Mycotoxins – the difference between profit and loss

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The word mycotoxin simply means a toxin produced by a fungus. The term was derived from 'mycotoxicosis', first used by Forgacs and Carll in 1955. Although the definition is very simple, the diagnosis is very difficult because clinical signs are unspecific and can be associated with other pathogens.

Besides this difficulty to diagnose, when we see the ease and frequency with which mycotoxins contaminate agricultural commodities, they can mean the difference between profit and loss for the poultry industry when animals are chronically exposed to these chemicals via contaminated feed.

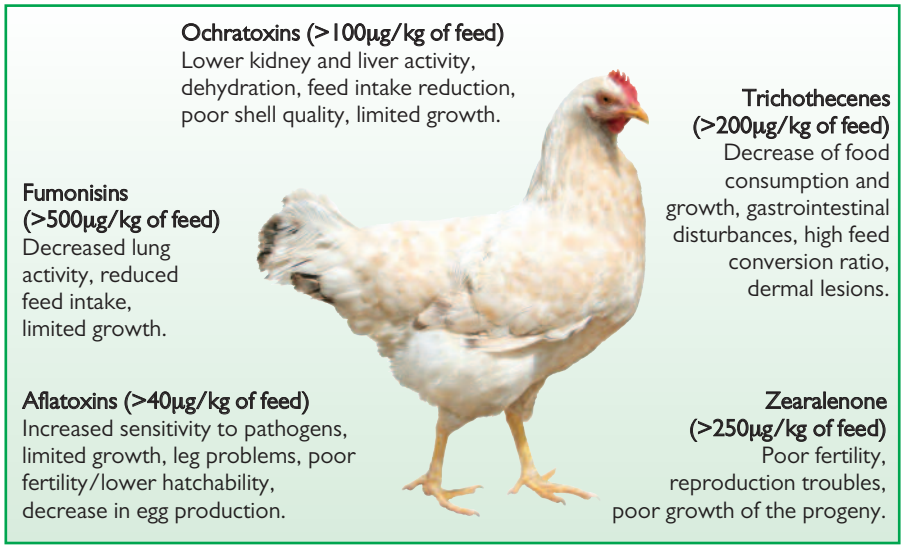

Fig. 1. The main effects of mycotoxins.

Resistance misconceptions

Poultry is wrongly assumed to be resistant to mycotoxins even if they seem less sensitive than pigs. Indeed, several studies report a decrease in the performance of poultry at several physiological stages.

Mycotoxins reduce the farm profitability by limiting the egg production of the laying hens.

It is necessary to say that, in spite of the sensitivity of the animals, the diagnosis is not easy because of the unspecific symptoms. Indeed, mycotoxins affect almost all organs in the body. The major organs and tissues affected are liver, kidney, oral cavity, gastrointestinal tract, spleen, brain and nervous system. The immunosuppressive effect of mycotoxins may induce the outbreak of a viral, bacterial or parasitic disease although the original problem to solve is the mycotoxicosis. The main effects of mycotoxins are described in Fig. 1.

Mycotoxicosis

The adverse effects of mycotoxin contaminated diets on performance range from undetectable to devastating in terms of reduced egg production in layers and breeders, and growth depression in broilers, turkeys and ducks.

Devastating can be synonymous with high mortality over a few days but in most cases, devastating means a limitation of the performance of the animals over a long period. In both cases, farm profitability is reduced in a significant way. However, in the second situation, even in good farming conditions, diagnosis is very difficult because animals appear exhausted with disease outbreaks and other background troubles (digestive, reproductive, growing).

Not only is performance limited but production costs will increase in an exponential way (veterinary costs, feed conversion ratio, reduced fertility inducing augmentation of the unproductive time). Losses due to mycotoxicosis have been estimated at more than $1 billion in Canada and over $2.5 billions in the USA during the 1990s.

Preventive measures

Because mycotoxins are a huge risk to animals, much consideration has to be given to prevention because good agricultural practices are not sufficient to make the hazard avoidable for the feed industry.

Factors favourable to the development of fungi in the field include:

- Hot and wet climate during the year.
- Previous cultural crops.
- Non ploughing of harvest residues.
- Use of varieties sensitive to fungi.
- Long interval of time between harvest and drying of raw materials.

The combination of several of these risk factors may lead to contamination.

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Secondly, the integration of a selection on disease resistance has been investigated for crop farming to limit economic losses in the field. Though, disease resistance is relative and hybrids may vary in reaction. The most common method of mycotoxin prevention is the use of mould inhibitors which prevent the development of moulds in stored commodity.

However, if mycotoxins were already formed in the field, the feedstuff will stay contaminated and keep its detrimental effects on animal health and production.

Clinical symptoms of mycotoxins are unspecific and induce an increase of the production costs. Layers may appear healthy but they do not express their genetic potential.

In addition, the use of a mould inhibitor on the field, if applied during fungi development, may produce mycotoxins due to the stress that it generates.

Indeed, mycotoxins are chemically stable during all manufacturing processes such as temperature (fumonisin is resistant up to 200°C) and pelleting. Chemical treatments are not realistic in industrial situations, mycotoxins resist storage and mould inhibitors may lead to the production of mycotoxins.

So, the difficulty in removing a mycotoxin is so high that the best solution to control mycotoxicosis is prevention through the feed with the addition of a mycotoxins inactivator to avoid mycotoxicosis being the limiting factor of the poultry's performance.

Because climate is uncontrollable and mycotoxins are very stable, a mycotoxins inactivator, which is efficient and reliable at low dosages, is the best solution either in preventive or in curative situations.

Mycotoxin adsorption

Over the past years, some research has been done on mycotoxins adsorption. A major breakthrough in the development of mycotoxin inactivators has been the invention by Olmix of pillared layered clay (Amadéite) in which the interlayer space has been enlarged on a nanometre scale, creating a very effective trap for various mycotoxins.

Thanks to the combination of this clay with seaweed extracts, yeast cell walls and diatomaceous earth in its formulation, the final product is introduced in animal feed to prevent contamination of different classes of toxins (aflatoxins, ochratoxin, trichothecenes, zearalenone, fumonisin).

Indeed, it is important to know that there is very rarely only one mycotoxin involved in the contamination but very often from three to six toxins.

Olmix noticed that only 7% of the samples sent by their customers to the laboratory contained less than three mycotoxins (88 samples in total), 55% of the samples contained between three and five mycotoxins and 38% of the samples contained six mycotoxins and more.

To face this multi-contamination and their synergy, it is important to use a mycotoxins inactivator with a broad spectrum of action. it means several ingredients acting in synergy to prevent mycotoxicosis.

Complementary data on laying hens and broilers demonstrate the necessity of using a mycotoxins inactivator over a long period.

Table 1. The use of MT.X+ increases average laying and reduces mortality.

	MT.X+ group	Control	Diff.	Variation (%)
Laying (%)	89.72	87.82	+1.9	+2.2
Cumulated mortality (%)	7.6	12.7	-5.1	-40.2
Average feed intake (g/day)	105.71	100.37	+5.34	+5.3
Average cracked egg (% per month)	0.75	1.1	-0.35	-31.8
Average pale egg (% per month)	2.5	2.19	+0.31	+14.2
Average dirty egg (% per month)	9.22	10.87	-1.65	-15.2
Total No. of eggs/month** (x1000)	1820	1695	+125	+7.4
No. of withdrawn eggs/month** (x1000)	224	240	-16	-6.5
No. of proper eggs sold/month** (x1000)	1596	1455	+141	+9.7

Results displayed above are the average results from September 2006 to February 2007.
** Calculations are made for a 100,000 laying hen unit.

Eggs shell quality may be lessened (cracked or pale eggs) by mycotoxins, involving a downgrading of the products and a lower selling price.

Indeed, MT.X+ was incorporated at 1kg/ton of feed (nearly 40g of MT.X+/hen/year). The control group received another mycotoxin binder. The supplementation was done from the 16th week (entrance) to the 40th week (after the production peak).

MT.X+ increased the average laying by 2.2% but also reduced the mortality rate by -40.2% (Table 1). This improvement on these two essential parameters induces a strong increase in the number of eggs produced per month: +125,000 eggs/month (+7.4%). By adding this mycotoxins inactivator, the hens consumed more (+5.34g/day) which may be a sign of better palatability of the feed due to the protection against mycotoxins.

Other important criterion is the quality of the eggs which determines the price of the egg. Even if we can notice a slight increase on the percentage of pale eggs in the MT.X+ group (2.5% versus 2.19%), the percentages of cracked eggs and of dirty eggs is reduced (respectively -31.8% and -15.2%).

All this greatly improves the number of eggs sold per month: +141,000 eggs (+5.6%) or 1.41 additional egg sold/hen/month.

A bigger problem?

Mycotoxins cause many issues in agriculture but, in reality, are they a bigger problem because of their invisible or hidden effects, such as immunosuppression and nutrients absorption interference?

With high cereal and protein prices, we must be cautious of not 'saving the pennies and losing the pounds' by making unwise economies such as removing mycotoxin inactivators from the birds' feed. In fact, if you are not using such products, now may be just the time to consider their use!

When margins were greater we probably rested on our laurels, but now that they are much tighter, or even non-existent, perhaps we should be looking more closely at how to improve performance. ■

References are available from the author on request.