

What is Elitox[®]

Elitox[®] is a unique mycotoxin management tool used to alleviate the negative effects of toxins present in ruminant diets. Elitox[®] can also be used as a preventive measure to counteract mycotoxicosis. It is a combination product that works by both absorption and biological detoxification of mycotoxins, whilst supporting animal defence mechanisms. Elitox[®] has been a trusted product within the Australian market for over 20 years.

What are mycotoxins

Mycotoxins are naturally occurring toxic metabolites produced by fungi (moulds). These fungi grow on raw materials (plants, grains) in the field or during storage of raw materials and feed and largely resistant to different storage and processing conditions. (Figure 1). Mycotoxin production is mainly related to climatic conditions such as temperature and humidity. Mycotoxins are very stable and resistant to different storage and processing conditions. It is difficult to analyse mycotoxins. They are not visible and have no odour. Moreover, they are found in very small amounts, parts per million (ppm) or even parts per billion (ppb).

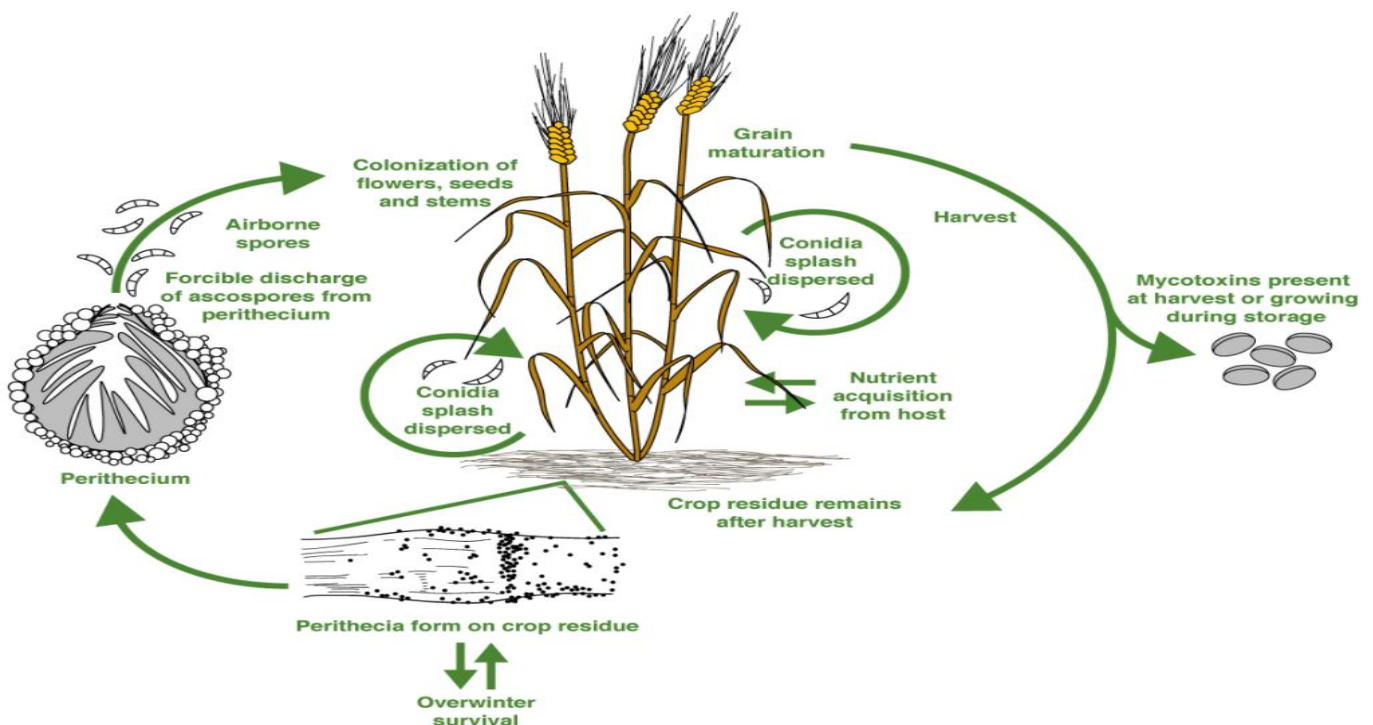


Figure 1: Mycotoxin growth on raw materials (plants and grains).

Effects of mycotoxins

Consequently, ingestion of contaminated material may affect animal health and cause mycotoxicosis, inducing productivity and fertility losses as well as animal health impairment (Table 1). Mycotoxicosis is the outcome or disease associated with consumption of mycotoxins and its severity will depend upon the toxin type, level of exposure time, type of animal, breed, age, sex, health status, environmental and handling factors. Effects of mycotoxins can generally include:

Fertility

- Toxins can have a catastrophic effect on fertility. Modest levels of some toxins could be considered to reduce fertility by 15 to 20 %.

Production efficiency

- Mycotoxins effects on gut health include impaired gut barrier functioning, higher susceptibility to secondary infections, state of inflammation, altered immune responses, intestinal infections, less efficient digestion and absorption of nutrients, all of which contribute to production losses.
- Even at subclinical levels daily growth or milk production can crash and a figure of 20 % reductions are representative.

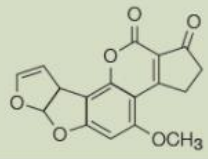
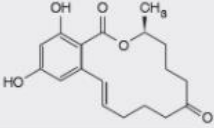
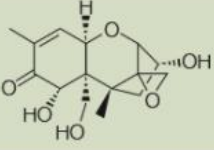
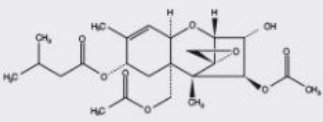
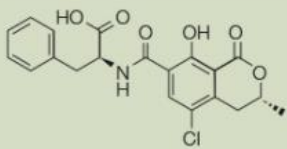
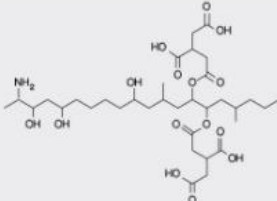
Security

- You don't know sometimes! Having a preventative is better than not! We all take personal insurance out for health, income protection, life etc. Why not insurance for animal performance?

Ingredient cost/feed formulation saving.

- If you already own or are committed to parcels of feedstuffs/forages and recognise these as being risky, then you can still use these with greater confidence. Furthermore, this will help alleviate the negative impacts on livestock performance and farm business productivity. This protects both your clients business and your own.

Table 1: The chemical structure, level of productivity and immunotoxicity impacts, clinical signs and main affected organs from different mycotoxins.

Mycotoxins	Chemical structure	Productivity loss	Immuno toxicity	Frequently related clinical signs	Main affected organ/system
Aflatoxins		+++++	+++++	Hepatitis, poor response to vaccination, unspecific infections, increased susceptibility to diseases	Liver, kidney, immune system
Zearalenone		+++++	++	Hyperestrogenism, reproductive disorders	Reproductive tract - mainly female.
Deoxynivalenol		+++++	+++++	Feed refusal, vomiting	Central nervous system, GUT epithelium, liver, immune system
T-2 toxin		+++++	+++++	Oral and epithelial lesions, loss of appetite	GUT epithelium, liver, immune system
Ochratoxin A		+++++	+++++	Nephritis (kidney damage - enlarged kidney), hepatitis	Kidney, liver, immune system
Fumonisin		+++++	+++	Porcine Pulmonary Edema (PPE), Equine Leukoencephalomalacia (ELEM)	Lungs and heart (pig), central nervous system (horse), liver, immune system

Sourced from Impextraco (<https://www.impextraco.com/products/animal-protection/power-protexion-power-mycotoxins-eliminator>).

Comparing simple “toxin binders” with toxin management tools

Mycotoxin control products are commonly grouped together as “toxin binders”, which is an oversimplification of this product group. A sub-group of products have a dual action that takes management of toxins beyond the basics of “binding” and moves to a mode of action that includes “Binding+ Deactivation”. Elitox® is the product that offers the important dual action.

At this point you’ll be asking why is having both binding and deactivation of toxins important in the product I choose? Usually when presented with a toxin challenge it comes from a range of toxins not one specific type. Toxins also have a multiplying effect on each other when found in combination. Therefore, if you want to secure your feed and reduce the toxin’s effects on performance being able to reduce the impact of a variety of toxin’s is critical and the product used is a decision not to be

taken lightly. At this stage it is important to realise that not all toxins behave the same or have the same properties, and this has large impacts on how we reduce the impact of that toxin type and what product you use.

There are generally two types of toxin groups, those that have a polar charge and those that don't. The group of toxins that have a polar charge are known as POLAR TOXINS. These toxins have a chemical nature that confers a differentially charged chain length impact to the toxin (having a +/- polar impact). The two groups of toxins that are accepted to have this structure are Aflatoxins and to a lesser degree Fumonisin. These toxins lend themselves to be bound, either with mineral clay based products that utilise ion exchange capacity, or with other binders such as yeast extract mono-oligo polysaccharides (MOS) style products that “adsorb” the toxin onto the surface area of the control product. The toxin is rendered more unavailable for absorption and is excreted from the body.

Many other toxins however do not have such a polar structure, and as such traditional binders are far less effective against these toxins. Therefore, these NON-POLAR TOXINS need to be deactivated in some other manner different to that of polar toxins. Deactivation is obtained through either degradation or transformation of the mycotoxin by enzymes. Such non-polar toxins include Zearalenone, T-2 toxins and other Tricothecenes. The safest and best products to use to protect your animals against both non-polar and polar type toxins are products which offer both binding and deactivation properties.

From a perspective of the challenge faced in southern Australia, we need to consider what fungi groups are producing the toxin challenge. In cooler climates, the fungal challenge is more typically Fusarium fungi, of which are the producers of the toxins that are not readily bound (Figure 2). Warmer conditions are favoured by Aspergillus fungi that produce Aflatoxins that are more readily bound. The tropical parts of the world have a risk of toxins dominated by Aspergillus and Aflatoxin, but more temperate areas see the challenge as Fusarium and a wider range of toxin challenge.

Within this discussion we stress that no product used to manage toxin challenges can hope to reduce 100 % of the challenge from 100 % of the toxins. That is infeasible. What we can hope to do is to increase our impact against a wider range of toxins, which Elitox[®] clearly achieves (Table 2).

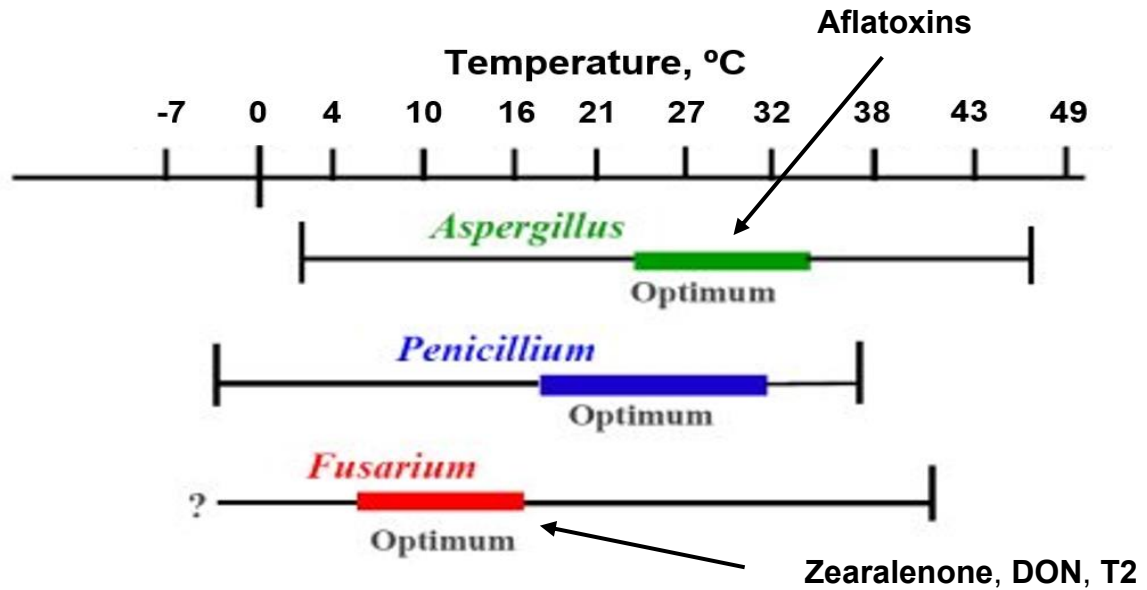


Figure 2: Favoured temperature ranges for mycotoxins.

Table 2: Effectiveness of products to counteract toxins.

Toxin	Products		
	Mould inhibitors	Mycotoxin binders	Elitox
Fungi	Yes	No	No
Aflatoxins	No	Yes (good)	Yes
Trichothecenes (ex. DON)	No	Not effective	Yes
Ochratoxins	No	Very limited	Yes
Zearalenone	No	Very limited	Yes
Fumonisin	No	Yes (quite OK)	Yes
Alkaloid toxins	No	No	Yes, in general

Roles of Elitox®

Elitox® is a unique mycotoxin eliminator for use in all ruminant diets. It combines in one single product different strategies to eliminate the maximum number of a wide range of mycotoxins (Figure 3). In comparison, a common “toxin binder” MOS style product shows that the capacity of glucomannans from the *Saccharomyces cerevisiae* to bind to a wide range of mycotoxins is more limited (Figure 4). A study by Yiannikouris & Jouany (2002) reports a relative link between clay

binder dose and MOS/glucomannan dose, and the impact of the MOS/glucomannan on toxin is set out clearly. There is a clear difference of the product type against certain toxins. The wider mode of action of a product like Elitox® that is both a binder and deactivator is evident (Figure 3). No product is 100 % active against 100 % of toxins. We do believe however that Elitox® realistically has a wider range of impact. Most products can handle the “easy polar toxins”... it’s how you go against the tough ones (non-polar toxins) that count.

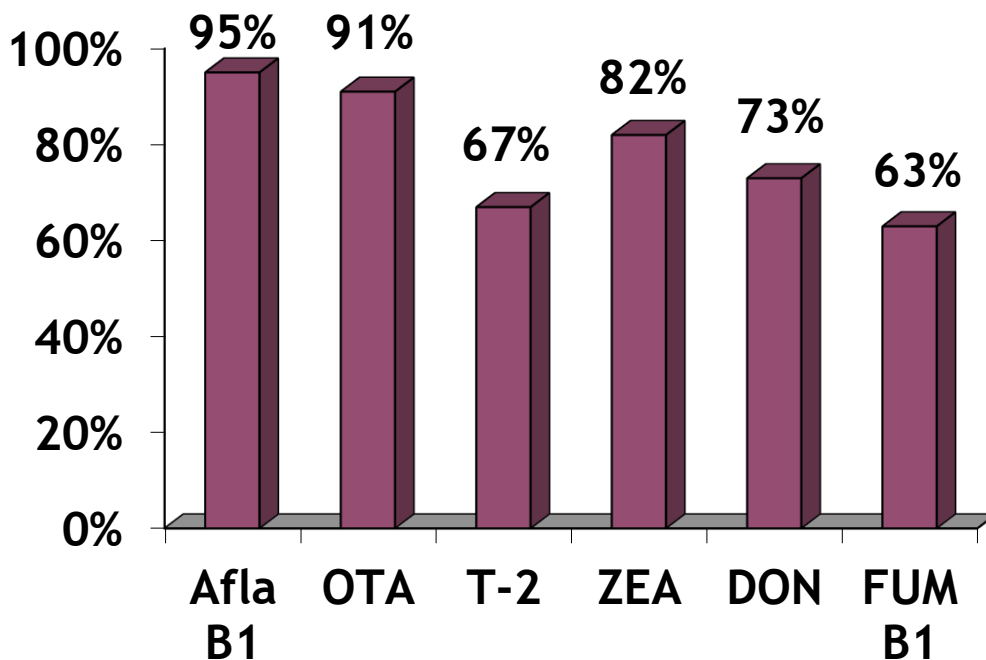


Figure 3: Percentage of mycotoxins eliminated when including Elitox® - summary of different in vitro simulator trials.

6.2.3. Microbiological methods

Certain strains of lactic acid bacteria, *propionibacteria* and *bifidobacteria* have cell wall structures that can bind mycotoxins [1, 19, 97] and limit their bioavailability in the animal body. Mycotoxins are then eliminated in the faeces without significant detrimental effects on the animals or any risk for toxic residues to be found in edible animal products. Research is currently underway to develop new classes of natural organic mycotoxin binders. Glucomannans extracted from the external part of the cell wall of the yeast *Saccharomyces cerevisiae* are able to bind certain mycotoxins (Tab. V). Their great binding capacity results from the large area available for exchange. Thus, 500 g of glucomannans from yeast cell-wall have the same adsorption capacity as 8 kg of clay [14]. This binder reduces the AFM1 content of milk by 58% in cows given a diet contaminated with aflatoxin B1 at a concentration of 0.05% of dry matter [94].

Table V. Capacity of glucomannans from *Saccharomyces cerevisiae* to bind to mycotoxins (adapted from [14]).

Mycotoxins	% Binding
Aflatoxins (total)	95.0
Fumonisin	67.0
ZEN	77.0
T-2	33.4
Citrinin	18.4
DAS	12.7
DON	12.6
OTA	12.5
NIV	8.2
Fusariotoxin	7.9

Figure 4: Capacity of MOS style products to bind mycotoxins. Sourced from: “Mycotoxins in feed and their fate in animals” (Yiannikouris & Jouany, 2002).

Elitox® combats mycotoxins produced by fungi that are toxic to animals in 3 ways:

- Adsorption of polar mycotoxins (Aflatoxins, Ochratoxins, Fumonisin). The ion exchange capacity (+/- charge) within Elitox® binds to these polar toxins and is excreted in the faeces with reduced physiological impact on the animal as it is not absorbed in the gastrointestinal tract. Specifically, in dairy cows Elitox® has been shown to improve milk production and quality, reduce the somatic cell count, as well as reduce the amount of aflatoxin carry over into the milk. Furthermore, Elitox® has been successfully shown to improve infection resistance, reducing the number of cows needing treatment for other health related problems such as mastitis.
- Biological deactivation of non-polar mycotoxins (DON, T2, Zearalenone).
- Supports the natural defence mechanisms of the animal. Natural extracts and vitamin C, broadly speaking, have wound-healing properties, improves mucosal resistance (gut barrier function), immune-enhancing effects, anti-oxidative characteristics, inflammation suppression and supporting the liver as antioxidants and methyl group donors. The liver is on the front-line impact of toxins and must be helped through challenges as its central in metabolism.

Of more relevance to the temperate grazing sector however is the ability to combat endophyte fungi toxins that are implicated in Perennial Ryegrass Toxicity (PRGT). This is common in temperate grazing systems and Elitox® has a unique proven efficacy position against PRGT.

Elitox® has been shown to reduce the negative effects of ryegrass staggers. Typically, perennial ryegrass toxicity (PRGT), otherwise known as ryegrass staggers, occurs when animals consume ergot alkaloid contaminated perennial ryegrass. Endophyte fungi grow naturally on perennial ryegrass and confer a degree of insect resistance to the plant. Seasonal environmental stress to the plant however (late spring into summer moisture shortfall most commonly) will see the fungi release toxins including Ergovaline and Lolitrem B. These create the behavioural and productivity issues we know as PRGT, commonly affecting the central nervous system causing muscle contractions and tremors, as well as large production losses. Most parts of Australia with Perennial ryegrass will see these challenges crop up across a season at some stage, but more often late spring and summer.

The Elitox®/Feedworks team focused their research efforts with University of Melbourne into this area. It was felt other parts of the globe were doing ample work on the traditional toxin challenge above, but there was a need to drive Australia's own efforts in the PRGT area as this is not a global issue. What resulted is (Feedworks are told) is still the only fully replicated university trial work on

PRGT that exists. It's probably also the best (and most relevant to grazing systems) LOCAL mycotoxin work that has been carried out in Australia for many years.

The study outcomes show the strongly positive impact that Elitox[®] can have in offsetting the behavioural and productivity impacts of the endophyte toxins that create PRGT. Elitox[®] was shown to lessen the impact of PRGT alkaloids, by reducing respiration rate, rectal temperature, drop in feed intake and loss in body weight created by PRGT alkaloids, hence being representative of reducing physiological stress.

Elitox[®] is active in the gut, where the toxins cause a problem, whilst also providing the animal with extra stabilized Vitamins to prevent the symptoms associated with mycotoxin toxicity. Furthermore, Elitox[®] is the only mycotoxin eliminator that has data to demonstrate an effect on Perennial Ryegrass Toxicosis. Elitox[®] helps to safeguard the animal's performance during mycotoxicosis and ensures optimum technical and financial results:

- *In vitro* study results have shown Elitox[®] to help regulate gut barrier function by improving mucosal resistance and preventing mucosal disruption.
- Elitox[®] also aids in the management of LPS, a toxin produced in low rumen pH environments.
- Elitox[®] does not bind or degrade dietary micro-nutrients such as vitamins and minerals.

When to feed Elitox[®]

Elitox[®] can be permanently included in the diet or strategically incorporated into the diet in response to mycotoxin challenges. Better yet, to avoid the effects of mycotoxins, it is best practice to implement a mycotoxin strategy; as it is commonly said, prevention is better than cure. Elitox[®] is a scientifically proven and consumer trusted product which can be used as an effective feeding management tool to mitigate the negative impacts of a range of mycotoxins present in animal feed.

Elitox[®] is supplied and distributed by FeedWorks Australia.

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