

integrated approach. Implementing good grain and system hygiene ensures insect numbers are limited, understanding insect species and their ecology assists in managing pests, and using chemical treatments and fumigants correctly ensures insects can be controlled when needed. Cooling grain using ambient aeration systems has increased in the past 10 years and is gaining widespread acceptance as a way of managing insects and quality by reducing grain storage temperatures.

Growers are increasingly becoming aware of the need to understand the quality of their grain, particularly to ensure grain out turned from their system meets market specifications. One of the advantages of on-farm storage is the ability to segregate grain more readily by using a combination of small, medium and larger storages.

Provided growers are willing to invest in a system which meets market requirements, they are in a unique position to provide a package which delivers product identity, traceability, can meet the needs of food safety requirements and best practise. There is no question that the on-farm storage system can build on and become a larger component of the supply chain, providing confidence and integrity to the market

Food Safety – Can on-farm storage meet this requirement?

The on-farm storage system is well placed to demonstrate that the product stored is safe for consumption. The grains industry has produced a number of codes and guidelines for growers and industry to enable this. "Growing Australian Grain – Safely Managing Risks with Crop Inputs and Grain On-farm" is a guide for growers and advisors to help manage risks with inputs, grain handling and safety on farm.

Grain Trade Australia has produced in collaboration with industry the Australian Grain Industry Code of Practice for the post harvest/post farm sector. Both of these documents enable growers to begin the journey to manage the risks associated with grain production and storage. The grains industry has also developed GrainCare which is a HACCP based quality assurance system which directly enables the grower to demonstrate they meet food safety requirements and are independently audited and assessed.

With the development of a modern, fit for purpose on-farm storage system, which can manage quality, identity preservation, outturn and food safety risks, there is a growing opportunity for the supply chain and market to access grain post farm gate with the confidence that supply chain integrity is maintained.

Conclusion

There is no doubt that the on-farm grain storage system is an integral and growing part of the supply chain. Growers need to ensure they understand their role in the supply chain, and invest in technologies, systems and training which enable them to implement best practise in their grain storage system.

Ensuring that the integrity of the supply chain is maintained requires all parties to do their part and give feedback to all stakeholders. Growers can and will respond to the needs of their market, providing a product which can provide traceability, product identity and assure the product meets food safety requirements. Managed correctly, the on-farm storage system can be a growing opportunity for markets to access quality products direct from the grower, minimising the risk to the end user and supply chain.

Strengthening national food safety for improved food security in Nigeria

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Abstract

A review of literature concerning the quality and safety of eight key staple products in Nigeria, West Africa, was made. These products included stored rice, maize, cashew, yam, cassava, millet, sorghum, and beans. Food safety notifications, both national and international concerning mycotoxins, pesticides, and quality in these foods are highlighted. Across these commodities, a significant number of non-conformances were found, arising from a combination of factors including lack of technical knowledge, supply chain management, and public institutional and policy challenges. The paper discusses the subsequent impact on health, well-being, and the economy. Current strategies aimed at improving food quality and safety in the country was also examined. Recommendations in addressing some significant issues are given.

Keywords: Food security, Nigeria, cowpea, safety, HACCP

The accepted definition of food security is when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life. In Nigeria, only recently, is food safety seen as an integral part of food security. According to a report by the Nigerian Federal Ministry of Agriculture and Rural Development (FMARD), the country is beset with an inability to either meet domestic food requirements or export agricultural products of the desired quality or safety standards. The agricultural sector in Nigeria suffers from inadequate infrastructure and resources, inadequate financial investments, weak food control systems, obsolete food regulation systems as well as inability to enforce compliance to international standards. The country lacks effective functioning, comprehensive food inspection mechanisms. Laboratory support is also woefully inadequate. Most supply chains in the country are inefficient, with poor traceability systems (The Agriculture Promotion Policy, 2016-2020), and thus national food control is weak.

Cassava, is one of a number of targeted export crops for 2016-2018 by Nigeria's Federal Ministry of Agriculture and Rural Development FMARD. In addition, rice, cowpea (beans), and maize are three of the five targeted domestic crops prioritized for 2016-2018. In terms of nutritional losses and safety, numerous studies have shown many marketed samples of rice across the Nigeria to contain harmful mould causing mycotoxins which is a public health concern (Makun et al., 2011; Egbuta et al., 2015). Maize samples across the country have been found to contain harmful levels of mycotoxins, particularly aflatoxins (Egbuta et al., 2015). The extent to which cashew nuts pose a real food safety risk owing to contamination during storage and marketing is not clear as there are few reported studies. Yam and cassava, however, are commonly processed into dried products using traditional methods. Dried yam derivatives such a 'Elubo' is common amongst the Yoruba tribe as a weaning food for babies. There have been many instances where Elubo has been found to contain elevated levels of mycotoxins, lead, and iron. Gari, a popular cassava derivative has again been found to contain aflatoxins in particular. Millet and sorghum samples across the country have also been shown to contain harmful mycotoxins in a number of studies. The Standards Organisation of Nigeria (SON) has drafted Codes of Practice for cowpea. However, maintaining cowpea quality is posing a significant challenge for farmers and traders, who may store for up to a year. Cowpeas vary according to the size of the grain, color of the skin, texture of the skin, and amount of damage resulting from insects. Consumers prefer beans with few insects present. This has led to the use of unauthorised pesticides in some cases. Due to the detection of high quantities of the unauthorised pesticide dichlorvos, the European Commission Implementing Regulation (EU) 2015/943 temporarily suspended the import of dried beans from Nigeria to the EU in 2015. The ban is still in place.

The Rapid Alert System for Food and Feed (RASFF) of the European Union which highlighted the safety concerns of Nigerian cowpeas was put in place to provide food and feed control authorities with an effective tool to exchange information about measures taken responding to serious risks detected in relation to food or feed. The legal basis of the RASFF is Regulation EC/178/2002 which highlights the principles and requirements of food law, and procedures relating to food safety. Concerning agricultural exports, processed or unprocessed, Nigeria does not export many products in significant volumes, with the exception of raw cocoa. Nevertheless, there were around 200

(RASFF) food-related notifications between the period January 2013 and March 2018 originating from Nigeria, over 50% of which were classified as 'serious', ~40% 'not serious' and around ~10% 'undecided'. Cowpea (or beans) were responsible for over 40% of the serious notifications and resulted in border rejections. The non-conformances mainly concerned the presence and levels of unauthorised chemicals such as dichlorvos, cyhalothrin, chlorpyrifos, dimethate, proferiofos, and trichlorphos in cowpea though the National Agency for Food and Drug Administration and Control (NAFDAC) has produced guidelines and regulations for the import, manufacturing and distribution of pesticides and other chemicals, food additives and fats and oils, and port inspections (<http://www.nafdac.gov.ng/>). Certification and inspection of food and produce is carried out by the Standards Organisation of Nigeria (SON), Agricultural Quarantine Service (NAQS), NAFDAC, the Federal Produce Inspection Service (FPIS), or a combination of agencies. In addition, the Nigerian Food Safety and Applied Nutrition (FSAN) Directorate's mandate is to ensure that food manufactured, imported, exported, distributed, sold, and marketed in Nigeria meets the highest standard of Food Safety reasonably available and protect public health and consumer interests. It is evident that the environments in most rural areas which is where significant production, postharvest handling, and processing takes place, the monitoring and enforcement of safety standards, and marketing and storage conditions are not conducive to protecting the highlighted products from contamination.

A group of international food safety experts and regional representatives met in 2012 to determine the requirements for an African food safety authority, similar to the EU's European Food Standards Agency (EFSA), along with a communication system such as the RASFF. The effectiveness of RASFF is achieved by having a simple structure: it consists of clearly identified contact points in the Commission, EFSA, EFTA surveillance authority and at national level in member countries. One of the issues highlighted for the failure of the Nigerian government to address over fifty warnings on exported cowpeas before the ban was imposed, was the uncoordinated reporting structure to the various responsible agencies responsible for food safety (TAIEX Report, 2016). A representation of structure of the RASFF is depicted below (Figure 1).

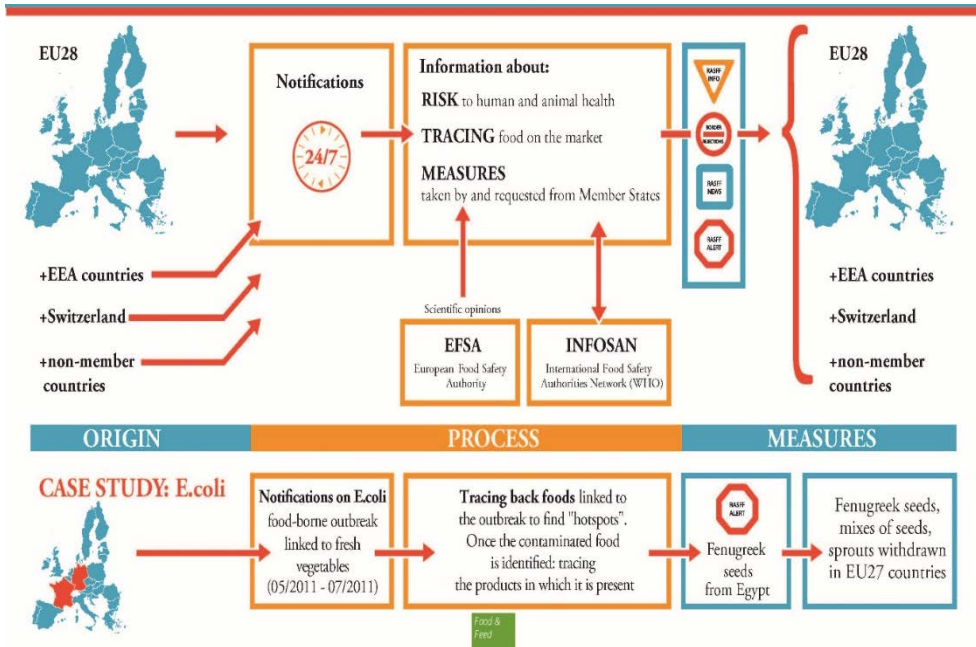


Figure 1: Workings of the European Rapid Alert System for Food and Feed

Source:https://ec.europa.eu/food/sites/food/files/safety/rasff/images/030614_how_does_it_work.jpg

Other serious RASFF alerts originating from Nigeria came in form of notifications relating to aflatoxin B1 (in nutmeg, groundnut, dried ugu leaves, dried bitter leaf, dried ginger, suya pepper, and sesame seeds in particular), various strains of Salmonella (in raw ginger, melon seeds, and sesame seeds in particular), *E. coli* (in ogbono, *Irvinia gabonensis*), and colouring Sudan Red in palm oil.

Unsafe food poses major economic risks. For example, the *E. coli* outbreak in Germany in 2011 was estimated to cost US\$ 1.3 billion in losses for farmers. Food-borne disease outbreaks, such as cholera, typhoid, lassa fever, chemical contamination like lead and mercury as well as mycotoxin poisoning, is thought to be responsible for thousands of deaths in Nigeria. However, the exact numbers will not be known owing to poor surveillance and reporting mechanisms. However, Odeyemi (2016) estimated that well over 35 million people (~20%) in Nigeria are affected by foodborne illnesses annually. The true economic and health impact of these illnesses is yet to be properly quantified.

Many African countries including Nigeria are becoming increasingly interested in regional and international trade, with demands to strengthen their Sanitary and Phytosanitary (SPS) capacity, and are consequently trying to address their national food safety issues. As a result, a common framework for the countries is being developed. International cooperation and technical support for African countries in areas of agriculture, food security and food safety is centred around the Comprehensive Africa Agriculture Development Programme (CAADP). In spite of such efforts, it is unlikely significant changes in Nigeria will be made over the next 5 years. This is reflected in the absence of a realistic budget set aside by successive governments to transform the food security situation in the country, including a detailed timebound, auditable, and accountable implementation strategy.

Over 70% of the food in Nigeria is produced in rural areas where farmers and traders often have not gone beyond secondary school education. The Nigerian government must therefore develop a practical and workable strategy to sensitize and educate such stakeholders on good hygiene practices. Achieving food safety begins with ensuring good agricultural practices in production at the farm level. Further, open markets and vendors with basic facilities should be in place. Many foodborne illnesses are well known to be preventable when adopting proper handling, processing, and storage methods for foods guided by HACCP principles. Therefore, the provision or accessibility of appropriate infrastructure to facilitate this such as clean water, power supply, good processing facilities, and physical market design, alongside regular basic HACCP and food handling training of food handlers and vendors should be made in order to significantly reduce the number of incidents of foodborne illnesses and deaths and support the national economy.

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