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Senegal's Confectionery Peanut Supply Chain: The Challenge of Controlling Aflatoxin Levels

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Abstract
The European Union's new standards on aflatoxin pose considerable challenges for countries exporting confectionery peanuts, like Senegal. This article describes the main elements of a project aiming to promote this supply chain, and bringing together the authorities, research, industrialists and other actors in the chain. One of the key aims of the project is to put into place a new quality control and certification procedure for confectionery peanut products destined for export. This has led to a focus on the country's laboratory capabilities – with a reinforcement of the industry's own self-monitoring labs and the establishment of a national reference laboratory authorized to certify lots for export. The aim is to create a quality label for Senegalese peanuts, which will orient the activities of actors all along the supply chain.

Introduction

Senegal, a West African nation, has a long tradition of groundnut farming, essentially for the production of oil and oilseed cakes. These products are in heavy competition with the oilseed crops of countries in the North (soy, canola and sunflower). In an effort to diversify its market opportunities, Senegal is has now turned towards the production of confectionery peanuts, for which there is a booming export market, and whose added value is more advantageous for the rural population. Anticipating this development, the local research system has developed, over the past fifteen years, varieties suitable for both human and animal consumption that will allow Senegal to diversify its output rapidly.

The current project aims to promote the production of confectionery peanuts both for export and the national and regional market, with products that meet the strictest health safety standards in terms of aflatoxin tolerance.

What is at Stake?

As the European Union (EU) is the main export market, the project is geared towards the production of finished products that meet the new standards of the European Community, which allow a maximum of 2 ppb of aflatoxin B1 or 4 ppb for the sum of the 4 aflatoxin B1 +

B2 + G1 + G2 in peanut products intended for direct human consumption. To position itself in this highly competitive but profitable market, currently dominated by the USA, Argentina and China, Senegal must offer high-quality products that are guaranteed to be free of health risks. The fact that exporters to the EU are required to transport non-complying products back to the country of origin constitutes a risk to exporters both in financial terms and in terms of reputation.

At the local market level, further processed products (butter, paste, snack products) can only be developed if the finished products provide a guarantee of quality superior to that of traditional artisanally-produced products. Consequently, processors must be able to ensure the quality of the nuts used.

Although the measures developed by the project do not yet relate to products for home consumption on the farm, one can hope that in time, they will raise the awareness levels of the populations concerned, or at least facilitate the sensitization process.

Aflatoxin Contamination and Control Methods

Contamination by *Aspergillus flavus* and *Aspergillus niger* mainly occurs during cultivation, during the stages of development and maturation of the nuts, particularly in the case of water stress, end-of-cycle drought or attack of the nuts by soil insects. The second critical phase is during drying, when the nuts stacked in heaps are too moist, or if they are wet by rain. A particularly damaging farming practice is the incorporation in the main harvest of damaged nuts from diseased or dead individual plants. This alone accounts for over 80 % of a lot's aflatoxin content.

As the available curative measures are limited to techniques for sorting contaminated seeds, it is necessary to implement a range of preventive techniques and practices. These include the choice of varieties adapted to the soil and climate conditions, the choice of appropriate climatic zones (and where feasible, irrigation), good cultivation practices, the protection of crops against foliar diseases and soil insects, good harvest, drying and storage practices, and finally, selective purchase of harvests.

In terms of curative measures, only quality raw materials (hardly contaminated by aflatoxin) allow an effective and profitable final selection to be made. This implies the need for perfect traceability of the harvests, from the production area and buying center to the dehulling factory, in order to eliminate the poor quality lots at each stage.

After dehulling and grading by size, the nuts are sorted either entirely by hand or with the aid of electric colorimeters and an additional final manual sort. All tainted or non-complying nuts eliminated during harvesting, purchasing or processing are crushed at the oilseed-crushing plant, where they are used to produce finished products free of aflatoxins (refined oil and oilseed cakes detoxified with ammonia). The "confectionery" and "oil/oilseed cake" supply chains are thus perfectly complementary.

The Quality Control and Certification Plan

The new monitoring system for quality control and certification is centered on the following structures, each with a precise set of tasks:

- Laboratories within the industrial units: implementation of a sampling and analysis plan at each stage of production (self-monitoring to check the aflatoxin content of

sorted nuts, with a second sorting if necessary to obtain finished products that meet the market's aflatoxin standards);

- The national reference laboratory: monitoring of aflatoxin in lots for export (analysis of samples obtained from the industry labs; certification that the lots are compliant; following fumigation, the certified lots are precisely labeled and packed into containers for exportation);
- Independent bodies such as the SGS or Veritas: Product quality validation and awarding of the "Senegal Quality" label;
- Wolff Laboratories (France): scientific backstopping for the laboratories based in Senegal.

Since these nuts will be tested at the port of entry in the importing country, traceability of the lots must be possible between the factory of origin and the port of arrival.

For the implementation of the control and certification plan, legislative texts and regulations will be drawn up, and an ad-hoc committee will be founded. This committee, made up of representatives from the various departments of the central government and partners in the industry, will write up a new decree covering: the generic definition of the confectionery peanut, physical and sanitary standards, labeling for traceability, quantitative monitoring (modes, frequency, etc.), certification and labeling of products in accordance with standards

Strengthening Laboratory Capabilities for Controlling Aflatoxin

Self-Monitoring Laboratories in Industry

Each company involved in processing confectionery peanuts will set up a laboratory in order to monitor the contamination level of the product at each stage of its processing. These laboratories will use aflatoxin dosage methods based on immuno-enzymatic techniques (semi-quantitative analyses of contamination), which offer the advantage of being simple and quick (ready-to-use kits). The staff of factory laboratories will be trained in the sampling and analysis procedures to use at the various stages of peanut processing.

The National Reference Laboratory

The main task of this laboratory will be to monitor the physical and sanitary (aflatoxin) quality of all confectionery peanut lots for export, according to the specifications established by industry. In this context, it will also provide technical and scientific support to the industrial laboratories. It will define the quality plan to be implemented by the companies, and check its execution. Finally, it will provide support on request to research establishments working upstream in the supply chain.

To qualify, this laboratory must meet three conditions: total independence from the Senegalese industrial operators, international recognition (approval and accreditation) and implementation of reference methods of analysis.

Given the choice between creating a new laboratory or reinforcing an existing one, the latter option was chosen. ITA's mycotoxin laboratory, with its 25 years of experience, was thus selected. It was audited by a consultant from Wolff laboratories who set out a list of recommendations for organization, reinforcement of equipment and staff training, particularly in quality management.

The goals of the laboratory are to obtain: accreditation by COFRAC (the French Committee on Accreditation) according to the French 45001 reference in the 91-1 program on the analysis of mycotoxins; approval by FOSFA (Federation of Oils, Seeds and Fats Associations); recognition by organizations such as the AFAQ (the French Association of Quality Assurance). To this end, programs of staff training, acquisition of some new equipment and the setting up of quality management program have been launched.

Staff Training

- quality training for the laboratory's quality assurance supervisor,
- metrology training for the metrology supervisor,
- technical training for the technician to familiarize him with sampling techniques (according to the 98/53/CE directive) and HPLC (high pressure liquid chromatography) analysis techniques with post-column derivatization using an electrochemical cell,
- plan and quality training for the laboratory manager (requirements of the 1002 COFRAC document).

Reinforcement of the Laboratory's Equipment

- acquisition of sampling, grinding and homogenization equipment for large quantities in order to comply with the requirements of the 98/53/CE directive,
- acquisition of HPLC equipment with a post-column bromine derivatization system,
- acquisition of laboratory supplies.

Implementation of a Quality Management Approach

In 1997, ITA laid out a plan for a continuous quality improvement program. This plan provided for the implementation of a quality system in the laboratories in accordance with the International Standards Organization ISO 25 guide. The current project on confectionery peanut will thus be able to draw on this base for the setting up of a quality approach in the mycotoxin laboratory, the future aflatoxin dosage reference laboratory for Senegal.

Conclusion

The control and certification plan aims to make the Senegalese confectionery peanut internationally renowned. This will be achieved by raising the awareness of all the industry's actors, from the farmer to the processor, without forgetting the Senegalese consumer, on the importance of preventing contamination.

The control plan will also provide the opportunity to induce farmers to apply proven methods of effective prevention. Finally, it will encourage the synergy of all the research and technology bodies (CIRAD, ISRA – the Senegalese Institute for Agricultural Research, ITA, Wolff Laboratories) in the control of aflatoxin, and make high quality confectionery peanuts available for export and for the local market.