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Insha Mir
Department of Veterinary & Animal Husbandry Extension Education, Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana, Punjab, India

Parminder Singh
Department of Veterinary & Animal Husbandry Extension Education, Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana, Punjab, India

JS Bedi
Department of Veterinary & Animal Husbandry Extension Education, Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana, Punjab, India

HK Verma
Department of Veterinary & Animal Husbandry Extension Education, Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana, Punjab, India

Corresponding Author:
Insha Mir
Department of Veterinary & Animal Husbandry Extension Education, Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana, Punjab, India

Aflatoxins: Feed value chain contamination and their management

Insha Mir, Parminder Singh, JS Bedi and HK Verma

Abstract
20 feed millers from 10 districts of Punjab were randomly subjected to questionnaire method to seek the information. It was found that majority of the feed millers gave first preference to ingredients of high protein content, followed by less price, grain size, more oil, less fibre, moisture, adulteration. It was found that (90%) of the feed millers used to conduct aflatoxin test regularly and only (6.67%) of the feed millers were having their own laboratory for testing. And it was also observed that the prepared feed contained more aflatoxin, (66.67%) of the feed millers increased the dose of the toxin binder, (13.33%) withdrew from market. 93.33% of the feed millers used toxin binders to reduce the toxicity of mycotoxins.

Keywords: Aflatoxins, feed millers, feed, practices

Introduction
Aflatoxins are one of the highly toxic secondary metabolites produced by fungal species such as *Aspergillus flavus*, *A. parasiticus*, and *A. nomius*. These fungi usually infect cereal crops including wheat, walnut, corn, cotton, peanuts and tree nuts and can lead to serious threats to human and animal health by causing various complications such as hepatotoxicity, teratogenicity, and immunotoxicity (Amaika and Keller, 2011; Roze *et al*., 2013) [1,, 9].
Food safety is one of the major problems currently facing the world; accordingly, a variety of studies have been conducted to discuss methods of addressing consumer concerns with various aspects of food safety (Nielsen *et al*., 2009) [8]. Aflatoxins are found in various cereals, oilseeds, spices, and nuts (Iqbal et al., 2014) [5]. These *Aspergillus* colonize among themselves and produce aflatoxins, which contaminate grains and cereals at various steps during harvesting or storage. Fungal contamination can occur in the field, or during harvest, transport and storage (Kader and Hussein, 2009) [7]. Aflatoxins contamination of wheat or barley is commonly happen by the result of inappropriate storage.
In milk supply chain, aflatoxin enters through the food on which cattle feeds and aflatoxin AFM1 and AFM2 are the hydroxylated metabolites of AFB1 and AFB2 respectively and are associated with cow milk upon ingestion of aflatoxin contaminated feed (Giray *et al.* 2007) [3]. AFMI and AFM2 are secreted in milk of both animal and human, and also excreted in urine and faeces (Kangethe, *et al.* 2007) [6]. In milk, aflatoxins is generally at 1–6% of the total content in the feedstuff. AFTs infect humans following consumption of aflatoxins contaminated foods such as eggs, meat and meat products, milk and milk products,

Materials and Methods
20 feed millers from 10 districts of Punjab were randomly subjected to questionnaire method to assess their knowledge and practices followed by feed millers related to aflatoxin contamination.

Results and Discussion
A combination of feed ingredients is needed to supply the nutrients and energy preference. Quality control begins with purchase of feed ingredients, continues through the feed manufacturing process and does not end until the animals have consumed the feed. So in this regard order of preference given by feed millers is checked and is presented in Table 1. It was found that majority of the feed millers gave first preference to ingredients of high protein content, followed by less price, grain size, more oil, less fibre, moisture, adulteration and lastly they prefer low aflatoxin levels in the feed ingredients FAO (2010) [2] suggested that the

production and use of safe feed will enhance animal performance and improve profitability. The first step is to obtain safe ingredients, as it is impossible to produce safe feed without safe ingredients.

Table 1: Order of preference of feed ingredients by feed millers

S. No.	Parameter	Mean score	Rank
1	Moisture	45	VI
2	Grain size	58	III
3	High protein	73.33	I
4	More oil	56	IV
5	Less fibre	54	V
6	Less price	61	II
7	Adulteration	32	VII
8	Low aflatoxin levels	20	VIII

Practices followed by feed millers related to aflatoxin contamination

Developing feasible, sensitive and robust analytical methods is paramount for the identification and quantification of aflatoxins present in low concentrations in feed. Masked mycotoxins pose a major concern to feed industry as they are not identified and detected by the usually employed detection technique. By considering, a checklist was asked from the feed millers regarding aflatoxin practices which they are following at their feed mill and it was found from table 2, that (90%) of the feed millers used to conduct aflatoxin test regularly and only (6.67%) of the feed millers were having their own laboratory for testing. And it was also observed that the prepared feed contained more aflatoxin, (66.67%) of the feed millers increased the dose of the toxin binder, (13.33%) withdrew from market followed by dilution with freshly prepared feed so as to compensate the level of aflatoxin. Complete rejected was opted by only (6.67%) of the feed millers.

Also a series of checklist of various ingredients which are more prone to aflatoxin was asked from the feed millers and it was found that majority (40%) told that maize got infested with aflatoxin followed by cotton seed cake and the least prone to aflatoxin in this study is bajra, it may be due to several reasons from pre harvest to post harvest stage of the ingredients. The reasons behind maize being the most infested one may be enhanced by favorable conditions such as high moisture content and temperature, extent of contamination by aflatoxins also varies with different geographic location, agricultural and agronomic practices, storage condition of crops and more importantly processing of food materials under favorable temperature and humidity conditions**.**

Table 2: Distribution of respondents regarding practices related to aflatoxin contamination

S. No	Particulars	Categories	Frequency	Percentage
1.	Conduct aflatoxin test regularly for feed	Yes	27	90.00
		No	3	10.00
2.	Have own laboratory	Yes	2	6.67
		No	28	93.33
3.	When feed is contaminated with aflatoxin then	Destroy	7	23.33
		Sell to other places	3	10.00
		Sell to lower prices	19	63.33
		Mix with new one	1	3.33
4.	If the prepared feed contains more toxin, then	Reject the lot	2	6.67
		Withdraw from market	4	13.33
		Dilute with freshly prepared feed	3	10.00
		Re direct the feed in another market	1	3.33
		Increase the dose of toxin binders	20	66.67

Use of toxin binder by feed millers

Detoxification and inactivation methods include the use of binders or sequestering agents added to feed as an approach to reduce toxicity of mycotoxins by reducing reactivity of bound mycotoxins and reducing their intestinal absorption. The use of binders offers an approach to salvaging feeds with low levels of mycotoxins and to protecting animals from the background levels of mycotoxins that, although low in concentration. Dose and rate of toxin binder differs according to the season and brand respectively. It was found that (93.33%) of the feed millers used toxin binders to reduce the toxicity of mycotoxins. And (76.67%) of the respondents told that dose differs due to seasonal variation. Each harvest season seems to bring with it a variety of challenges that producers need to tackle in order to safeguard the health of their animals and the quality of their feed. Moulds or fungi and the mycotoxins they produce are an ever present threat and effective mycotoxin management is, now more than ever, fundamental to the success of any farm or feed mill reported by Haladi (2012) [4].

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