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REVIEW

Possible Natural Toxins in Organic Livestock Farming

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Summary

Public concern about food quality has intensified in recent years. In the last decades, the amount of farmland managed under certified organic practices has expanded dramatically and it is expected to increase in the future. There is a growing demand for organic foods driven primarily by consumers' perceptions of the quality and safety of these foods and to the positive environmental impact of organic agriculture practices. This growth in demand is expected to continue in the future. Obviously many factors in production systems have an impact on the health and welfare of the animals involved. Animals feed or forage may be the source of disorders for farm animals also could lead to human illness. The types of feeds administered do not differ significantly in organic farming and in this respect there are mostly quantitative differences observed. Pesticides, agricultural and industrial chemicals, heavy metals, radionuclides as well as natural pollutants as mycotoxins may pollute animal feed. The aim of this review was to find out the possible natural toxins of animals associated with organic farming.

Keywords: *Organic farming, Feeding, Natural toxins, Pollutants*

Organik Hayvancılıkta Olası Doğal Toksinler

Özet

Son yıllarda halkın gıda kalitesi ile ilgili endişeleri artmıştır. Son dönemlerde sertifikalı organik üretim uygulamaları yapılan alanlar önemli ölçüde genişlemiş ve gelecekte daha da artacağı tahmin edilmektedir. Organik ürün eldesiyle ilgili uygulamaların çevreye olan olumlu etkileri, elde edilen ürünlerin gıda kalitesi ve güvenliği ile ilgili tüketicilerin algıları bu ürünlere olan talebi giderek artırmaktadır. Organik ürünlere olan sözkonusu talebin gelecekte de artacağı tahmin edilmektedir. Organik üretim sistemindeki birçok uygulamanın hayvan sağlığı ve refahı üzerine olan etkileri açıktır. Hayvan yemlerinin çiftlik hayvanlarında bazı metabolik bozuklukların kaynağı olabilir, hatta insanlarda da hastalıklara yol açabilir. Organik hayvansal üretimde hayvanlara verilen yem çeşidinin niteliğinde belirgin bir fark yokken, genellikle miktarda nicelik farklılıklar gözlenmektdir. Pestisidler, tarımsal ve endüstriyel kirleticiler, ağır metaller, radyoetkin bileşikler ile doğal kirleticilerden mikotoksinler de dahil olmak üzere birçok etken hayvan yemini kirletebilirler. Bu derlemenin amacı, organik hayvancılıkta olası doğal toksinler hakkında bilgi sunmaktır.

Anahtar sözcükler: *Organik tarım, Beslenme, Doğal toksinler, Kirleticiler*

INTRODUCTION

The industrial agriculture system consumes fossil fuel, water, and topsoil at unsustainable rates [1]. The expansion of factory style animal agriculture creates environmental and public health concerns, including pollution from the high concentration of animal wastes and the extensive use of antibiotics, which may compromise their effectiveness in medical use. The type of agriculture that has become conventional throughout the industrialized world is, in historical terms, a new phenomenon [2-5]. Humans have practiced agriculture for more than 10000 years, but only in the past 50 years or so have farmers become heavily dependent on synthetic chemical fertilizers and pesticides and fossil fuel-powered farm machinery. In the last decades, however, industrial agriculture has increasingly separated animals from the land [6].

Organic farming is the result of theory and practice since the early years of the 20th century, involving various alternative methods of agricultural production, mainly in northern Europe [7-9]. Organic livestock farming is based on the principle of a close link between the animals and the soil. The need for a link with the soil requires animals

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to have free access to outside areas for exercise, and also implies that their feed should be not only organic, but preferably produced on the farm. This sector of organic farming is, also, strictly regulated by rules of animal welfare and veterinary care [10-13]. Organic farming was developed and driven by people searching for a sustainable way of farming. They often sold their products directly to consumers, bypassing the many marketing steps between the farm and the consumer. Today the situation is very different [14-18]. Organic farming is likely to receive a major boost in the European Union (EU) and most probably also worldwide since consumers have lost some trust in food derived from conventional production. However, this growth in organic farming is also expected to continue in the presumable future in Turkey [19]. This is as a result of recent crises and due to concerns apropos the use of pesticides in farming and antibiotics in livestock feed [11,20-23].

European Council Regulation (EEC) No 2092/91 on organic production of agricultural products and suggestions referring on agricultural products and foodstuffs was adopted on 24 June 1991. In 1999, the Council adopted Regulation (EC) No 1804/1999 of 19 July 1999, which lays down Community rules for producing organic livestock products; this completes the framework of Community legislation, which now covers both crop and animal products. Part B of Annex I to Regulation (EEC) No 2092/91, as amended on 19 July 1999 by Regulation No 1804/1999, lays down minimum rules for organic livestock production. The Member States may adopt stricter rules, under Article 12 of Regulation (EEC) No 2092/91, concerning the animals and animal products produced on their territory [13,24].

As the nutritional quality of organic foods for humans there seems to be no difference in nutritional quality between an organic diet and conventional diet, though the perception of consumers is that organically-produced crops and animal products are of higher nutritional quality and safety [25-28]. The small number of papers published is not surprising since the development of organic farming and its philosophy [29]. Therefore, this article is limited to review the possible natural toxins that represent significant risks to organic livestock.

1. ORGANIC FARMING AND ANIMAL FEEDING

To get insight into the different types of feeds used in organic and conventional production systems information was obtained from different sources on the internet. This because the information in scientific articles was too limited and fragmented [11,27,29]. From the information assessed it is clear that a major difference between organic and conventional production of feeds is that in organic production only limited crop production and other products are permitted. A remark should be made the natural source of the products is no guarantee for non-toxicity for humans [30-33].

International food safety standards and food hygiene requirements are equally valid for conventionally and organically produced food. The issue of other food quality characteristics is less clear-cut. There is a widely-held view that the food industry is best placed to make decisions about the quality of their products based on their understanding of market demands [9,18,34]. However, compulsory and optional quality standards do exist to ensure that essential product requirements are met and to protect consumers against fraudulent practices [35,36]. Most problems that occur in conventional agriculture may also be present in organic farming, such as erosion, nitrogen leaching, ammonia volatilisation from animal wastes, high levels of native soil cadmium, accumulation of trace metals in soil, and subsoil compaction caused by farm machinery [37-41]. Organic farming methods do not offer solutions to many of these problems. In contrast to conventional agriculture, organic farming without purchase of feed may result in a nutrient depletion of soils. Through the import of feeding stuff to farms, which means a net input of nutrients, depletion is normally avoided. As the feeding stuff may be produced elsewhere with inorganic fertilizers, organic farming indirectly depends on the soil fertility of conventional farming [42,43]. However, regulations about the conventionally grown feeding stuff to be used in organic farming differ between countries [24,34,44,45].

For cattle the types of feeding of the animals do not differ between organic and conventional systems. Feeding of organic cattle should however be derived from organic production systems [46-48]. Also the percentage of mixed feeds and raw feeds differ in organic cattle production. For example 60% of the feeds should be raw feeds for organic cows. For organic cows also no synthetic additives, antibiotics etc. are allowed. Rules for pigs and chickens are similar [15,20,49]. In conclusion the major differences in the quality of feeds between organic and conventional products systems seems to originate from differences in production of plants (such as limited use of crop production products) and the lack of certain additives in the feeds. The types of feeds administered do not differ significantly and there are mostly quantitative differences observed (more raw feeds) [13,14,27,50,51].

2. ENVIRONMENTAL CONTAMINANTS

One reason for the increase in organic agriculture in many countries in Europe today is we need to solve environmental problems. In such situations, we often tend to accept appealing solutions. Furthermore, the intensive propaganda by representatives of organic farming movements has had a strong influence on public opinion, politicians, and scientists [38,44,52,53]. A wide range of organic and inorganic compounds may occur in feedstuffs, including pesticides, industrial pollutants, radionuclides and heavy metals. Pesticides that may contaminate feeds originate from most of the major groups, including organochlorine, organophosphate and pyrethroid compounds. Although pesticides are potentially toxic to farm livestock, the primary focus of concern centers on residues in animal products intended for human consumption [31,54-59]. It should be noted that organic producers are not prohibited from using all pesticides -certain pesticides from natural sources can be used. Natural pesticides like the chemically synthesised pesticides must be subject to safety evaluation. Natural pesticides used in organic management are usually restricted under certification schemes. International guidelines for organically produced foods include lists of substances that can be used for plant pest and disease control if the need for such is recognised by the certification body. In organic management, biological control is the preferred method of pest management [13,35,50].

Contaminants in animal feeds, such as pesticide residues, agricultural and industrial chemicals, heavy metals and radioactive nuclides, can result in safety hazards in foods of animal origin. As EC regulations (EC No 1804/1999) require that livestock, claimed to be produced organically, is fed on organically produced feed stuffs, the potential for contamination with pesticide residues and other agricultural chemicals is greatly reduced compared to conventional farming methods [3,39,60]. However, organic agriculture does not reduce the levels of persistent environmental pollutants in organically grown products. These may therefore be present in organic feedstuffs and hence in organic food of animal origin [13,32,35,61]. Conversely, excluding pesticides may result in increased concentrations of secondary plant metabolites and of mycotoxins of field fungi. Thus, to exclude pesticides does not necessarily mean that crop products do not contain unwanted substances [31,44].

3. POSSIBLE NATURAL TOXINS OF ANIMAL FEEDS

Animal products are a primary source of proteins, amino acids and fats, and when they are a major constituent of diets they contribute a significant part of total calories. They are, however, perishable products which require special attention to prevent their deterioration and contamination by various agents, biological as well as chemical. Some of these contaminants can be transferred by the feed [22,62-64]. Animal feeds are routinely subject to contamination from diverse sources, including environmental pollution and activities of insects and microbes. Animal feeds may also contain endogen toxins arising principally from specific primary and secondary substances produced by fodder plants [65-67]. Thus, feed toxins include compounds of both plant and microbial origin. Although these toxins are often considered separately, because of their different origins, they share several common underlying features. Therefore, particular compounds within both plant and microbial toxins may exert antinutritional effects or lessen reproductive performance in farm animals [23]. Also, the combined effects may be the result of additive or synergistic interactions between the two groups of compounds. The extent and impact of these interactions in practical livestock feeding remain to be quantified. Feed contaminants and toxins occur on a global scale but there are distinct geographical differences in the relative impact of individual compounds. The term "feed" is generally used in its widest context to include compound blends of straight ingredients as well as forages. With such a broad perspective, it is necessary and more instructive to introduce some focus [54,59,68].

3.1. Contamination from Natural Fertilisers

Variation in stocking rates of grazing ruminants can change the structure and composition of pastures with potential impacts on biodiversity and produce methane, a greenhouse gas [69,70]. The search for reducing agricultural surpluses led the EU to promote livestock production extensification and a decrease in stocking rates on grasslands. The value of species rich grasslands are also reinforced by the increased interest of consumers in site-specific and origin-labelled products, and the growing scientific evidence of the role of local grassland flora on various sensory characteristics of both cheese and meat products, such as colour and flavour of cheese and meat, respectively [34,71,72]. Animal manure and other organic waste are the main fertilisers used in organic farming. These natural fertilisers are also widely used in conventional agriculture with chemically synthesised fertilisers. Micro-biological contamination arising from the use of natural fertilisers and measures needed to address it must focus on both organic and conventional agriculture. Untreated or improperly treated manure or biosolids used as fertilisers or soil nutrient agents, whether in organic or nonorganic agriculture, can lead to contamination of products water sources [42,53,73,74]. Animal and human faecal matters are known to contain human pathogens. Properly treated manure or biosolids are effective and safe fertilisers. Growers need to follow good agricultural practices for handling these natural fertilisers to minimise microbial hazards. Researches indicates that pathogenic organisms can survive up to 60 days under compost conditions. The Codex General Principles of Food Hygiene provide the basic rules for ensuring food safety for all foods. Organic production, as with all other types of food production, must follow the rules outlined in this international code of practice. However, for some, drift and runoff from near fields may result in microbial hazards. Growers may consider scheduling application of manure on near fields to maximise the time between manure application to those fields and harvest of fresh market products [5,35,50,51,53].

3.2. Bacterial Contamination

There is considerable interest in the occurrence of *Escherichia coli (E. coli)* in animal feeds following the association of the O157:H7 type of these bacteria with human illness [2]. The US Centre for Disease Control (CDC) identifies the main source of human infection with *E. coli* as meat contaminated during slaughter. Virulent strains of *E. coli*, such as *E. coli* 0157:H7 develop in the digestive tract of cattle, which is mainly fed with starchy grain. Replication of faecal *E. coli*, including the O157:H7 type was demonstrated in various feeds under conditions likely to occur on cattle farms in the summer months [2,8,49]. Since faecal contamination of feeds is widespread on farms, it is an important route for exposure of cattle to *E. coli* and other organisms. The potential for exposure to bacteria also exists when poultry litters are fed to cattle. Cows mainly fed with hay produce less than 1% of the *E. coli* found in the faeces of grain-fed animals. It is one of the most important goals of organic farming to keep the nutrient cycles closed. Therefore, ruminants like cattle and sheep are fed diets with a high proportion of grass, silage and hay. It can be concluded that organic farming potentially reduces the risk of *E. coli* infection [55,56,75-78]. *Listeria monocytogenes* occur in poor-quality silages and big-bale silage. When grass is ensiled under anaerobic conditions, the low pH regime ensures that *Listeria spp.* is excluded from the resulting silage. However, in big-bale silage a degree of aerobic fermentation may occur, raising pH levels and allowing the growth of *Listeria spp.* These bacteria also survive at low temperatures and in silages with high levels of dry matter. Contamination of silage with *Listeria spp.* is important as it causes abortion, meningitis, encephalitis and septicaemia in animals and humans. The incidence of various forms of listeriosis has been increasing in recent years [79-81].

3.3. Mycotoxins

There are consistent reports of worldwide contamination of feeds with fungi and their spores. In the tropics, *Aspergillus* is the predominant genus in dairy and other feeds [82,83]. Other species include *Penicillium*, *Fusarium* and *Alternaria*, which are also important contaminants of cereal grains. Fungal contamination is undesirable because of the potential for mycotoxin production. However, spores from mouldy hay, silage, brewers' grain and sugar beet pulp may be inhaled or consumed by animals with destructive effects termed "mycosis" [31,59,84-86]. Most important mycotoxins were resumed in *Table 1* [87].

Mycotoxins are metabolites produced by fungi of various genera while they grow on agricultural products before or after harvest or during transport or storage. Mycotoxin contamination of forages and cereals often occurs in the field following infection of plants with particular pathogenic fungi or with symbiotic endophytes. Contamination may also occur during processing and storage of harvested products and feed whenever environmental conditions are appropriate for spoilage fungi [88,89]. Mycotoxins are regularly found in animal feed ingredients such as maize, sorghum grain, rice meal, cottonseed meal, groundnuts and legumes, wheat, barley and others. Most are relatively stable compounds and are not destroyed by the processing of feed and may even be concentrated in screenings. Some fungi such as *Aspergillus spp*. and *Penicillium spp*. can invade grain after harvest and produce mycotoxins, while others, such as *Fusarium spp*., typically infest grains and produce mycotoxins before harvest [85,90-92]. In some circumstances *Aspergillus ssp.* can grow and produce mycotoxins before the crop is harvested. Both intrinsic and extrinsic factors influence fungal growth and mycotoxin production. The intrinsic factors include moisture content and acidity, whereas extrinsic factors also include appropriate substrates (rice, corn, nuts, wheat, and food and feeds originated from them) and production period for 3-6 days [35,57,93-95]. There is only limited information available on the occurrence of mycotoxin residues in animal products intended for human consumption. It is known that milk cows can convert Aflatoxin B_1 into

Table 1. *Common mycotoxins, commodity affected, and negative effects on health*
Tablo 1. *Sıklıkla karşılaşılan mikotoksinler, etkilenen ürünler ve sağlığa olan olumsuz etkileri*

Mycotoxin	**Commodities**	**Fungal Source(s)**	**Effects of Ingestion**
Aflatoxin B_1, B_2, G_1, G_2	Corn, peanuts, and many other commodities	*Aspergillus flavus* *Aspergillus parasiticus*	Aflatoxin B_1 identified as potent carcinogen by IARC [a] Adverse effects in various animals especially chickens
Deoxynivalenol Nivalenol (Vomitoxin)	Wheat, corn and barley	*Fusarium graminearum* *Fusarium crookwellense* *Fusarium culmorum*	Human toxicoses in India, China, Japan, and Korea Toxic to animals, especially pigs
Zearalenone	Corn, wheat	*Fusarium graminearum* *Fusarium culmorum* *Fusarium crookwellense*	Identified as possible carcinogen by IARC. Affects reproductive system in laboratory animals and pigs
Ochratoxin A	Barley, wheat and many other commodities	*Aspergillus ochraceus* *Penicilium verrucosum*	Suspected by IARC as human carcinogen Carcinogenic in laboratory animals and pigs
Fumonisin B_1	Corn	*Fusarium moniliforme* and several less common species	Suspected by IARC as human carcinogen. Toxic to pigs and poultry. Cause of equine eucoencephalomalacia (ELEM) a fatal disease of horses

a: *International Agency for Research on Cancer*

Aflatoxin M_1, which is found in milk. This has caused considerable trade problems when Aflatoxin M_1 is found in milk, and concern about the safety of such milk [35,57,96].

Mycotoxicoses are diseases caused by exposure to foods or feeds contaminated with mycotoxins. Mycotoxins show various biological effects in animals, such as liver and kidney toxicity, central nervous system effects or estrogenic effects. There are differences between animals on the susceptibility towards different mycotoxins [68,85,97]. Poultry secrete mycotoxins relatively fast because of a particular digesting system. The ingredients used for animal feeding should be checked to ensure that satisfactory quality standards are maintained and that mycotoxins are not present at higher than acceptable levels [96,98]. Further research is needed to study the metabolism of mycotoxins by animals and the residues of mycotoxins and their metabolites in animal tissues. However, in many instances the problems of mycotoxins in feeds have more direct effects that they can create illness in animals and prevent efficient growth or feed use [49,84,89].

Since fungicides are not allowed in organic production and given that mycotoxins constitute a major health hazard, their relative presence in foods produced organically or conventionally has been the subject of many studies. From these studies it cannot be concluded that organic farming leads to an increased risk of mycotoxin contamination. It is important to emphasise that good agricultural, handling and storage practices are required in organic as in conventional agriculture to minimise the risk of mould growth and mycotoxin contamination [35,91,98,99]. Several research teams in EU have carried out comparative surveys of the frequency and levels of mycotoxins in conventional and organic foods. The results are surprisingly consistent. Averaged across 24 direct comparisons of mycotoxins in conventional and organic foods in published studies, mycotoxins were detected in conventional food about 50 per cent more often than in corresponding organic food [11,31[. Mycotoxin levels in conventional food averaged a little over twice as high as in the corresponding organic foods. The probable explanations for the higher levels of mycotoxins in the conventional wheat crops grown in EU is the routine use of high levels of nitrogen fertilizer, and fungicide applications to prevent diseases and losses [31].

It has been suggested that organically produced food has higher levels of mycotoxin contamination because organic farming bans the use of fungicides. There is no evidence to support this claim [98,99]. In fact organic farmers would contend that their crops are less prone to fungal diseases because high doses of nitrogen increase the growth rate of crops leading to a thinning of the plant cell walls making the crop more vulnerable to fungal attack [49,99,100]. Good animal feeding practices also require that feed is stored in such a way 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 [35,89,98].

3.4. Potential Plant Toxins

Many plant components have the potential to precipitate adverse effects on the productivity of farm livestock. These compounds are present in the foliage seeds of almost every plant that is used in practical feeding [101]. Typical concentrations of selected toxins were presented in *Table 2* [59].

Table 2. *Plant toxins: sources and concentrations*
Tablo 2. *Bitkisel toksinler: kaynakları ve konsantrasyonları*

Toxin	Principal Source(s)	Typical Concentrations
Lectins	Jackbean	73 units/mg protein
	Winged bean	40-320 units/mg
	Lima beans	59 units/mg protein
Trypsin inhibitors	Soybean	88 units/mg
Antigenic proteins	Soybean	-
Cyanogens	Cassava root	186 mg HCN/kg
Condensed tannins	Acacia spp.	65 g/kg
	Lotus spp.	30-40 g/kg
Quinolizidine alkaloids	Lupin	10-20 g/kg
Glusosinolates	Rapeseed	100 mmol/kg
Gossypol	Cottonseed	0.6-12 g/kg (free)
Saponins (steroidal)	*Brachiaria decumbens, Panicum spp.*	-
S-methyl cysteine sulphoxide	Kale	40-60 g/kg
Mimosine	*Leucaena leucocephala*	145 g/kg (seed)
		25 g/kg (leaf)
Phyto-oestrogens	Clover, lucerne, soybean	-

Plant toxins may be divided into heat-labile and heat stable groups. Heat-labil group comprising lectins, proteinase inhibitors and cyanogens, which are sensitive to standard processing temperatures. Heat-stable group includes many compounds such as antigenic proteins, condensed tannins, quinolizidine alkaloids, glucosinolates, gossypol, saponins, nonprotein amino acids (such as S-methyl cysteine sulphoxide and mimosine), and phyto-oestrogens [102-104]. The role of these substances as anti-nutritional factors has been considered in detail by D'Mello [59]. Contamination of animal feeds with weed seeds is also a major problem worldwide. The impact of weed seeds arises from the toxins they contain and from their diluent effects on nutrient density of feeds. Examples of weed seeds that are controlled by legislation in various countries include those of *Datura spp.*, common vetch, castor-oil plant and *Crotalaria spp.*[35,54,59].

4. CONTROL OF FEEDBORNE HAZARDS

Over many years feeding animals and preparing feed ingredients has not received adequate quality and safety attention. FAO organized in 1997 an Expert Consultation on Animal Feeding and Food Safety to determine how to better address the problems of feed ingredients and contaminated feed [54]. The primary purpose of this Expert Consultation was to discuss current animal feed problems, and to develop a draft Code of Practice for Good Animal Feeding for consideration by the Codex Alimentarius Commission, as advice to FAO member countries. This draft Code covers good animal feeding practices, and adherence to Good Manufacturing Practices (GMPs) in the procurement, handling, manufacturing, storage and distribution of commercially-produced feeds for food-producing animals. Feed and feed ingredients should be obtained and preserved in stable conditions to prevent hazardous effects due to contamination or deterioration. When received, feeds should be in good condition and meet generally accepted quality standards. GMPs should be followed always [54,84].

Preventive management of mycotoxin contamination of food and animal feed should be checked regularly in organic farming. Strategies to prevent mycotoxin contamination must be applied strictly. It is important for producers to realise that good agricultural practices (GAPs) represent the primary line of defence against contamination of cereals with mycotoxins, followed by the implementation of GMPs during the handling, storage, processing, and distribution of cereals for human food and animal feed [105]. Many strategies to prevent mycotoxin contamination of food and animal feed have been developed. Various crop genotypes resistant to fungus infection [106-108], pre-harvest control strategies [89,109], field and harvest management as well as post-harvest applications including improving drying and storage conditions [110-113], and the use of biological agents [114-116] have been shown important in the prevention of mycotoxigenic mould growth and mycotoxin formation. Preservation can be facilitated by low temperature storage, ensiling, dehydration or the addition of appropriate chemicals [54]. However, several natural plant extract and spice oils of eugenol, cinnamon, oregano, onions, lemongrass, turmeric and mint are known to prevent both mould growth and mycotoxin formation during post-harvest season [112,117-119]. Although activated charcoal, hydrated sodium calcium aluminosilicate, aluminosilicate, zeolite, and bentonite have shown good potential for use in the animal feed to help overcome aflatoxicosis. Recently, there has been an increasing interest in the use of bacteria, yeast, and fungi to help reduce the toxic effect of mycotoxins [114,120,121]. Another approach to the problem has been the use of mycotoxin-binding agents in the diet that sequester the mycotoxin in the gastrointestinal tract thus reducing their bio-availability [94,95,119,122]. The suitability of these applications may be questionable regarding the organic farming regulations. At the same time it should be noted that chemical treatment is not allowed within the EU for commodities destined for human consumption.

More information may be found in the first edition of the "Prevention and Reduction of Food and Feed Contamination" publication [105] that contains all the codes of practice related to the prevention and reduction of contaminants in foods and feeds adopted by the Codex Alimentarius Commission until 2011.

CONCLUSION

There is a growing demand for organic foods driven primarily by a consumer's perceptions of the quality and safety of these foods and to the positive environmental impact of organic agriculture practices. This growth in demand is expected to continue in the foreseeable future. Animal feed, including herbage, may be contaminated with organic and inorganic compounds. Main contamination sources are available in all farming systems and must be taken seriously. Mycotoxins holds many problems among the natural toxins. Naturally occurring toxicant contamination of feeds and foods with mycotoxins is inevitable and unpredictable and poses a unique challenge to organic farming as well as conventional farming. The best way to reduce the mycotoxin content in food and feed is the prevention of mycotoxin formation in the field, but this is often not sufficient, consequently other effective methods are required. A well maintained quality assurance system has to be set up based on the occurrence, detection and prevention. Good agricultural, handling, manufacturing and storage practices are required in both organic and conventional agriculture to minimize the risk of natural toxins. Residues transferred to edible animal products presents consumer health risks. Food safety is the shared responsibility of governments, academia, the food and feed industry farmers and the consumer. In view of consumer expectations, it is important that governments, industry and consumer groups carefully examine issues related to organic food quality and safety and make whatever interventions may be necessary to ensure an appropriate level of consumer protection.

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