steps of the OR referencing method, some are mandatory to understand and predict the effects of OR applied in agriculture (for example the treatment and storage duration). Others criteria are less relevant and are therefore optional (for example the duration of the treatment).

#### **Conclusion and perspectives**

The test of this method for few organic residues showed that it is well adapted to the classification and the description of the great diversity of OR recycled in France. It also enables a good cross-checking with the in-process nomenclature of OR elaborated for the project.

The method developed for OR classification and characterization homogenized at the national scale will permit to compare the same types of OR studied on the field experiments inventoried in the Réseau PRO. Moreover, a typology based on analytical data and in situ expected effects would be developed thanks to an OR referencing as detailed as the one presented in this study.

#### **References**

[1] Bell A, Michaud A, 2012. « Réseau PRO »: analyzing the French context of field experiments assessing agronomic, environmental and sanitary impacts of organic residues recycled in agriculture. Abstract Ramiran 2013.