Management strategies related to legislative, economic, agronomic and environmental impact of organic wastes.

Invited Paper

Stratégies de gestion des déchets organiques prenant en considération leur impact législatif, économique, agronomique et environnemental.

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Abstract

As a result of scientific studies and public awareness, environmental protection is now recognized as one of the basic state policies. Strategies management of anthropic activities must, more than ever, take in account not only the environmental legislation corpus, but the concepts and principles that are used to build the public policies. Most of the times, it considers also economical and financial procedures (taxes and grants) and technical tools analysis (systemic analysis and flows balances). Agriculture is highly concerned because of its natural relations to environment and also because of its weight as a production / consumption chain.

In most cases, spreading is used for soil restitution of nutrients but with unbalanced flows resulting in environmental impacts. It is obvious that territorial regulation of a « back to soil strategy » must be built on the aptitudes of :

- *soils to be amended,*
- *crops to be fertilized,*
- *farms to gain profit,*
- *neighbours to agree,*
- *natural areas and ressources to be protected and exploited,*
- *.....*

When considering each elementary flow, the questions are : what kind of natural cycle is pertinent for a specific flow ? Where and how is it stored in nature ? The answer is different for carbon, nitrogen or phosphorus.

Résumé

Devant les résultats d'études scientifiques et face à la demande du public, la protection de l'environnement est maintenant reconnue comme une des politiques publiques des états.

Les stratégies de gestion des activités humaines doivent de plus en plus prendre en compte non seulement le corpus juridique et réglementaire de l'environnement mais aussi les concepts et principes sur lesquels sont construites les politiques publiques. Très souvent, elles intègrent aussi des procédures économiques et financières (taxes et subventions) et s'appuient sur des outils techniques (bilans et analyse systémique). L'agriculture est hautement concernée, par ses relations naturelles à l'environnement, mais aussi par son poids dans la chaîne de production / consommation.

L'épandage est une modalité très utilisée mais en raison du déséquilibre des flux, il conduit à des impacts environnementaux. Il est évident qu'une stratégie de retour au sol doit être basée sur l'aptitude :

- des sols à être amendés,
- des cultures à être fertilisées,
- des exploitations à être rentables,
- du voisinage à être d'accord,
- des zones et ressources naturelles à être préservées et exploitées,
- .....

Si l'on prend en considération chaque flux élémentaire, les questions qui se posent sont : A quel cycle naturel se rapporte-t-il ? Où et comment est-il stocké dans la nature ? La réponse est différente pour le carbone, l'azote ou le phosphore.

1. Introduction

Traditionally, management strategies of manufactured products cover the wide range of technical, economical and social considerations, which have learned to live together more or less quietly. The emergence of environmental considerations is relatively recent and leads to troubles. At this point of our knowledge and practices, we can say that :

- new questions that have to be taken in account are identified
- their solutions are not always correctly implemented
- it is often difficult to organise them into a global problematic
- it is even more difficult to translate them into actions

Applied to waste management, the level of difficulty increases of several points, because waste management is, more than other subjects, a conflict area. Further if you add "organic" to "waste", you again increase difficulty because of the

complexity of the organic matter, of its reactive potential and of psychological considerations.

A management strategy results of the answers to the following questions :

- What is ideally wishful ? considering the global context
- What is socially acceptable ? considering the present situation
- What is readily feasible ? considering my specific position

These questions must be asked with a frequency depending on the speed of evolution of context, situation and position. However, this evolution is rather rapid because we actually live a period of construction under uncertainties. It means that the questions related to organic waste management must be answered through a prospective analysis, and with a proactive management policy as strategy means that you want to anticipate, to predetermine events and not to stay running after them.

So, the first point is to review the main environmental policies, to analyse their conception and development mechanisms in order to find how they can change in the next future. The second point is to detail the role of waste management policies and systems inside the range of environmental policies, and finally the third point is to describe the possible strategies for organic wastes. I will conclude on the future of the "back to soil" strategy applied to all kind of wastes.

2. The place and role of environmental policies

Maybe, the second part of our finishing century will stay in memories as the emerging period for environmental public policies. And maybe that future generations will find at least funny or completely crazy our polemic debates and our environment protection programs. But, the fact is that each state is building progressively its environmental policies through :

- the organisation of public services for control and incitation
- the development of a legislative corpus
- the modification of the existing economical rules

The role and respective weight of this different parts varies a lot from state to state resulting in more or less "hard" or "soft" regulation policies.

These policies answer to a social demand, as the public opinion has been aware of environmental impacts through scientific works. Aiming to modify our economical development conditions, basically responsible of environmental problems, it is not surprising that they use of financial mechanisms in order to change the value of things, activities and products.

If we look for details on environmental policies, we must consider on one hand the concepts, principles and tools on which they rely and on the other hand the different fields they cover and the way it is co-ordinated.

The concepts, principles and tools can be related to their rationale :

- economical changes	to	polluter/payer principle
- global public policies	to	sustainable development concept
- scientific approaches	to	systemic analysis
- engineering	to	best available technologies strategies
- ecological ideal	to	nature protection strategies

Environmental policies cover a wide range of problems. It results in specific thematic subpolicies, which can be gathered into groups :

- Natural Resources Quality Preservation (air, soils and water)
- "Wild" Nature Protection (biodiversity, protected areas, species in danger...)
- Production Activities Regulation (emissions regulation and waste treatment)

The third one is often the result of the others which give the background to assess the field and level of regulations.

Agriculture is highly concerned with environmental policies, because of its natural relations to nature. It is surrounded by :

- elementary fluxes and geo/biocycles
- space occupation and landscapes
- quality of its own natural resources
- wild life versus its domestication processes (fauna and flora)

The main problems with agriculture is that :

1. local impacts are the result of a collective behaviour. So the corrective actions must also be collective
2. agriculture covers a wide range of activities, and two main levels of production, e.g. vegetable growing and animal feeding, which have significant differences considering their respective environmental impacts.
3. production systems for a specific activity are also widely different, depending on many parameters, a part of them are determined by the natural local context.

Agriculture is also involved, as a primary activity, in an important production/consumption chain : the food chain. Specific tools have been developed to analyse the impacts of products through their production chain. Life Cycle Analysis is a well known one. It considers that quality requirements and environmental production conditions are more and more imposed to producers as a feed-back requirement of consumer behaviours. Applied to primary agriculture productions, the problem with such tools is to correctly integrate all the local impacts most of them depending of conditions or practices inside the system and then of the hypothesis that are used.

Another common specificity of the different production steps of this chain is the co-production of organic wastes :

- crops residues
- animal slurries and manure
- agro food organic wastes and by-products
- the organic wastes or fraction of wastes produced by shops, restaurants, and finally household
- at the far end, the organic wastes coming from sewage treatments

All these wastes are involved in a specific management system based on biological processes through animal feeding, biodegradation and new vegetable organic carbon fixation

Following this organic chain, we can notice that generally :

- the production of organic wastes decreases from agriculture to food industries and then to household
- the organic purity decreases also, either by mixing with other wastes or by contamination
- the financial capacity increases

When trying to solve environmental local impacts, the first problem is to define the territorial system and its boundaries. For water pollution problems, it is relatively easy. But, for air pollution, it can be more difficult. Another problem is to determine the respective responsibilities and also to find the solidarity between activities on which can be built action plans. Concerning local space management, there are two main competitors involved in land uses responsibilities : agriculture (cropping) as an exploitation activity and municipalities as a public administrative regulation level. Manufactories and shops are more concerned with product exchanges (transport of goods, of energy, water resources...) and then with territorial equipment and networks. The corresponding public administrative levels are regional or national.

To achieve this description of environmental problems and strategies, let's have a look on the systemic analysis method. As it comes from physical and chemical

principles, it has been developed to assess the impacts of physical and chemical fluxes in and out of a specific system, a production system for instance. But, the reasons of the present situation are not physical or chemical. It is more and more important to take in account for the same system :

- social and economical flows (employment, costs, added value...), which can be easily done
- psychological and cultural flows, which is a little bit more difficult

It is important because the problem of environmental impacts of anthropic activities, which is as old as humanity, needs a negotiated political response and not only a scientific explanation. Maybe, we can find here the reasons of the troubles produced by environmental considerations when applied to social, economical and technical systems.

3. Waste management policies

Among the different specific environmental policies, one is dedicated to waste management. Its role is to develop an intermediate eco-industrial activity which avoid the direct contact between raw rejections (sewage, gases, solid wastes) and the environment. The waste management system takes in account :

- primary wastes from production/consumption chains including used packaging, by-products...
- secondary wastes from treatment of rejections as sewage sludge, flying ashes...

Any waste management system relies on :

- Prevention including avoided productions and improved quality of wastes
- Re-use and recycling of wastes
- Storage in landfills or salt mines, with graduate levels of insulation depending on the wastes danger potential

The system is limited and then determine by the two main points that are Prevention and Landfilling. The problem with prevention is to agree on what has to be prevented : pollution, costs, landfilling, transport... The problem with landfilling depends on the role it plays in the system. It can be only a final storage equipment for treated wastes or a treatment step, something like an outdoor reactor.

The waste system is mainly defined by the pressure that is made on landfilling through its legal, technical and economical obligations, comparatively to the same kind of obligations on the other possibilities. The aim of waste re-uses is not only to avoid environmental damages from waste disposal, but also to decrease the exploitation of natural resources through recycling. As it is generally not

economically profitable to recycle, taxes and financial mechanisms have been developed mainly to charge the consumer and not the citizen.

As the waste treatment activity can produce more pollution than avoided, the waste treatment system must be a clean one. Most of the time, specific emission levels are decided for wastes treatment plants and specific quality composition for waste derived products.

Re-use of waste can be done through three main strategies :

- an industrial recycling/re-use strategy
- a "back to soil" strategy
- an energy production strategy

Each waste strategy can be done by different ways. On one hand, it can integrate industrial cycles, as a "secondary raw" matter, for instance glass or cardboard recycling or industrial organic fertilisers production for organic wastes. At the opposite, less valuable wastes are managed through a territorial organisation of treatments plants, with different space levels as for "Russian puppets". These plants feed proximity utilisation (through networks or local markets).

4. Organic wastes management

The recycling of organic wastes back to the food chain can be done at different steps of this chain. For instance, animal blood can be used for human food, for animal feeding or for crops fertilisation. It seems natural that organic wastes come back to the food chain, but only as far as it is acceptable, I mean safe and not shocking. But, organic matter can also be used for energy production through digestion or combustion or cogeneration, as a gaseous, liquid or solid fuel, which represent a lot of different possibilities. If lignocellulotic, it can also be used in material recycling, and so on.

The problem of the best solution with organic wastes management covers three main considerations.

First, the complex composition of organic matter, if we consider all the elements, leads to a lot of environmental questions about the most pertinent way to manage the corresponding fluxes. Is nitrogen better in air as ammonia than in water as nitrates ? And what about soil accumulation of trace elements ? Is phosphorus the best target element for organic wastes spreading ?...

Secondly, organic matter is generally very "reactive", I mean potentially source of reactions (as biodegradation, volatilisation, toxicity, ecotoxicity...) depending on its environmental fate. It leads to two kinds of consequences : pollution problems, of

course, but also treatment problems as whatever the process you choose, it has adverse effects.

Third, organic wastes can have a high content of water with and consequently, the fate of this water flow must be considered. But, the main point with this associate water is that the alternative strategy is not a solid waste one but a sewage treatment one.

Up to now, most of the territorial organic waste management systems include :

- a "back to soil" basic strategy, through spreading of more or less treated (denitrified, digested, composted, limed...) products. The limits of this basic option come from crops and soils needs and from environmental policies based on nitrogen or phosphorus loads. The adequate territorial level is the local agriculture area. It is relevant for the most aqueous organic wastes including a wide part of soluble elements. The solid wastes or the extracted solid part of wastes can also be managed with the same strategy but at a larger space scale.
- an energy strategy based on combustion or incineration in local supplying energy plants. It works pretty well for dry lignocellulotic wastes and can be used for the excess solid part of wet organic wastes. The good scale covers several municipal territories depending on the local activity pressure and the energy corresponding networks. Anaerobic digestion can supply energy but remains a biological strategy as the final digested products is mainly spread on lands.
- finally, landfilling is still widely practised. But, the future of organic waste landfilling is under discussion and most of environmental policies aim to reduce or ban it. Direct organic wastes landfilling needs methane recovery and, if profitable, utilisation.

5. A biological management strategy for organic wastes

What will happen in the next future ?

There is, nowadays, a great problem of acceptability of spreadings, for municipal sewage sludges because of health risks and of the bad image of the product, which applies also to animal slurries because of odour and excessive spreadings.

In order to stop a slow decline of spreadings, the ADEME works on the concept of biological management of wastes. This concept covers all the "back to soil" possibilities but places life and biological processes at the heart of the strategy, as

the main decision parameters to regulate this strategy. Then, it must be a demand drived strategy, highly determined by quality requirements.

A programme has been developed on this concept, based on three complementary fields :

- research and development to reduce uncertainties and to improve quality
- pilot sites to work on genuine practices and figures, and to know what is needed and what is effective
- information system for communication and references

To be sure to forget nothing to describe the rules and laws of this strategy, seven "points of view" are needed :

a) image, communication and social acceptability
b) legislation , contracts and standards
c) quality management and training
d) economical and financial conditions
e) processing, logistics and organisation
f) agricultural integration and results
g) environmental impacts assessment

The aim of this programme is to determine the future conditions of development of the "back to soil" recycling strategy, safety conditions of course but also and mainly its contribution to our future sustainable development.

Another key for future is our ability to develop integrated territorial strategies for all the different sources and kind of organic wastes. We know that the resulting systems will used more or less of each basic management possibilities, landfilling, energy production, fertilization, animal feeding, industrial recycling... depending on local and actual conditions. The co-treatment of different organic wastes is already possible and has been widely demonstrated. But, the genuine co-management has to face many resistance, and first the one which lays in minds reducing our point of view to what happens or not in our backyard.

6. References

Burton C.H., Beck J., Bloxham P.F., Derikx P.J.L., Martinez J., (eds) 1997. "Manure Management -Treatment Strategies for Sustainable Agriculture" Silsoe Research Institute, Wrest Park, Silsoe Bedford, UK. 181 pp.

Parfait G., Martinez J., Burton C.H. (eds) 1996 . "Animal Manure and Environment in Europe" (In French and English) Ingénieries-EAT - Special Issue, Cemagref, Antony, Paris. 200 pp.

Ademe - Ministère de l'Agriculture et de la Pêche . 1997 . "Interactions entre Agriculture et Environnement - Quels outils de diagnostic ?" . Actes du colloque du 2 avril 1997.