Federal Ministry
of Food
and Agriculture

PROCESSING

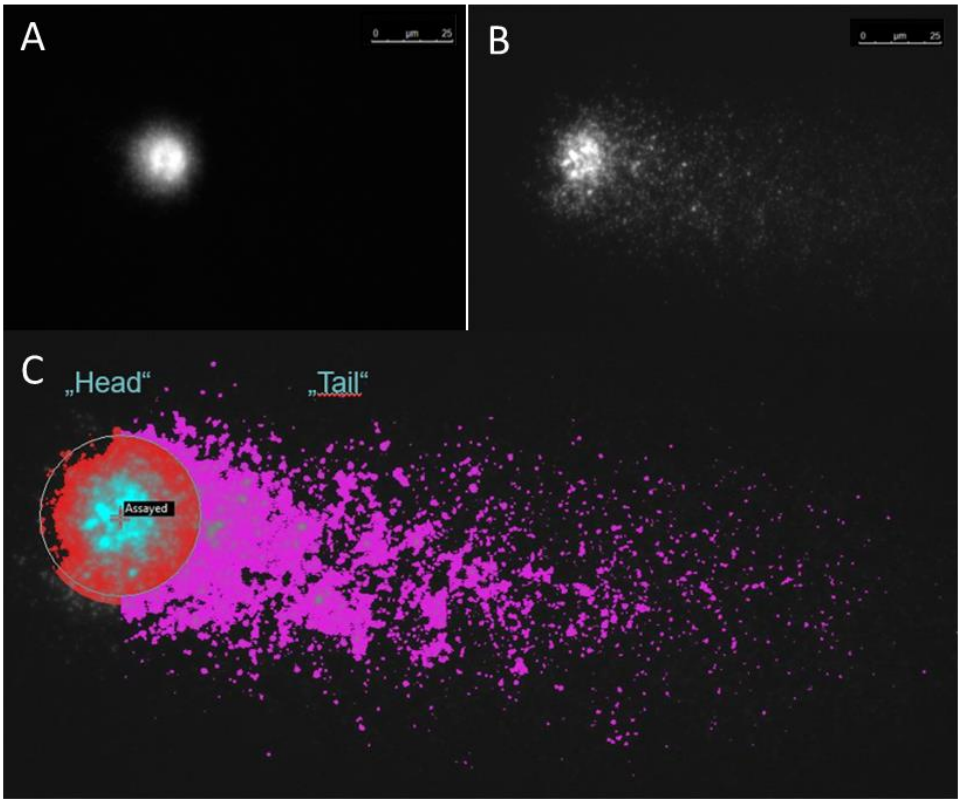
Innovative approaches to process local food in Sub-Saharan Africa and Southeast Asia, which contribute to improved nutrition, as well as qualitative and quantitative reduction of losses

AflaZ: Analysis of aflatoxin biomarker and characterization of health status of dairy cows

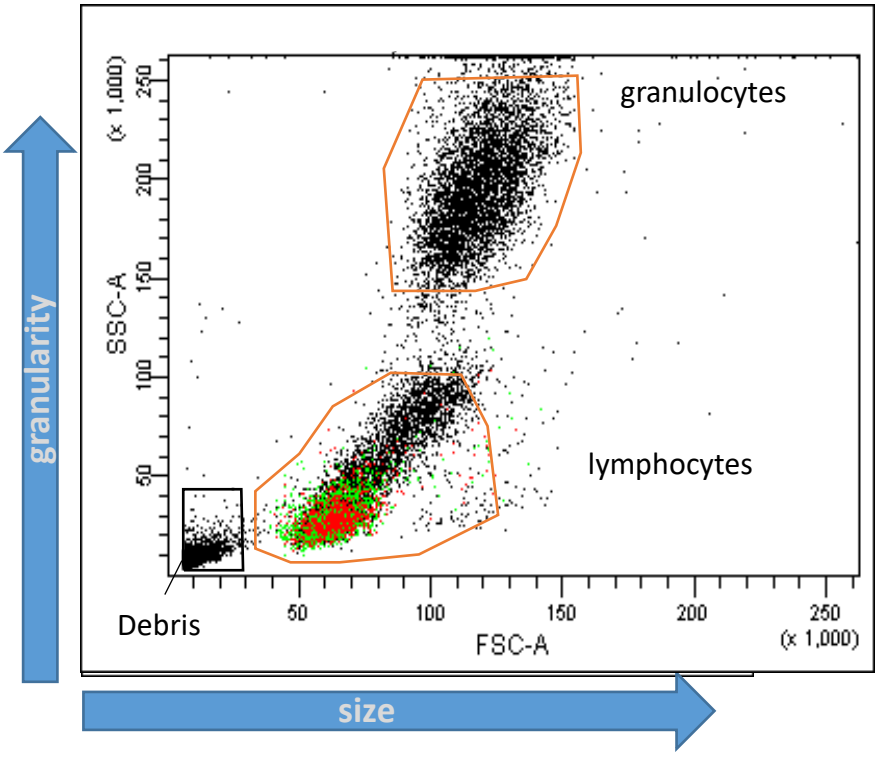
country/countries	Germany, Kenya
funding agency	Federal Ministry of Food and Agriculture - BMEL
project management	Federal Office for Agriculture and Food – BLE
project coordinator	PD Dr. habil. Markus Schmidt-Heydt
project partner(s)	Max Rubner-Institute, Julius Kühn-Instituet; University Koblenz-Landau, KALRO (Kenya Agriculture and Livestock Research Organization), EAFF (East African Farmers Federation)
project budget	**53.693,64 €**
project duration	3 years 2 months

key words	Aflatoxin biomarker, aflatoxin M1, biocontrol strains, animal health
background	In African society, maize is used both as basic foodstuff and for animal feed. Due to the climatic conditions, maize is frequently and heavily contaminated with aflatoxins, so that both humans and livestock are often exposed to aflatoxins. So-called biomarkers, which can be used for risk assessment, play an important role in evaluating the exposure of humans and animals. To minimize aflatoxin exposure, biocontrol strains, which suppress the toxin-producing *Aspergillus flavus* directly on the field, are used for example in Kenya and other typical maize export regions such as the USA. For these strains, it has not yet been clarified to what extent the implementation of this minimization strategy has negative effects on animal health, e.g. by previously unknown metabolites or toxins.
objective	While AFM1 in milk is already established as a biomarker in dairy cows, other aflatoxin biomarkers (AFM1 in urine, Aflatoxin-Lysin in blood) were to be investigated within the project. For this purpose, suitable chromatographic or immunological methods were to be developed and their applicability was tested with samples from the project's internal animal experiment (MRI Kiel). Furthermore, the health status of dairy cows was extensively analysed during the trial to check the effects of biocontrol strains compared to toxigenic *A. flavus* strains.
results	In the present feeding trial, in which dairy cows were supplemented with maize treated with various biocontrol and *A. flavus* strains or control maize for 14 days, no effects on the health status could be determined. For this, various parameters in the blood and in the liver were evaluated. A further flow cytometric analysis of the blood cell population showed that during the first three weeks of the experiment the proportion of B-cells in the groups supplemented with *A. flavus* or biocontrol strains was lower than in the control group. It remains unclear if this change has any health significance. Within the project, an immunological (ELISA) and a chromatographic method for the determination of AFM1 in bovine urine were developed. Both methods were applied to the samples taken in the experiment and can be used as a veterinary diagnostic tool to assess aflatoxin exposure. AFM1 could only be detected in test samples from the *A. flavus* group on day 14, with the concentration depending on the method being between 0.33 and 1.79 ng AFM1/mL urine.
recommendations	The present feeding trial can only serve as a first indication for assessing the risk of biocontrol strains on animal health. It could be shown that dairy cows that received inoculated maize with one biocontrol strain (here: atoxigenic *A. flavus* and *T. afroharzianum*) showed no effect on their health status. Furthermore, AFM1 in bovine urine could be identified as a potential biomarker of AFB1. The present project should be understood as an initial impulse to further expand this biomarker, especially in the veterinary diagnostic field for dairy cows and other livestock.

photos



Representative depiction of a cell nucleus without (A) and with a tail (B), as well as the stained DNA of a leukocyte nucleus (C) for the determination of the quantity of DNA damages in blood leukocytes using the Comet-assay



Flow cytometric determination of T-cell populations in whole blood samples of dairy