Networking on Aflatoxin Reduction in the Food Value Chain

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Introduction

Aflatoxins are naturally occurring, **potent fungal toxins in maize**, other cereals, spices, herbs and nuts, which are declared responsible for stunting in children and may poison humans and animals even at low concentrations. The frequent occurrence of aflatoxin in food and feed, especially under sub-Sahara climatic conditions, is related to enormous economic losses in the African countries and has a **great impact on food safety**.

Despite tremendous gain of knowledge, the aflatoxin problem has not been solved yet. More research is needed to combat aflatoxin occurrence and **enhance food and feed safety**.

Fig. 1: Maize infected with *A. flavus*

Project

The project funded by the German Ministry of Food and Agriculture in 2016 is designed as an initial study that is planned to be followed by a more intensive, overall collaborative project with African partners. The goal of the AflaNet project is to **establish a long-term network** between research and development partners in Kenya/East Africa and Germany to address the **reduction of aflatoxins in the food value chain**. Scientific results have been gathered by conducting a carry-over study of aflatoxin into milk, about verifying aflatoxin rapid tests and molecular methods to minimise contamination.

Rapid tests

It is desirable that less trained persons (such as farmers) are able to **detect aflatoxins simply, quickly and safely** in order to ensure the harvested maize is of no health concern. The values determined by means of rapid tests fluctuate and may lead to incorrect conclusions if the measurement is only carried out once. Further efforts are necessary to achieve reliable values.

Carry-over of aflatoxin into milk and cheese

The **carry-over rate** determined by a carry-over test was about 2%, and thus **within the range of 1-3%,** which is usually given in the literature (range 1 to 6%). The use of an aflatoxin binder reduced the aflatoxin M_1 content in the milk at about 25%.

The distribution of aflatoxin M_1 in whey and curd during cheese processing in our own plant showed that the main amount with approx. 75% was found in the whey and the remaining 25% in the curd.

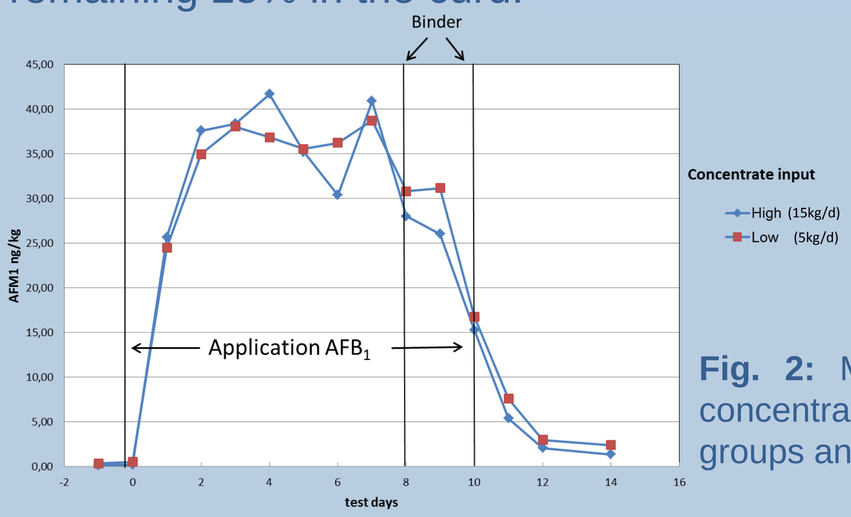

Fig. 2: Mean values of AFM_1 concentration in milk weighted by groups and daily milk amount

Molecular methods

Improved methods are reported to determine the conditions which lead to aflatoxin formation, to monitor the growth of *Aspergillus flavus* and to obtain knowledge about the physiology and the behaviour of the fungus directly in the maize environment.

Experimental Approach

The primer aflR_for (5‘ - GCC GCC GTT GAG GTA CAC TG - 3’) and aflR_rev (5‘ – CGA ACG TGG TCT TGC CTG TC – 3‘) were developed by using the sequence of the *afl*R gene (GeneBank accession number AY650938.1). According to the current knowledge they give a positive PCR signal with DNA from species like *A. flavus* and *A. parasiticus*.

In order to show that the primers developed can be used in a ddPCR to monitor the growth of *A. flavus* in maize, the cereal was infected with a spore solution (10^4 spores/ml) of a consistently aflatoxin producing *A. flavus* strain.

The results are shown in Fig. 3. There is **a clear correlation between** the increase of DNA, which means the increase of **fungal biomass**, **and** the increase of **aflatoxin B_1** produced. This correlation is of course not absolute, but shows that **increased amounts of aflatoxin are** only **produced after** a certain growth of the fungus

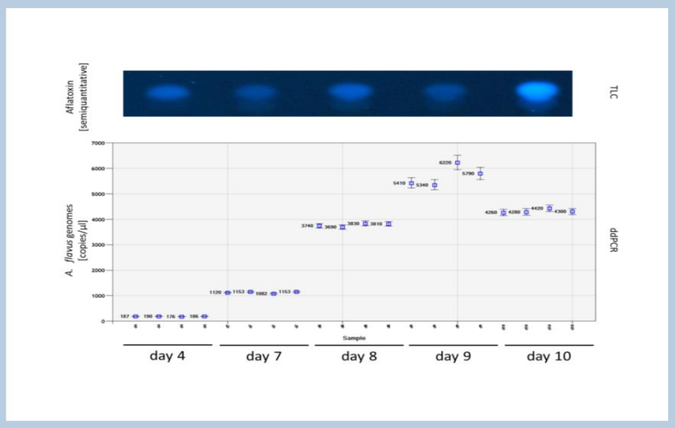

Fig. 3: Aflatoxin production and gene expression as a function of time with the developed ddPCR method

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