Genetically modified organisms and typical food-products in Italy

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Abstract

The comparison of the feed requirements of our livestock production on one side and the availability at the national, European and international levels of non-GM feed on the other side, indicates that GMO-free diets for the production of typical food products can be realistically implemented only with a cereal-based feed but not with a feed high in plant proteins, particularly if derived from soybean. This problem is more relevant for the production chain of meat, particularly pork, rather than for the production chain based on milk.

Introduction

The safeguard of traditional food products, in particular those with a certified "appellation of origin" (i.e. "typical" products), represents an important source of income and prestige for many producers as well as an effective way to protect our national agriculture. According to EU regulations 2081/92 and 2082/92, typical products are protected by two classifications: DOP ("Denominazione di Origine Protetta": Protected Origin Appellation), specifying the name of the region or place of origin of a product or foodstuff, whose quality and properties should be related to the geographic environment and to the natural and human factors characterizing the place where it is produced and processed; and IGP ("Indicazione Geografica Protetta"; Protected Geographic Indication) specifying the name of the region or place of origin that may instil special qualities, which may even be processed away from its production area. The most valuable typical products are the DOP and IGP cheeses, charcuterie and hams that make up more than 98% of all the value of typical products.

Amidst the noise of the media campaigns on the utilization of genetically modified organisms (GMOs), it may be useful to consider the products derived from

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our livestock and identify their qualitative characteristics. This, in turn, will facilitate the identification of possible problems as well as the implementation of the corrections and remedies required to solve such problems.

Based on the new EU rules included in the EU regulations 2081/92 and 2082/92, which regulate the utilization of DOP and IGP brand names, the old specifications for products of typical, controlled origin as indicated in 1954 are now obsolete. As pointed out by Mucchetti (2004), marketing strategies and the media have facilitated and reinforced the formation, within the whole society, of a concept of "typical product" as an "ancient" product associated with a typical production system and derived through artisan work. These products are often portrayed as "ancient product", "natural;", "unique" and "good tasting" products, in contraposition to the negative image of an industrially "standardized", "bad tasting", "unnatural" and "global" product. In Italy, among the so-called "historical" products, there are a number of industrial products protected with a name brand (e.g. the "Bel Paese" cheese) and included as DOP products that are not produced "artisanly", because of their large-scale production and the technologies being deployed. Clear examples of this are the "Prosciutto Parma" (Parma ham), the "Prosciutto San Daniele" (San Daniele ham), the "Grana Padano" cheese and the "Parmigiano-Reggiano" cheese.

Therefore, it is clear that the level of "traditionality" of a product (Mucchetti 2004) cannot be measured based upon the company size and the production protocol. Additionally a test of "traditionality" should be undertaken whenever new, innovative processes, rather than archaic and often obsolete ones, are applied. Innovation within tradition then becomes the main objective of those willing to improve productivity avoiding the alteration of the typical characteristics of the numerous DOP and IGP products providing prestige and income to Italian agriculture. Among such products, cheese and cured meat products prevail, as indicated by the fact that they represent 62.5 and 35.8% of all the value of the DOP and IGP products, respectively.

Thus, a question arises: should the utilization of GMOs in animal feed for the production of typical products be considered as an innovation within tradition or as something incompatible with the production of typical products? Furthermore, in case the latter is chosen, will it be possible to sustain livestock production for typical products based upon the exclusive utilization of feed obtained with GMO-free ingredients?

Clearly, if livestock production in Italy could be sustained completely with GM-free feed, the "non transgenic" option could be more convenient. However, in case this option is not technically possible should we give up our typical products derived from livestock or should we just "pretend" that our typical products derive from livestock fed with GM-free feed? Would this be right and ethically correct? Based on the available data we will try to answer these questions by examining the present situation and its likely evolution.

Before proceeding any further, it should be mentioned that the principle of "substantial nutritional equivalence" between GM and non-GM products, is now shared by scientists worldwide (Consensus Document 2004). Therefore, we will not elaborate on issues related to food security of GMO-derived products, a vast and complex theme already exhaustively treated by other qualified scientists (Aumaitre 2004, Matassino and Occidente 2004). Even assuming that GMOs could pose a risk to human health, such risk would be reduced enormously once the GM product is eaten and digested by animals.

Area cultivated with genetically modified (GM) crops

A recent and detailed study (Nomisma 2004) has evidenced numerous and important aspects on this topic. In particular, the following should be underlined:

- From 1996 to 2003, the surface cultivated with GM crops has increased from 3 to 70 million hectares;
- Well over 80 million tons of soybean produced worldwide is GM, which corresponds to ca. half of all the soybean produced globally;
- The main producers of GM soybean are the USA and Argentina; these two countries are the main exporters of soybean seed and soybean flour;
- GM maize provides approximately 11% (66 million tons) of maize produced worldwide. More than 90% of GM maize is produced in the USA, 5% in Argentina and the remaining 5% in South Africa, Mexico and Spain;
- Because maize, soybean and its derivatives are the main ingredients for livestock feed, particularly for those used for the production of DOP and IGP food, it is indispensable to know all the data concerning the quantity of feed required and their origin in order to define the best strategy for their utilization.

The economic relevance of livestock production in the agriculture of the EU amounts to ca. 45% (38% for Italy), with a sizeable import deficit from non-EU countries for supplying the ingredients (maize and especially soybean) required for feeding the livestock.

As to soybean, only 2.5% of the 28.4 million tons used in 2001 in the EU were harvested and processed in Europe. The processed product (mainly extracted flour) produced in countries where growing GMOs is allowed contributes ca. 60% of the feed required in Europe, while the remaining 35-40% is derived from seed processed in Europe but produced in countries where GMOs can be cultivated. Consequently, more than 95% of the soybean used in Europe is produced in countries where cultivation and commercialization of GMOs are permitted. If we hypothesize that the imported products reflect the cultivated surface, approximately 19 million tons of soybean products (seed and meal) are derived from GM soybean. For

maize, the situation is very different because the EU is almost self sufficient (up to 95%). Yearly, only 2.3 million tons are imported, of which 1 million tons are produced in countries where GM corn is not grown.

Also Italy has a large soybean deficit, although on a lower scale as compared to the rest of Europe. In consideration that ca. two-thirds of all soybean processed in Italy are produced from seed imported from the USA, Argentina, Canada and Brazil, analogously to seed directly imported from the same countries, it is estimated that ca. 400,000 tons of GM soybean seed and ca. 2.3 million tons of flour obtained from GM seed are imported each year. On the contrary, the national production of corn covers ca. 95% of the demand. Only 1.4% of the 425,000 tons of imported maize is from countries where the cultivation of GM maize is allowed.

Typical-food products and requirements for feed ingredients in Italy

As previously indicated, products derived from livestock represent ca. 98% of the entire value of all typical products produced in Italy, mainly cheese (62.5%) and cured pork meat (35.8%). Clearly, feed and their ingredients have a primary role in this production line. Along this line, and in keeping with a parallel study carried out by Nomisma (2004), the present study has attempted to estimate the quantity of soybean required to sustain the production of typical, livestock-derived products. Accordingly, we have thus proceeded to:

- Estimate the production of typical livestock and the number of animals;
- Evaluate the quantity of soybean and maize required to sustain the different productions;
- Forecast the yearly requirements for soybean and maize;
- Compare the feeding requirements of the animals and the availability of non-GM maize and soybean.

Based on the available data of the feed requirements of each category of animal and the average composition of the feed utilized, this study indicates that on a yearly basis all the different typical livestock productions will require the amounts herein reported.

Soybean

- For milk production	454,000 t
- For meat production	640,000 t
- *For typical livestock products*	*1,094,000 t*

Maize

- For milk production	977,000 t
- For meat production	2,737,000 t
- *For typical livestock products*	*3,714,000 t*

These values are inclusive of the global needs for soybean and maize for the production of milk and pork meat which on the whole correspond to:

Soybean

- For milk production	912,000 t
- For pork meat production	1,965,000 t
- *Total*	*2,877,000 t*

Maize

- For milk production	1,100,000 t
- For pork meat production	4,400,000 t
- *Total*	*5,500,000 t*

In Italy, the availability of defatted, non-GM soybean flour produced nationally has been estimated to be equal to ca 393,000 tons including also exports. This amount would be sufficient to satisfy ca. 36% of the feed demand for livestock destined to the production of typical products. Consequently, covering all the needs of feed required for the production of typical livestock products (ca. 1,100,000 tons/year), will absorb the entire national production and will require the import of ca. 60% of the total amount. Because this quota would be imported from countries where GM soybean is grown, most likely it will be from GM soybean.

As to maize, the situation is substantially different: the animals utilised for the DOP and IGP products require ca. 3,700,000 tons of grain, equivalent to ca. half of the quantity required globally for livestock production; the internal production (GM-free) is thus largely sufficient to cover the needs for the production of typical products.

Therefore, these data unequivocally indicate the inadequacy of the soybean supply at the national level; on the contrary, maize is largely sufficient to cover the needs of the livestock production chain. Seed of other proteinaceous, non-GM crops such as protein pea, horse bean, etc., cannot provide a meaningful contribution to the protein dietary intake required for a proper livestock production. Interestingly, in many cases the nitrogen content of the feed can be lowered in due consideration of the frequent adoption of protein-rich diets which rarely meet the concept of an "ideal protein feed". It should be noted that these protein-rich diets concur to increase the overall level of nitrogen pollution derived from livestock farming.

Additionally, we cannot exclude that in the future the production of heavy pigs will utilize diets with lower protein and energy content in order to slow down the growth rate, which, in turn, would allow us to produce pork meat of superior qual-

ity with a lower concentration of catepsins (Virgili et al. 2003) and, as such, better adapted to industrial processing.

Granted all the above and given the persistency of the ban on the utilization of animal-derived meal as an ingredient for animal feed, it is difficult to picture livestock production in Italy without soybean, particularly for pigs. As to milk production, the problem is less severe, because high-quality forage crops (e.g. alfalfa) cut at an early stage and adequately stored can be sufficient to satisfy the protein needs of a balanced diet.

A recent study conducted in the production chain of Parmigiano-Reggiano indicates that it is possible to sustain average daily productions of milk greater than 30 liters/day/cow using a diet devoid of soybean and with a relatively low protein content (14% of raw protein on the total dry matter) with no negative effects on the production level, the health of the animals and the quality of the milk. However, this will only be possible on farms having access to equipment of top quality and with an organizational level that is unfortunately rarely available.

All the above should consider that even in the EU countries where GMOs are not planted, the final products could be contaminated by GMOs. It should also be mentioned that contamination by GMOs cannot be excluded on *a priori* basis for the ca. 20,000 tons of maize seed (ca. 75% of the national requirements) and 14,000 t of soybean seed (more than 50% of the national requirements) imported yearly in our country to satisfy farmers' needs. Indeed, contamination of the seed used to plant the crops and/or of the raw materials used for feed production is a problem that cannot be neglected if products are declared to be GMO-free. Such contaminations are accidental and technically inevitable and can occur (Mordenti, 2003):

- Due to carry-over contamination;
- In the field through pollen from adjacent fields;
- In the oil mill during the production of panels and extraction of flour;
- During drying, milling and mixing for producing the feed;
- During transport (ships, train cars, trucks, etc.);
- In warehouses where feed ingredients are kept, sorted and mixed.

It should be pointed out that when the ban applies to "organic" and "typical" (DOP and IGP) products, non-specialized feed manufacturers (i.e. those without "dedicated" productions) will likely be unable to meet the requirements or will need to utilize raw ingredients with less than 0.9% of transgenic material to avoid contamination of the production chain. It is also important to point out that following the reduction of EU subsidies, soybean production has plunged from 850,000 t in 2001 to 330,000 in 2003, with a parallel increase in imports.

All the above indicate that while the supply of maize produced in Italy is sufficient to sustain the local production of typical and biological products, the soybean produced nationally is largely insufficient, and thus incompatible with a GMO-free

food chain. As to the needs of EU countries (EU-15), self-sufficiency for soybean would require a 30-fold increase in the area planted with soybean, an increase clearly impossible to achieve in view of the present conditions. The problem is less prominent in Italy but nevertheless difficult to solve, particularly for what pertains to the production of typical products.

Conclusions

Presently, the possibility of producing typical cheese and cured pork meat in Italy using exclusively GMO-free feed seems unattainable. The problem increases enormously if we would like to extend the GMO-free prerequisite to the whole livestock production chain in Italy. The limiting factor is not represented by the supply of GMO-free cereals (maize in particular) but is represented by the supply of GMO-free soybean, whose availability is rather limited and totally insufficient to satisfy the local demand. The reduction of protein content in the diet and the utilization of alternative plant protein sources (protein pea, faba bean, small faba bean, etc.), although could provide a meaningful contribution to solve the problem, has major technical and economical limitations, particularly as to the composition of the raw materials. Imports from other countries where non-GMO soybean is grown does not appear to be a viable alternative due to the fact that most of the exported soybean is genetically engineered. The acceptance or refusal of GMO-derived products in livestock feed thus represent a difficult and embarrassing problem. For the time being, given the lack of sufficient quantity of GMO-free protein feed, the acceptance of a GMO-free production chain, though desirable, appears to be a technically difficult, if not impossible, option even for typical products, with a particular reference to the production of cured pork meat.

References

Aumatre A (2004) Safety assessment and feeding value for pigs, poultry and ruminants animals of pest protected (Bt) plants and herbicide tolerant (glyphosate, gluphosinate) plants: interpretation of experimental results observed worldwide on GM plants. It J Anim Sci 3:107-121

Consensus Document (2004) Sicurezza alimentare e OGM. 5 May 2004, Bologna, Italy

Matassino D, Occidente R (2004) Alcune riflessioni sugli OGM. L'Allevatore 60:7-10

Mordenti A (2003) Organismi geneticamente modificati e produzioni biologiche. Commissione di studio ASPA "Produzioni biologiche e qualità dei prodotti". pp 159-162

Muccehetti G (2004) Le peculiarità qualitative dei formaggi tradizionali ed a Denominazione di Origine: caratterizzazione e strumenti per la salvaguardia. Scienza e Tecnica Lattiero-casearia 55:5-24

Nomisma (2004) Biotecnologie e zootecnia: scenari, potenzialità e ambiti di scelta per le produzioni italiane di qualità. 12 March 2004, Verona, Italy

Virgili R, Degni M, Schivazappa C, Faeti V, Poletti E, Marchetto G, Pacchioli MT, Mordenti A (2003) Effect of age at slaughter on carcass traits and meat quality on Italian heavy pigs. J Anim Sci 81:2448-2456