Assessing the risk from mycotoxins for the organic food chain: results from Organic HACCP-project and other research

G.S. Wyss
Research Institute of Organic Agriculture, Ackerstrasse, CH-5070 Frick

Introduction

Mycotoxins are toxic compounds produced by the secondary metabolism of toxic moulds in the *Aspergillus*, *Penicillium* and *Fusarium* genera occurring in food commodities and foodstuffs. The range and potency of mycotoxins make this group of naturally occurring toxins an ongoing animal health hazard and a constant risk for contamination of the food supply.

Mycotoxicoses are diseases caused by exposure to foods or feeds contaminated with mycotoxins. Mycotoxins exhibit a variety of biological effects in animals, such as liver and kidney toxicity, central nervous system effects or estrogenic effects. There are differences between animals with regard to the susceptibility towards different mycotoxins. Poultry secrete mycotoxins relatively fast because of a particular digesting system. Ingredients used for animal feeding should be checked to ensure that adequate quality standards are maintained and that mycotoxins are not present at higher than acceptable levels. Good animal feeding practices also requires that feed is stored in such a way as to avoid contamination. As organically raised livestock are fed greater proportions of hay, grass and silage, there is reduced opportunity for mycotoxin contaminated feed to lead to mycotoxin contaminated milk.

Mycotoxins have been reported in organic produce. One theory is that organically-grown products are likely to contain higher concentrations of mycotoxins than conventionally-grown products. However, there is little evidence to support this theory (Tamm *et al.* 2002). Higher or lower mycotoxin contents in feed and food made in different production systems may be caused by i) systematic differences in the production systems during pre-harvest (e.g. use of agrochemicals), ii) differences in post-harvest handling (e.g. storage, transport) and iii) differences during the transformation of raw products into processed foods. Also differences that are in fact due to improper handling procedures during harvest or post-harvest tend to occur systematically if there are systematic differences in the type of equipment used or in the technical qualifications of those who handle the products. Obvious omissions, regarding quality assurance, lead to poor quality but this phenomenon is not linked to organic agriculture in particular (Tamm 2001).

Within the 5th EU-framework project “Recommendations for improved procedures for securing consumer oriented food safety and quality of certified organic foods from plough to plate“ (QLRT-2002-02245; “Organic HACCP”), a systematic analysis was carried out among selected certified organic food production chains, e.g. milk but also wheat bread. The aim was to investigate current procedures of production management and quality assurance related to the examined chains. For the quality and safety criteria “microbial toxins” (there were six more) the information was analysed to identify Critical Control Points (CCPs) and to suggest ways how the control of quality and safety can be further improved. CCPs were defined as the

steps in supply chains where the qualities of the final product can be controlled most efficiently.

Materials and methods

Details about the collection and analysis of data regarding the criteria "Microbial toxins" can be found in this proceeding in "Assessment of current procedures for animal food production chains and critical control points regarding their safety and quality: Preliminary Results from Organic HACCP".

Results and discussion

In the investigated chains, the risk of mycotoxin contaminated milk was variable, even within single chains (Table 1).

All farmers produced their own feed, such as fresh and dry roughage and silage. Some produced also grass pellets, rape and corn. This reflects the typical practice in organic livestock of feeding large proportions of hay, grass and silage, which reduced opportunity for mycotoxin-contaminated feed. All investigated farmers also bought concentrates from feed companies. Most of the farmers did not check the fodder upon delivery for obvious mould growth or smell. They trusted the feed companies and the analysis certificate that accompanied the feed. None of the farmers mentioned the option that mycotoxins may evolve under storage in his/her own storage facilities. This represents a serious risk: spoiled fodder is not detected and then fed to lactating cows. Therefore, it is highly advisable that all farmers establish a quality assurance system, including written checklists for inspecting newly delivered feed and own storage practice.

As organically raised livestock are fed greater proportions of hay, grass and silage, rather than corn, there is reduced opportunity for mycotoxin-contaminated feed to lead to contaminated milk (FAO 2000). Studies have found that aflatoxin M1 levels in organic milk were lower than in conventional milk (Woese *et al.* 1997). An investigation by the Food Standard Agency (2001) showed that while 3% of conventionally-produced milk samples contained aflatoxin M1, no samples of organic milk were contaminated.

Table 1 Selected critical control points for four examined milk chains from European countries

CCP	**Examined European Milk chains**			
Feed	**M1**	**M2**	**M4**	**M5**
Mould infested feed - subsequent forming of mycotoxins at production level.	Risk variable; own for the 3 feed productions questionned; they all buy dry and fresh roughage but also concentrates; in one case is a quality assurance concept available and two of the operations trust their feed supplier.	Risk variable in this chain; all three operations maintain an own food production; they feed dry/ fresh roughage, silage, grains, grass pellets and corn. Two operations also feed concentrates and trust their supplier and the accompanied certificate; all three have no quality assurance (QA) concept.	Medium risk in this chain; the farmer buys feed from a neighbour, there is no quality assurance concept with checking of feed upon arrival.	There is a medium to high risk in this chain; all three operations maintain an own fodder production, dry/fresh roughage, silage and grains; all three buy concentrates; one of the operations checks the feed upon delivery by visual control; none of the farmers is aware of the risk or uses a QA system.
Fodder storage				
Inappropriate storage condition	There is a low to medium risk in this chain; awareness of risk available; one of the operations has temperature control, two have no temperature control but keep different types of fodder separate/in special containers. They also have an established drying facility. No use of a QA concept.	There is a medium to high risk; the awareness for a risk is not available; two operations have storage under simple conditions and one has storage in a gas-tight silo; none of them has a QA concept for feed. One operation takes samples for analysis and two trust their feedstuff supplier.	There is a low risk in the chain; storage under simple condition for some feed, but the major portion contains fresh and dry roughage/silage. There is no quality assurance concept available.	There is a variable risk in the chain. Partially, there is awareness for the risk. All three operations maintain simple storage. One checks concentrates upon delivery, one stores grain in gastight silos. No QA concept available.

Conclusions

There are no relevant differences among farming systems in terms of higher risks for mycotoxin contaminations. Major contamination sources are available in all farming systems and must be taken seriously. A well maintained quality assurance system has to be set up based on occurrence, detection and prevention. Good agricultural, handling and storage practices are required in both organic and conventional agriculture to minimize the risk of mould growth and mycotoxic contamination.

Literature:

FAO. 2000. Food safety and quality as affected by organic farming. Paper read at 22nd FAO Regional Conference for Europe, at Porto, Portugal; http://www.fao.org/docrep/meeting/ X4983e.htm

FSA. 2001. Survey of milk for mycotoxins. *UK Food Standards Agency* 17 (01).

Tamm, L. 2001. Organic agriculture: development and state of the art. *Journal of Environmental Monitoring* 3:92N-96N.

Tamm, L., and Thürig, B. 2002. Mycotoxins and pathogens in organic food. *The Organic Standard* 15:12-13.

Woese, K., Lange, D., Boess, C., and Bögl, K.W. 1997. A comparison of organically and conventionally grown foods – results of a review of the relevant literature. *Journal of the Science of Food and Agriculture* 74:281-293.