The Ethical Merits of the Use of By-products in Agriculture

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Abstract. A dramatic gain in efficiency is an absolute necessity if we are to overcome the agricultural challenges of the third millennium. One of the ways that could lead to such a gain in efficiency is a renewed and augmented use of by-products.

In an agricultural context the food industry is a major source of potentially valuable by-products. For other Western European countries VALORBIN (2003a) mentions 5 million tons in Denmark, 11 million in The Netherlands, and 14 million tons in Germany. 70 to 80% of food industry by-products are reused in feed manufacturing.

In all applications, two important ethical aspects seem to overarch all others, being (the care for) public health, and the need for recycling. Both aspects will be important with all by-products and all applications, but their relative importance will differ. This does not mean that zero-risk or maximum recycling need to be the goal. In both aspects environmental considerations are included. It is important to keep an eye out for direct and indirect impacts on other products.

A hierarchy seems to exists, in which reuse as food has priority over use as feed or biomass (energy or green chemistry), and with a sustained faith as waste as the least preferable option.

The by-products that one wants to use in feed production, will have to be selected based on type (e.g. category 3 animal by-products should be safe), traceability (single sourced products are preferred) and goal (e.g. is the target animal omnivorous).

Keywords. Ethics, animal by-products, recycling

INTRODUCTION

In the third millennium, and starting already in the beginning of the 21st century, agriculture is facing some serious challenges. Population growth and climate change are well-known and important issues, but there are many others (energy cost, nature preservation, etc.). It seems that a dramatic gain in efficiency is an absolute necessity if we are to overcome these challenges.

One of the ways that could lead to such a gain in efficiency is a renewed and augmented use of by-products of other economic processes. Using such animal and other by-products (rest products, waste products or genuine by-products) as inputs in agricultural processes seems a promising and fruitful way to technical and economical valorisation of such products.

On the other hand, the past has already proven that such a recyclation of products in agriculture is not without risks. It is therefore a timely question to explore whether it is indeed possible to reengage in the use of by-products in agriculture (and especially animal production). Based on the situation in Belgium and the EU, this paper will engage in the technical side of this question only shortly, but focus instead on the societal and ethical questions that arise in this context.
MATERIALS AND METHODS

The data used in this paper are the result of a literature search between April and September 2008.

RESULTS AND DISCUSSIONS

Status questiones

In an agricultural context the food industry is a major source of potentially valuable by-products. On a worldwide scale, Bolck et al. (2003) estimated that poultry production alone is responsible for the production of about 20 million tons of by-products (3,4 million of those in Europe). There are few cumulative data beyond national or sub-national level, therefore the following serves to illustrate the importance of the by-product production. It is based on the production of Belgium, a densely populated area with an intensive agriculture (animal as well as plant production).

In Flanders (the Northern part of Belgium), the food industry produced about 4,7 million tons of a wide range of organic by-products in 2003 (VALORBIN, 2003b). For other Western European countries VALORBIN (2003a) mentions 5 million tons in Denmark, 11 million in The Netherlands, and 14 million tons in Germany.

Animal by-products are a specific type of by-products. EU Regulation (1774/2002) defines three different categories of animal by-products and their respective valorisation ways. The main Belgian renderer (Rendac) estimates a yearly Belgian production of 230 000 tons of category 1 and 2 material, 350 000 tons of category 3 material, and another 120 000 tons of specific materials (“foodgrade”, feathers, pig hair, blood).

But there are other important, non-food, sources of by-products. In Flanders, these sources may even be more important (weight based) than the food industry. VALORBIN (2003b) estimated an additional production of 1 to 1,3 million tons. This is a combination of roadside mowings (200-500 Kton), household greenery (340 Kton), industrial sludges (186 Kton), food and beverage sector (100 Kton), sea port wastes (70 Kton), etc.

The same source estimates that 70 to 80 % of food industry by-products are reused in feed manufacturing. This would account for over 20 % of feed constituents (Bemefa, 2007). In theory, there are many other routes of valorisation for by-products. Bolck et al. (2003), for example, identified 15 different possibilities, for poultry related by-products alone. Regulation 1774/2002 mentions at least 30 possible uses of animal by-products, explicitly excluding its use in animal feed.

This use as a feedstuff is probably the most wellknown use of by-products in the agri-food sector. What is generally less known, is that the use of “meat-and-bone meal” (MBM) is a rather old practice. As the report of the BSE Enquiry (2000) in Great Britain pointed out, in 1865 Liebig already suggested the use of MBM in pig feed and it seems that around 1900 MBM was a common ingredient in the feed of ruminants. Since the BSE crisis, though, the EU has, through Directive 999/2001, prohibited the use of animal protein in feed for food producing animals. MBM is still used as fuel for cement mills and energy production, while
category 3 material can still be used in pet food. Fats made from category 3 materials can on the other hand be used in common feeds.

For other by-products there are similar regulations closing some promising valorisation possibilities. For example, some types of sludges cannot be used as fertiliser (mainly industrial sludges).

**General ethical discussion**

It is of the utmost importance to make a clear distinction between the different types and characteristics of by-products. It is clear from the forgoing discussion that there are many different processes that can produce a wide range of different by-products. This means that one should in fact refrain from making general statements about the use of by-products in the agri-food chain, except that it is good to aim for a maximum sustainable recycling. Individual applications should be judged individually.

Two important ethical aspects seem to overarch all others, being (the care for) public health, and the need for recycling. Both aspects will be important with all by-products and all applications, but their relative importance will differ. In practice this means we aim for:

- A minimal risk for public health;
- An optimal reuse of products and production wastes.

The ethical relevance and primordial attention to public health is rather evident (although not a given) when arguing from a catholic-christian (mildly) anthropocentric tradition. We will not engage in this fundamental, but theoretical discussion as it would deflect us too far from the current topic. We will suffice with stating such a primordial attention is not a trump card in the sense that it overrides all other concerns. Neither is it a search for zero-risk, which is an unrealistic expectation in any case. It is on the other hand the notion that human health is very important and needs to be protected from unnecessary harm (by direct or indirect causes) if reasonably possible, and that proportional reasons need to be invoked for any risks taken. This will explained further in this paper.

The second points merits some further explanation. An optimal recycling of by-products is clearly not equal to the search for maximal recycling, but it appeals to a sustainable application of by-products. That reuse of by-products can have ecological benefits, may be rather evident, but it also needs to be economically sound and unnecessary risks needs to be avoided (see first point). It may be that a practical hierarchy of pathways exists, in which reuse in food production is best, than reuse as a feed constituent, then as biomass (energy, green chemistry) and only then should it be considered as waste. This raises the interesting question whether market forces can be used (and/or trusted) to make this distinctions.

In both aspects there is room (and a necessity) for the inclusion of environmental considerations. It is clear that more recycling can (and should!) lead to less pressure on the environment, but environmental care (in the general sense) is also important for public health. For example, recycling can help to protect water quality, help prevent climate change, etc., but it can also contribute to the spread of pathogens (see e.g. BSE Enquiry, 2000).
Recycling should contribute to a more efficient production, in more than one way. Not only should it result in less waste, it also substitutes other inputs in the production process. This could impact on the final production cost. When basic commodities as food products are concerned, this is an important socio-ethical concern; not only in Western Europe, but also (far) beyond. In this regard, it is important to keep a close look at the bioenergy developments. The industry is only recently aiming for second and third generation technology. These should no longer compete for food products, but can have an impact on feed production. Instead of a producer of inputs (different by-products) they would then be a competitor for these inputs. This would mean a direct influence on animal product prices, but possibly also an indirect impact on other products (such as grains, soy; that are substituents for the by-products). The relation between animal (feed) production and energy and green chemistry merits a discussion of its own, something that is urgent, but cannot be done within the framework of this paper.

**Feed production**

As already mentioned, different applications merit different analyses. It seems that an important distinction can be made between by-products that one wants to reuse within agriculture itself (animal feed), and other applications. For an application in feed, it seems that human and animal health is of the utmost importance. For each product that is ‘technically’ fit for inclusion, health considerations will decide whether a product can be included, for which animals, and under which conditions. Traceability and controlability will probably be important elements, as we will see.

The most pressing (and certainly the most sensitive) question in this regards is whether one would, could, or need to support the reintroduction of MBM in feed for production animals. This issue boils down to the question whether it is good to again use an intrinsically very valuable feed constituent (for different species) of which we know that in specific cases and circumstances serious animal and public health problems can occur with great economic impact (see BSE Enquiry, 2000). This goes far beyond the question whether the Precautionary Principle (European Commission, 2000) should be invoked here (as there is no uncertainty about potential effects). The question is quite bluntly whether the risks and effects that have been observed are (still) a reasons (to continue) to consider MBM as dangerous waste.

A first element leading to an answer to that question can be found in EU Regulation 1774/2002. The animal by-products that fall in category 3 (mainly products coming from animals found to be fit for human consumption) should be free of pathogens and other problems. This is the type of by-products that can be used in pet food. It seems reasonable to argue that it should be possible to use these products for some (if not all) production animals, without changing the regulations for type 1 and 2 by-products.

Secondly, it seems important to distinguish between simple, single-sourced by-products and products that are a mixture of types and sources. As bacterial, viral or other pathogens spread more easily between animals of the same species, it could be reasonable to avoid feeding products to animals of the same species. This condition can probably be met when using MBM produced based on carcasses or slaughterhouse products, but not when using products from the food industry, the distribution, or others. One could therefore suggest to agree with the former, but not with the latter; of course within a control framework.
Furthermore, it seems useful to restrict the use of MBM in feed to those species that are naturally omnivorous (in a European context mainly pigs and poultry). It seems reasonable (but there is little concrete data on this issue) that these species have evolved to have a bigger resistance to oral transmission of pathogens. The EFSA conclusion (Andreolletti et al., 2007) that no BSE cases have been found in pigs and poultry and that transmission is very difficult, seems to support this conclusion. Additionally, reduce the risk by (1) only feed poultry MBM to pigs and vice versa, and (2) exclude ruminant MBM.

This analysis seems to indicate that it is possible to reintroduce MBM in certain feed products under specific conditions. Whether the advantage (a new high-valued input) can outweigh the associated costs (separate collection, separate production lines, controls, ...) is a question that cannot be answered here, but certainly merits thorough investigation.

Other uses

The many by-products that are not fit for inclusion in animal feed, such as some animal by-products or greenery, sludges, packaged materials, etc., should also be reused as far as possible. Depending on the technical possibilities, one should identify the optimal strategy, based on financial, energetic, environmental, and other considerations.

Some of these products are already recycled, for example in compost production, but others are treated as common waste. It seems that much progress can still be made, not in the least by finding ways to include these products in later-generation bioenergy production.

It is on the other hand important to realise that some of those applications do also produce by-products. Bioenergy production through fermentation, for example, leaves digestates that are organic by-products that themselves need to find an application. Whether such multistage processing is advantageous, needs to be carefully investigated.

The same ethical considerations can be invoked as with the other by-products. Public, animal en environmental health will again be the major issues. By-products could, for example, contain toxic or pathogenic elements (heavy metals, prions, ...) that make them unfit as fertilisers.

CONCLUSIONS

Processing and trade of commodities not only produces ready-for-market products. A large amount of a wide range of by-products are the result of the many different production processes. Many of those are used as an input in other processes, within food, feed, or energy production, or in one of many other processes. On the other hand, a large amount of organic matter is still considered ‘waste’. There are good economic and ecological reasons to investigate the (renewed) use of these ‘waste’ by-products.

The main ethical considerations in all by-product uses are to safeguard public health, and to optimise recycling (to increase efficiency). This does not mean that zero-risk or maximum recycling need to be the goal. In both aspects there is room (and a necessity) for the inclusion of environmental considerations. It is important to keep an eye out for direct and indirect impacts on other products (such as grains, soy; that are substituents for the by-products).
Some sort of hierarchy seems to exist, in which reuse as food has priority over use as feed or biomass (energy or green chemistry), and with a sustained faith as waste as the least preferable option. Prioritising between animal (feed) production and energy and green chemistry merits a discussion of its own, but could not be done within the framework of this paper.

The by-products that one wants to use in feed production, will have to be selected based on type (especially with animal by-products), traceability and goal (which type of feed). Category 3 animal by-products, for example, seem fit for inclusion in poultry and pig feed, certainly if the species barrier is observed.

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