



Aflasafe[®] technology transfer and commercialisation in Africa

Country status: Senegal

September 2020

Senegal's aflatoxin challenge

Aflatoxin causes liver cancer. A 1962, a study revealed that when wet harvested groundnuts are left on the ground for several days, they get highly contaminated with aflatoxin. Diop *et al* (2008) reported heavy contamination of aflatoxin B1 (the most toxic type) in Senegal's artisanal oils and peanut butter.

Aflatoxin

is a natural **cancer-causing poison** from toxin-producing types of the *Aspergillus* fungus. Because aflatoxin **contaminates food**, the effects of aflatoxin build up in our bodies and damage our health. As well as **causing liver cancer**, aflatoxin makes us weaker against other diseases and stunts children's growth. In some cases, aflatoxin in food can be fatal.

In large amounts, aflatoxin can make us ill or kill straight away (acute aflatoxicosis). But most of the time, we eat it without noticing. It can therefore gradually **infiltrate our bodies**, with its effects building up within us (chronic aflatoxicosis). For this reason, aflatoxin can be present undercover for many years doing us long-term harm, **yet very difficult to detect**. As with all ills, the best cure is prevention.



All the groundnut-oil samples were contaminated, having 6–109 parts per billion (ppb) of aflatoxin. Groundnut cake samples had 18.97–389 ppb. Safety levels for aflatoxin worldwide generally range between 4 and 15 parts per billion (ppb), with aflatoxin at 2 ppb in Nigeria and the European Union (EU) for example.

A 2012 joint study by the International Institute of Tropical Agriculture (IITA) and *l'Université de Thiès* revealed high aflatoxin in groundnuts and related products in markets across Senegal (above 20 ppb in some cases). In the Sudano-Sahelian zone, more than a quarter of the production was contaminated: 90% of the samples had more than 20 ppb. There are no contamination data to date for imported maize, whose quantities surpass domestic production, nor for rice which is Senegal's most consumed cereal. Recent studies show high levels of mycotoxin contamination in rice.

Despite compelling scientific evidence, Senegal still lacks an aflatoxin safety standard. In the groundnut basin – a vast swathe straddling at least six regions – two out of three meals are groundnut-based and maize consumption is equally high. Blood tests in the basin reflected a commensurately high level of aflatoxin. Simulation modelling based on liver-cancer cases in the different regions predicted between 1,057 and 1,477 cases per year in Senegal.

The aflatoxin problem transcends health. In 2013, the cost of aflatoxin was USD 128 million (CFA 64 billion) in lost opportunities. Senegal's groundnut exports have long been unable to meet the EU standard of 4 ppb.

Evidence-based health and economic impacts of aflatoxin in Senegal were highlighted in the 2015 study by the African Union's Partnership for Aflatoxin Control in Africa (PACA). The cost of inaction is estimated at a minimum of CFA 46 billion (USD 86,792,452) and a maximum of CFA 81 billion (USD 152,830,188), equivalent to 0.6 to 1.1% of GDP. The cost of action by establishing and applying an aflatoxin standard is CFA 21 billion (USD 39,622,641).

Geography	Area: 197,161 km ² Agroecology: Sahelian, Sudanian, Sudano-Sahelian Neighbours: Mauritania, Mali, Guinea and Guinea Bissau. The Gambia constitutes an enclave of 10,300 km ² inside the Senegalese territory		
Population	16 million, with 12.3 million in farming; rural – 53%, urban – 47%		
Agriculture and Economy			
GDP	USD \$25.32 billion, with agriculture accounting for 17%		
Main crops	Groundnuts, millet, maize, sorghum, rice		
Food consumption	Kilos per capita per year, and rural/urban household percentage consumption		
	National	Rural	Urban (%)
Rice	78.1	80.9 (59%)	76.6 (77%)
Groundnuts	35.4*	25 (57%)	15 (23.5%)
Millet	30.2	53.3 (28%)	23.1 (19%)
Maize	9.2	19.5 (11)	6.0 (5%)
Sorghum	0.7	2.8 (2%)	0.05 (0.03%)
	*Groundnuts are eaten on a daily basis in many processed products such as oil, groundnut cake, peanut butter and also eaten raw or cooked.		
Crop production	Agriculture is mainly rainfed, with only 1.5% under irrigation. Arable land, 3.8 million hectares (19%), of which, on average, 2.5 million hectares (65%) is exploited per year.		
	Main industrial crops		
	Crop	Percentage acreage of industrial crops	
	Groundnuts	90%	
	Cotton	7%	
	Sugarcane and sesame	3%	
	Production forecasts for 2018/2019 season (metric tonnes)		
	Cereals.....2,732,109 (millet, sorghum, maize and rice combined)		
	Groundnuts.....1,432,086		
Sources(s): African Union's Partnership for Aflatoxin Control in Africa (2015); Ministry of Agriculture Annual Report (2018)			

Solutions from IITA and partners

IITA worked with Senegal's *Direction de la Protection des Végétaux, l'Université de Thiès* and the United States Department of Agriculture – Agricultural Research Service (USDA–ARS) to develop Aflasafe SN01 for Senegal and The Gambia to protect maize and groundnuts from aflatoxin. It was tested in 2010–2014 in Diourbel and Kaolack, and reduced aflatoxin contamination by more than 80%, with even greater reduction during storage.

Aflasafe



Aflasafe SN01 was approved for registration in 2016 by the intergovernmental *Comité permanent inter-États de lutte contre la sécheresse au Sahel* (CILSS), to counter aflatoxin in maize and groundnuts in Senegal and The Gambia. Aflasafe is a **safe natural solution** to the problem of aflatoxin, **homegrown in Africa** through national and international collaboration. It works from the plot to your plate to **stop contamination from reaching dangerous levels** and keep foods like maize, groundnuts and sorghum **safe to eat**.

Aflasafe tackles toxic tragedy using harmless types of *Aspergillus flavus*. Surprisingly, this is the same kind of fungus that produces aflatoxin, but in this case they are kinder cousins that **do not and cannot ever produce the toxin**.

Each country has its own version of Aflasafe using a mixture of four fungal strains, all found growing naturally in local soils. The friendly fungi are coated onto ordinary sorghum grain, which acts as a vehicle to help them get established, and can easily be broadcast onto fields.

Aflasafe is dyed blue using food colour, to distinguish Aflasafe from sorghum to eat. Aflasafe has the highest World Health Organisation standard for safety.



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PACA's work highlighted Senegal's aflatoxin problem and its impact on trade, health, agriculture and livestock. The PACA study was adopted by Senegal, forming the base for the National Plan for Aflatoxin Control drawn up in mid-2015. The plan recommended Aflasafe SN01 to combat aflatoxin.

Aflasafe SN01 was registered in 2016. Following the registration, IITA's Aflasafe Technology Transfer and Commercialisation (ATTC) facilitated the dissemination of the technology. The starting point was a commercialisation strategy to guide our intervention in the country, based on the potential market, the feasibility of local manufacturing and distribution, the policy environment and the investor landscape. The strategy defined the key partners and interventions necessary. ATTC then vigorously engaged with private-sector actors, leading to the selection of BAMTAARE Services (*Base d'Appui aux Méthodes et Techniques pour l'Agriculture, les autres Activités Rurales et l'Environnement*), a subsidiary of Sodefitec, as the licensed partner to undertake Aflasafe production, marketing and distribution on a commercial basis across the country. In 2017, IITA granted BAMTAARE a five-year exclusive licence for the manufacturing and distribution of Aflasafe SN01 in both Senegal and The Gambia.

The company's entry strategy for Aflasafe focused on the pre-existing and well-structured farmer cooperatives, processors and exporters in the groundnut value chain in both Senegal and The Gambia. ATTC supported BAMTAARE in convening these early business-to-business fora in 2018, and in structuring the business case for Aflasafe and formulating market strategies in 2019.


Prior to local production, facilitated by ATTC, BAMTAARE imported Aflasafe SN01 from IITA headquarters in Nigeria. BAMTAARE has since constructed its own AflasafeSN01 factory. The factory has a daily capacity of 10 tonnes: sufficient to adequately supply the requirements for Senegal and The Gambia. The modular design allows for upgrading as demand increases, simply by enhancing the limiting module.

Production began in mid-2019. ATTC provided, and continues to provide, technical and advisory support for factory construction, equipment and running; staff training for production and quality control; market development; training of trainers on how to use Aflasafe and training technicians on aflatoxin sampling and testing. BAMTAARE was the pioneer beneficiary of IITA's dry-inoculum innovation, which will significantly reduce production costs. ATTC facilitated multimedia Aflasafe marketing communication products and tools produced by BAMTAARE. BAMTAARE used these marketing tools on national and community radio, and on television.

BAMTAARE targeted key potential buyers including large-scale processors and exporters, and key farmer organisations. The 2019 testing results from these large corporate clients showed aflatoxin below 2ppb, thus opening the doors for export to lucrative markets.



Aflasafe contributes to two of the United Nations Sustainable Development Goals.

BAMTAARE Service (*Base d'Appui aux Méthodes et Techniques pour l'Agriculture, les autres Activités Rurales et l'Environnement*), is a full-service agribusiness firm involved in the aggregation and export of various agricultural commodities.

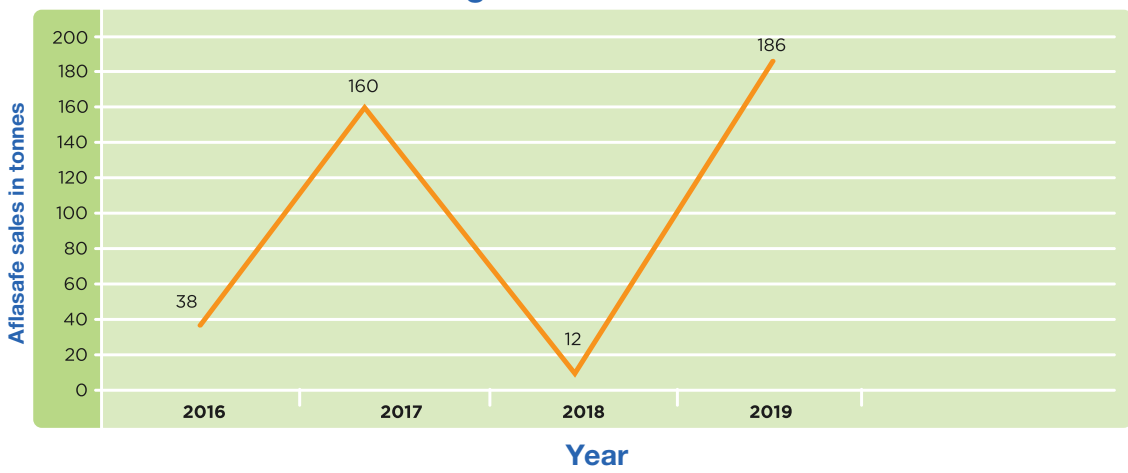
A 100% subsidiary of SODEFITEX as its special purpose vehicle for rural development, BAMTAARE Services is a public limited company with a Board of Directors.

Established on 15th March 1974 as a mixed public-private ownership company with a public ownership majority, besides cotton agri-business, SODEFITEX also supports rural development.

Main partners in Aflasafe commercialisation

- Aflatoxin Technical Working Group (ATWG)
- Ministries of Agriculture, Health, Trade and Industry
- The African Union's Partnership for Aflatoxin Control in Africa (PACA)
- *Compagnie d'Exploitation des Oléagineux* (COPEOL)
- *Association Sénégalaise pour la Promotion du Développement par la Base* (ASPRODEB)
- West and Central African Council for Agricultural Research and Development (CORAF/WECARD)

Aflasafe sales in Senegal









Locations where Aflasafe has been applied: 2017–2019



The Gambia

Well-situated: BAMTAARE's Aflasafe factory in Kaolack, Senegal, is strategically located within the transboundary Senegambia groundnut basin to serve both 'halves' of Senegal and The Gambia too in between. The Kaolack Region alone accounts for a quarter of Senegal's total crop production.

-  BAMTAARE Headquarters
-  Aflasafe Factory
-  Aflasafe distribution point
-  Areas where Aflasafe has been used

ATTC has been deeply involved in – and supported – the inter-ministerial national Aflatoxin Technical Working Group (ATWG) to engage policymakers on effective strategies and actions to tackle aflatoxin.

This included supporting the ATWG in drafting a technical brief to the Ministry of Agriculture on the policies required to control aflatoxin contamination in Senegal. The government set aside CFA 2 billion (USD 3.4 million) to fight aflatoxin.





What remains to be done?

Effective aflatoxin control is a 'shared responsibility', calling for concerted collective action by all. The government is indispensable.

Food safety is not as rigorously regulated as it should be. Therefore, the private sector should send a strong signal to farmers and intermediaries by rewarding quality. The government should not only formulate but also enforce appropriate food-safety policies and regulations. Effective collaborative action by the public and private sector to sensitise value-chain actors and consumers would increase the demand for safe food, and thus, for Aflasafe.

Priority actions include the following:

- **Fact-driven, sustained public awareness and sensitisation on aflatoxin**, based on documented evidence of aflatoxin contamination, and its disastrous health and economic impacts, which include rising liver-cancer cases and continued loss of income. The Centre antipoison which leads CODEX activities in the Ministry of Public Health, relevant stakeholders and the ATWG should jointly design and run a well-structured nationwide awareness and sensitisation campaign on aflatoxin, and how to fight it.
- **Regulation and enforcement:** Senegal still lacks a national aflatoxin standard and accompanying legislative and regulatory mechanisms to control aflatoxin. Instead, the country relies on *CODEX Alimentarius* and the standards dictated by foreign target markets for export. There are no regulatory and enforceable aflatoxin-control measures for domestic consumers and markets. These local measures are a must.
- **Capacity building and delivery:** To further cement regulation and enforcement, it is crucial that aflatoxin management be mainstreamed in national policies and national agricultural investment plans and budgets. To enable this, IITA would work with the Ministries of Agriculture, Trade, Health, and other development partners to train a critical mass of trainers on aflatoxin management along the entire agricultural value chains. The resultant ever-expanding pool of awareness and expertise would greatly improve the delivery of much-needed advisory support to value-chain actors, where, when and how the actors need it. It would require refreshing the existing curricula to incorporate modules on aflatoxin management and solutions, among them Aflasafe.
- **Including Aflasafe as an essential input, and expanding its use:** With a wholly locally owned Aflasafe factory – a product that has been locally tested and proven to effectively control aflatoxin – it is no longer tenable that Senegal's groundnut exports to EU and Asia continue being rejected on account of aflatoxin, thereby needlessly giving the country's produce a bad reputation. This harms Senegal's long tradition of groundnut production, processing and trading on a world scale. But even more worrying, the latest liver-cancer cases in Senegal's groundnut basin reported by the 2019 APS (*Agence de Presse Sénégalaise*) Journal are alarming. This chronic yet solvable life-threatening situation alone provides reason enough for the government to aggressively promote, facilitate and encourage the use of Aflasafe SN01, by including it as part of the government-subsidised inputs package for farmers. The Aflasafe factory in Kaolack is strategically and conveniently located right in the heartland of the transboundary SeneGambia groundnut basin, and the Kaolack Region alone accounts for a quarter of the country's total crop production.
- **Comprehensively revamping groundnut value chain for safer food:** The continued economic loss is immense, and so too are the benefits of concrete action. According to the World Bank (2013), reducing aflatoxin contamination alone would inject an addition of nearly USD 300 million a year to Senegal's groundnut exports. Therefore, end-to-end measures are needed to support groundnut value-chain actors in the fight against aflatoxin to limit these losses – measures that will also keep the Senegalese safe from aflatoxin.
- **Increased testing, and extended technical assistance:** Testing capacity should be expanded at a reasonable cost up to farm level to facilitate end-to-end aflatoxin screening along the entire value chain. Given its international scientific expertise and local knowledge, IITA is well-placed to continue playing a role in this area through a formal agreement with the government for permanent representation in the country, as has been done elsewhere. Subject to necessary funding and infrastructure, IITA will be better able to facilitate the technical support to the appointed Aflasafe manufacturer. This would also enrich and further enhance the support IITA is already providing to the country through collaborative field research programmes with different government and non-government institutions.
- **Continuous research needs to be conducted by IITA:** Although Aflasafe SN01 has now been commercialised in Senegal, like all products, a degree of investment in product improvement will still be required. Additional research investments are also needed on food safety for other crops such as sorghum and rice. Recent rice studies have shown relatively high levels of mycotoxin, including aflatoxin contamination. However, there are no contamination data available for either domestic rice production or imports. This knowledge gap needs to be filled.

Implemented by:

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