PAEPARD

DEALING WITH A HIDDEN MENACE: REDUCING AFLATOXIN LEVELS IN GROUNDNUTS

Groundnuts infected with Aspergillus flavus likely to contain aflatoxins.

Unsafe food poses a direct threat to the nutrition and health of consumers. One of the major food hazards in Africa and elsewhere is a group of harmful substances called mycotoxins. Mycotoxins are produced by certain types of mould and are difficult to detect in contaminated food and animal feedstuffs. Aflatoxins are a special type of mycotoxin which can affect maize, groundnuts and certain other field crops. They may also be found in some dried fruit and nut products. High levels of aflatoxin in humans can lead to potentially fatal poisoning (aflatoxicosis) and liver cancer.

Worse still, there is substantial evidence that aflatoxins increase the rate of progression from HIV infection to AIDS. This is particularly important in considering high prevalence of HIV in sub-Saharan Africa. Aflatoxin in the diet also has significant impacts on the nutrition of pregnant women and young children and is associated with low birth rate babies and child stunting. Infants and young children in Africa are especially vulnerable to aflatoxin exposure when they are given complementary foods from the age of six months. Complementary foods are often based on maize porridge with a recommendation to add groundnut flour to increase protein levels.

So it is vital that the ingredients are free of aflatoxin. Unfortunately, maize, groundnuts and some other produce frequently are contaminated with high aflatoxin levels. For example, when groundnut samples from local markets in Malawi were analysed it was found that almost half of them had higher aflatoxin levels than those considered to be safe by the European Union. There is a particular problem with peanut butter as it is not generally possible to see evidence of contamination in the product. Although there are regulations about permissible levels of aflatoxin, most African governments lack the resources to ensure that they are followed.

Recent surveys of groundnuts stored in rural households in several countries in southern Africa also revealed high levels of aflatoxin. This is a particular concern in years when there is a poor harvest as, even if people are aware of the risks, they may decide to consume aflatoxin-infected food if there is little else available.

Whole value chain approach

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Beatrice Makwenda
NASFAM Policy and Programmes coordinator

The National Association of Smallholder Farmers (NASFAM) in Malawi is collaborating with partner organizations in Zambia, South Africa and the United Kingdom to identify ways to minimize the risk of aflatoxin occurrence in groundnuts. With support from the European Union-funded **PAEPARD** project these organizations are working closely together to develop and test practices that have the potential to reduce aflatoxin contamination. This is being done with farmers and agricultural advisory services to enhance the exchange of ideas and support the sharing of knowledge. The partners are also engaging in awareness raising activities with policy makers in order to help strengthen the enabling environment for improved aflatoxin management.

One of the challenges in managing aflatoxin in groundnuts is that the problem can arise both while the crop is still in the ground and after it has been harvested. The mould that produces aflatoxin occurs naturally in the soil and it is most likely to infect the crop when plants are stressed; for example, in infertile soils or under drought conditions. When crops are stored in a damp environment this also favours the development of the mould. Since groundnuts may be infected with aflatoxin both before and after harvest it is necessary to take into account the risks from 'farm to fork'. **Beatrice Makwenda,** NASFAM Policy and Programmes coordinator and leader of the aflatoxin research initiative, explains how this is reflected in the design of the project. "As aflatoxin infection in groundnut may occur at different stages from production to consumption the project is taking a whole value chain approach. We have identified certain critical periods when the risk of infection is high and, working with farmers and other stakeholders, we are evaluating some potential control measures which we believe have the potential to make a substantial contribution to reducing aflatoxin contamination. Based on our initial assessment we know that research is also being done elsewhere to address the problem. For example, researchers in Malawi are attempting to breed varieties of groundnut that are less susceptible to infection with aflatoxin. Other research is investigating the effect of tied ridges in conserving moisture and so reducing the aflatoxin risk. We are exploring additional crop management options which will complement and add value to these interventions. We are also looking at post-harvest practices which are likely to have a major impact in preventing mould from developing on groundnut kernels".

Figure 1 – Dr Limbikani Matumba Researcher, LUANAR-NRC campus and Memory Makiyoni, Association Field Officer (AFO), Mikundi, Mchinji.

Before starting any research with farmers it was necessary to find out how they viewed the aflatoxin problem. Beatrice Makwenda reveals that although some farmers have heard about aflatoxin and its health hazards, the level of awareness among a lot of farmers is still low.

"As a result", she says "farmers continue to produce groundnuts which are heavily contaminated. Worse still, they continue to consume the heavily contaminated groundnuts and so put themselves at risk of such effects as cancer and immune-suppression. Therefore, there was a need to conduct sensitization meetings with all stakeholders starting with farmers who are the producers."

The next step was to decide which interventions to test and this was done with input from the farmers. Based on the principle that **'Seeing is believing'** a series of farmer-managed demonstrations were mounted to showcase several good practices. The demonstrations showcased different methods of constructing ridges as well as single row and double row planting. Later in the season technologies for drying groundnuts in the field after harvest were shown during field days in which 100 farmers attended each demonstration across four districts in Malawi namely Lilongwe, Dowa, Mchinji and Ntchisi. In preparation for the subsequent field trials, farmers and frontline extension staff were trained in the implementation of practices and the collection of data.

When crops are stored in a damp environment this also favours the development of the mould.

Figure 2 – Prisca Jonas, a farmer, Mikundi Association, Mchinji.

Research has demonstrated that plant density has an important influence on the growth and yield of groundnuts and the recommended plant density depends on the type and variety of groundnut cultivated. However, in broad terms, the aim is to rapidly achieve a closed canopy without using too high a plant population as this will increase the competition between plants and may favour the development of certain fungal diseases. According to **Dr Limbikani Matumba**, aflatoxin specialist at the Lilongwe University of Agriculture and Natural Resources (LUANAR-NRC campus), spacing of plants within and between the rows affects canopy closure and water use by groundnut plants and influences the quality and yield of the kernels produced. "We designed a trial to research optimal plant density for yield and low aflatoxin contamination", says Dr Matumba. "We are interested to learn whether planting a double row of groundnuts on a ridge would produce better results than a single row .

Farmers were also interested in investigating whether incorporating residues of the previous crop before planting groundnut would increase or reduce the risk of mould developing on the kernels. Farmers report that they remove crop residues in a groundnut field to reduce mould infestation as they may act as a source of inoculum and increase the risk of insect damage especially termites. However, incorporating residues may be beneficial if this helps to conserve moisture and supports the growth of Trichoderma, a type of fungus which inhibits the development of the mould producing aflatoxin. So the trial compared mould proliferation and aflatoxins levels in plots with maize residues incorporated in the soil with plots from which residues were removed.

Prisca Jonas is a farmer in Mchinji in Malawi who grows soya bean and maize. This year she has also planted groundnuts for the first time in a small area of her farm. Prisca has a young family and she is interested in the crop for its nutritional qualities. She plans to sell any surplus groundnuts to local traders to generate extra income. She heard about aflatoxin through listening to the radio and she is keen to learn more about how to produce a healthy crop and obtain a good yield. For this reason she decided to take part in the trial that Dr Matumba is leading. She says that she has learned a lot from the trial and her initial assessment is that the single row planting technique is more suitable than the double row method for her system. She also noticed high levels of mould in the plot where residues were incorporated and says that she will avoid this practice when she plants a larger area of groundnut next year.

A critical time for protecting groundnuts from the risk of aflatoxin is just after plants have been harvested. It is important to reduce moisture levels in the kernels to around eight percent to prevent mould from developing when they are stored. Traditionally, plants which have been removed from the soil are laid in windrows to dry in the field.

An alternative practice which is promoted by some non-government organizations is to place groundnut plants in a stack called a Mandela cock. The idea behind this method is that groundnut pods in windrows are exposed directly to sunlight and this can affect the viability of the kernels when they are planted in the following season. In the Mandela cock the plants are laid with the pods on the inside of the stack and the free flow of air through the structure gradually removes moisture from the pods. It is worth mentioning however, that farmers in Malawi are reluctant to adopt the Mandela technology due to its high susceptibility to theft, arson and livestock destruction.

Dr Bruno Tran, post-harvest specialist at the Natural Resources Institute explains, there has not been a scientific evaluation of the Mandela cock method. It is possible that hot and humid conditions in the slow-drying structure may create a favourable environment for mould development. "Depending on how the stack is constructed,

the ventilation may not be adequate to allow heat to escape efficiently" says Dr Tran. "Also, when there is persistent heavy rain after harvest, as has happened in some districts in Malawi this year, it may be necessary to place a protective cover on the stack to prevent the plant material from becoming saturated". Mandela cocks were constructed at each of the 50 demonstration sites across the four districts in Malawi, which provided representative samples for validating the technology and drawing recommendations for smallholder responsive aflatoxin advisory services and policy recommendations.

In conclusion, **aflatoxin contamination in groundnuts poses serious health and economic challenges at household,** national and international levels. However **the aflatoxin problem can greatly be reduced following good agricultural practices.** Specifically, farmers should:

- use agro-ecologically adapted varieties;
- supply adequate soil nutrients;
- use optimized plant spacing;
- follow good pest and disease management practices;
- practice crop rotation;
- harvest in a timely manner and avoid damaging the groundnut pods;
- rapidly reduce moisture levels after harvest to ≤8% moisture level by drying;
- sort and remove any contaminated pods;
- then store the sorted groundnut pods in clean, dry, cool conditions, preventing insect infestation;
- and when necessary shell and sort kernels removing any contaminated ones before consumption or sale.

To achieve this, there is need to enhance the awareness of smallholders and traders about these practices and more broadly about aflatoxin contamination and the associated consequences. This needs a whole value chain approach in which development-oriented research plays an important role.

"Investing in pre- and post- harvest loss research, technical advice and policy advocacy to reduce food losses could significantly increase the food and nutrition security."
Sharon Alfred, FANRPAN

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