

Sanitary and Phytosanitary Standards and African Country Agro-Food Exports: An Assessment of the Senegalese Groundnut Subsector

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Abstract: *This paper uses a case study approach to assess Senegal's capacity to comply with standards governing world trade on groundnuts. The Senegalese groundnut sector includes three major components: oil-mill groundnut (oil and oilcake) and confectionery groundnut. Since 1999, the European Union – Senegal's major client in world market – has harmonized member countries' standards as regards acceptable level of aflatoxin contamination in groundnuts. In this document, we trace out the technical itinerary that can reduce risk of contamination to a level compatible with EU rules. Besides, costs and advantages of complying with such rules are duly identified and appraised. Our results indicate that observance of such itinerary would boost Senegal's exports of confectionery groundnut through a price effect and a volume effect.*

Normes sanitaires et phytosanitaires et exportations agroalimentaires africains : Une évaluation du sous-secteur d'arachide sénégalais

Résumé : *Ce document emploie une approche d'étude de cas pour évaluer la capacité du Sénégal de se conformer aux normes mondiales du commerce des arachides. Le secteur d'arachide sénégalais inclut trois composants importants : arachide d'huile-moulin (pétrole et tourteau) et arachide de confiserie. Depuis 1999, l'Union européenne - le client principal du Sénégal sur le marché mondial - a harmonisé les normes des pays membres dans le niveau*

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acceptable de la contamination d'aflatoxine dans les arachides. Dans ce document, nous traçons l'itinéraire technique qui peut ramener le risque de contamination à un à niveau compatible avec des règles d'UE. En outre, des coûts et les avantages du consentement à de telles règles sont dûment identifiés et évalués. Nos résultats indiquent que l'observance d'un tel itinéraire augmenterait les exportations de l'arachide de confiserie du Sénégal par un effet des prix et de volume.

Introduction

This study is aimed at assessing the capacity of Senegal's groundnut sector to meet quality standards in export markets.¹ While it is now widely accepted that those standards can act as non trade barriers (NTBs), they are supposed to play a central role for consumer protection as regards certain types of goods, mainly food. The groundnut sector consists of two subsectors: oilseed groundnuts (used to produce oil and groundnut cake) and edible groundnuts (for human consumption). While the oilseed groundnut subsector is relatively long established, production of groundnuts for food was introduced as a cash crop only in the early 1970s. Currently, there is practically no difference between the seeds used for edible groundnuts and oilseed groundnuts. The final use of the product is determined by the quality of the groundnuts, which are sorted in a multistep process that reserves the best for food and sends the rest to be crushed for oil and cake.

Brief History:

The cultivation of groundnuts in Senegal goes back to the beginning of the nineteenth century during the colonial period. At that time, the role of the colonial

¹ It was prepared in accordance with the methodological guides written by Henson and others 2002.

administration in the sector extended from distributing seeds, fertilizer, and seasonal loans to marketing the crop. Groundnut production increased from 31,000 tons in 1885–90 to 579,000 tons on the eve of independence in 1953–59 (Diop 2000). At independence, during the 1960s, groundnuts provided 80 percent of exports and the lion's share of rural incomes in Senegal. The sector employed 87 percent of the active population, covered half the arable land, and accounted for 42 percent of revenues in industry.

Although groundnuts long have been grown for oil in the country, the same is not true of groundnuts grown for human consumption. The first trials of this variety of groundnut date from 1963 in the department of Sédhiou, in the south, and were carried out by the Casamance agricultural and industrial development company (*Société de développement agricole et industriel de la Casamance*). In 1964 the Oils and Oilseeds Research Institute (IRHO) was given the task of selecting varieties that would grow well in Senegal and meet the requirements of the world market. The Virginia variety GH-119-20 was chosen. Cultivation of edible groundnuts did not actually begin until 1969. That year 20,000 ha were planted in the Kaolack region, with support from the European Development Fund. From 1969 to 1972, the dehulling (shelling) company SODEC (*Société de Décorticage*) had an exclusive arrangement to process and exports the product. SODEC, which was a private company, built a factory for this purpose with an annual capacity of 10,000 tons. The edible groundnut subsector grew quite rapidly at first but then entered a phase of marked decline in the mid-1970s. The land initially devoted to this cash crop thus decreased from 21,600 ha in 1975 to 5,963 ha in 1977, and the harvest shrank from 18,000 tons to 542 tons over the same period. The dehulling plants were no longer assured of sufficient supply (Gaye 1999). This crisis was explained by the fact that the European financing had run out, and failures had occurred in collecting the harvests and distributing the seeds.

In the early 1980s, the National Oilseed Marketing Company SONACOS (*Société Nationale de Commercialisation des Oléagineux*) was asked by the government to rescue the sector. SONACOS bought SODEC and in 1985 set up a new subsidiary, SEPFA (*Société d'Exploitation et de Promotion de la Filière Arachidière*). In 1990 the edible groundnut subsector was privatized, and a new operating company, NOVASEN (*Nouvelle Valorisation d'Arachide du Sénégal*), was created. Senegalese and French private investors held 91.7 percent of the new entity's share capital, and SONACOS held the rest. NOVASEN advises and assists more than 32,000 contract workers and, at the end of the 1990s, was producing in the neighborhood of 60,000 tons a year. Its main grading and sorting facility, with a capacity of 300 tons a day, is based in Kaolack. NOVASEN controls the entire subsector. It chooses and advises the producers and takes charge of collecting, processing, and marketing the product. Eighty percent of its output by value is exported, notably to the European Union, and the rest is absorbed by the local market.

Rising Standards for Groundnuts:

Since 1999, Europe has harmonized the standards of the various member countries concerning contaminants of groundnuts, making these standards stricter. The maximum allowable content of aflatoxin B1 is set at 2 parts per billion (ppb) for edible groundnuts and 20 ppb for groundnut cake. In theory, the oil that Senegal produces is not contaminated, by aflatoxin because any aflatoxin present is eliminated in the crushing process. For the presscake, SONACOS uses an ammonia detoxification process that is approved for the European market. It is primarily in edible groundnuts that there appear to be problems. The quantity of Senegalese edible groundnut products shipped to Europe has decreased sharply in recent years, falling from 10,000 metric tons (MT) a year in the 1990s to approximately 500 tons at present. The contamination of edible groundnuts by

aflatoxin occurs mainly in the field, and with the current state of technology, there is no method of detoxifying edible groundnuts during processing at the factory. The agricultural practices that can prevent groundnuts from being contaminated by aflatoxin are well known and not costly. It is a question of providing growers with a minimum of extension services and incentives so that they will follow these practices in the field.

In this study, the author reviews the evolution of policies in the groundnut sector; the role of this sector in the national economy; the requirements that it must meet, notably in terms of quality management; and the measures that can be taken to improve quality. The author also performs a cost/benefit analysis of groundnut production that meets quality standards to see which net benefits accrue to each of the different production segments.

I. Groundnut Sector: Production and Stakeholders

1.1. Place of Groundnuts in the National Economy

The agricultural sector in general and the groundnut subsector, particularly, play a prominent role in the national economy. For this reason, the poverty reduction strategy paper (PRSP) identifies the subsector as a key element of the measures that the Senegalese government plans to implement to reinvigorate growth and reduce poverty. The groundnut crop is the principal source of income for the rural population and ranks among the top export products alongside fish, phosphates, and tourism. Besides the formal activities of collection, processing, and marketing that the groundnut crop entails, it also supports other business activities that are significant in a rural context: artisanal oilseed crushing and sales of peanut butter and roasted groundnuts. In recent years, the sector has encountered some fairly severe difficulties,

but its role in the economy remains a considerable one. The record harvests of 2000 and 2001 increased rural income by CFAF 71 billion in the first year and CFAF 81 billion in the second. Over the 1993–99 period, income to producers had averaged approximately CFAF 28 billion a year (ASPRODEB 2002). Some 700,000 farming operations, each of which supports a family or a village, are active in the subsector.

Groundnut production has varied considerably over the years. The most remarkable years for output were the middle to late 1970s and the years 2000 and 2001. Annual production exceeded 1,000,000 tons during these periods.

Groundnut production occupies 45 percent to 60 percent of the land under cultivation in the groundnut-growing basin and accounts for nearly half of all cultivated land in Senegal. Agriculture is the occupation of 80 percent of the rural population, which itself is estimated at 58 percent of the total population, and the vast majority of growers are in the groundnut sector. Sixty percent of the farming income of rural households derives from groundnuts. In 2000 and 2001, groundnuts accounted for approximately 5 percent of GDP, and income from this product totaled approximately CFAF 180 billion. This amount represents net income from the sale of groundnuts and groundnut stalks, taxes, bank interest and insurance premiums (ASPRODEB 2002). The number of jobs generated by the sector is substantial. The number of agents and other operators involved in marketing is estimated at 10,000 and the number of permanent and temporary jobs at the processing plants (oilseed and edible groundnuts) at approximately 4,000. For comparison, total employment in the modern sector in Senegal runs approximately 120,000. In years of favorable harvests such as 2000 and 2001, the sector represents roughly 12 percent of exports. The crop also serves a significant function as a source of food and fodder: groundnut kernels and pastes are used in preparing various foods for human consumption, while

the leaves and stalks serve as feed reserves for temporarily stabled livestock such as draft animals and small ruminants.

1.2. Players in the Sector: The Production and Marketing Chain

The chain of production in the groundnut sector includes several different types of players: seed suppliers, producers, collectors, processors, and exporters.

1.2.1. Seed Suppliers

Seed production in Senegal is done in several stages. At the bottom of the ladder is the research institute, ISRA (*Institut Sénégalais de Recherche Agricole*, Senegalese Institute for Agricultural Research), which performs varietal testing, production of pre-basic seed stock in target volumes between 25 and 30 tons a year, and multisite trials. ISRA's products thus are intended to be seeds of excellent quality that will be reproduced in quantity during several later phases to provide crop seed for planting by farmers. Downstream from ISRA there are:

- o Contract producers. They supply basic seeds and certified seeds for the distributor-operators of UNIS (*Union Nationale Interprofessionnelle des Semences*, National Union of Seed Industry Associations).
- o Operators. These are the collectors and distributors who distribute seed to farmers. In 1999 there were 188 of them operating 314 seed collection locations. Their capacities vary between 12,000 and 25,000 tons of seed per year (ASPRODEB and CNCR 2003).
- o DISEM. This is Senegal's Seed Department, responsible for controlling and certifying seed quality.
- o CNCAS (*Caisse Nationale de Crédit Agricole du Senegal*). Senegal's national farm credit bank is responsible for managing the guarantee fund that underwrites the collection and marketing of groundnuts.

Before the privatization, the state was producing 120,000 tons of seed a year, including 50,000 tons of pedigreed seed. With the state's withdrawal from the sector in 1994, the private operators have been struggling to produce 15,000 tons of certified seed a year.

For edible groundnuts, it should be noted that NOVASEN does the seed selection by skimming, that is, setting aside the best seeds from current crops for planting in following seasons.

1.2.2. Producers

These are the rural farmers who produce groundnuts on farms, sometimes in combination with raising livestock. Most of the crop is sold for subsequent processing, but a portion of it is retained as personal seed reserves or consumed in place. Since the SONAGRAINES (*Société Nationale des Graines*) entity disappeared, farmers have been selling their crops to private operators authorized by SONACOS, which takes charge of reselling the crop to the processors. It must also be said that a substantial fraction of the harvest goes to independents operating outside the SONACOS-authorized circuits.

For edible groundnuts, the producers are farmers selected and advised by NOVASEN. The selection criteria include geographic location, size of farm, and degree of mechanization. NOVASEN supplies the needed inputs on credit and buys the resulting crop at a price that varies according to the grade of the groundnuts.

1.2.3. Collectors

Since the implementation of the Structural Adjustment Program for Agriculture (SAPA), two types of players can be distinguished in collection of the crop: the official circuit and the informal circuit (Badiane and Gaye 1999). The official circuit is controlled by SONAGRAINES, which relies on the private storage operators (PSOs) and agricultural cooperatives. SONAGRAINES sets beginning and ending dates for the groundnut season and supplies funds and transport equipment for crop collection. The

PSOs and cooperatives are paid a fixed commission rate per ton. It should be noted, however, that this system has become inoperative since 2001, when the system of delivery to the factory gate was put in place. Since November 2001, SONACOS is no longer involved upstream from the collection phase. It authorizes private operators, who obtain financing from the banking system, to carry out their crop collection operations and deliver the crop directly to the oilseed crushing company. To be authorized, the operator must fulfill the following conditions: have working capital sufficient to buy 500 tons of groundnuts, have the necessary equipment, and be able to pay the official price in cash. This new collection system has given rise to many failures in recent crop years, and these failures have brought calls and proposals to reform it (Government of Senegal 2003a, ADE 2002, ASPRODEB 2002).

For edible groundnuts, the producers are advised by agents recruited by NOVASEN who also do the crop collection during the harvest period for the company's account.

1.2.4. Processors

These are essentially SONACOS and NOVASEN.² SONACOS crushes groundnut kernels to produce unrefined oil and presscake for export markets, particularly the European market. It also imports raw vegetable oil that it refines and sells on the local market. NOVASEN deals mainly with edible groundnuts. Groundnuts that meet European standards are exported; the remainder (the sorting culls) are crushed and sold in the form of unrefined oil and presscake.

These two companies export directly to traders (brokers) and to companies that refine the crude groundnut oil before putting it on the market.

² Not counting traditional oilseed crushers and producers of peanut butter for the local market.

II. Sector Performance

Appendix 1 gives historical figures for groundnut production and area under cultivation.³ It shows that production of oilseed groundnuts has fluctuated greatly from one year to another, with a minimum of 260,000 tons in 2002–03 and a maximum of 1,434,000 tons in 1975–76. Production of edible groundnuts, on the other hand, shows a steep rise, from 8,000 tons at the beginning of the 1970s to more than 60,000 tons in the mid-1990s. This dramatic rise is explained primarily by the agricultural extension work of NOVASEN, which had considerable success during this period. However, the most important determinant of these production figures is, without question, the amount of rainfall: harvests fall significantly in years of drought such as the 2002–03 season. In contrast, with the ample rains of the 2000–01 and 2001–02 seasons, oilseed groundnut production hit annual highs of approximately 1,000,000 tons, and edible groundnut production reached approximately 60,000 tons. Besides this purely exogenous factor, though, there are many others that are of more or less importance, depending on the crop (Freud *and others* 1997)

When harvests are poor, groundnut production falls short of installed crushing capacity. Thus, SONACOS, with installed capacity of 960,000 tons, achieved its best output figures since the 1990s with the good harvests of 2000 and 2001. In most years during that period, however, collections were less than 300,000 tons, with a low of less than 100,000 tons in 1997 (ADE 2002). As for NOVASEN, it was able to export more than 10,000 tons of edible groundnuts a year in the late 1990s, but its exports have declined to approximately 600 tons in the past few years. This drop seems to be due more to the quality of the harvests than to their quantity.

³ Note that the figures in this table are for groundnuts in the pod. On average, the kernels account for two-thirds of the weight, the hulls one-third.

The age and lack of availability of farm equipment probably explains a good part of the industry's difficulties. The problem is persistent for both crops but more pronounced for oilseed groundnuts. For edible groundnuts, for which equipment quality requirements are more demanding (for example, 20-notch disks and appropriate seeding shares), NOVASEN's extension agents target farmers who already have a certain minimum amount of farm machinery.

Moreover, the land area planted in groundnuts has declined sharply over the years due to land pressure, certain institutional factors, and pricing policies (Freud and others 1997). Yields also declined, especially in the mid-1970s, although there has been a fairly significant recovery in yields since 1999 due to the government's deep phosphate treatment program and the record rainfalls in 2000 and 2001. The decline in yields is explained by deterioration in soil quality, reduced consumption of fertilizer, unfavorable cultivation practices, and degradation in seed quality.

The last of these factors is the one blamed most for the crisis in groundnut production, notably for edible groundnuts. Seed production follows a fairly long cycle—from selection of the cultivar to preparation of level 2 seeds—and this cycle seems to have been broken in recent years. Pedigreed seed is becoming increasingly scarce, and more ordinary seed is being used. For edible groundnuts, NOVASEN's procedure is to set aside the best seeds from past harvests as seed capital. This approach means that the seeds that are no longer reproducing lose some of their quality, and the mixing of varieties ultimately alters the purity of the seed stock.

Structure and Performance of the NOVASEN Production Chain:

In the areas in which it operates, NOVASEN works with a number of growers and provides advice and assistance to them. The company has three production zones. The northern zone, around Louga, covers approximately

14,000 ha. It receives much less rainfall than the other areas. NOVASEN provides minimal extension services and no seasonal credit. This zone produces a Spanish variety (55-437) that yields much larger kernels than the Virginia variety (GH-119-20). The southern zone, around Kolda, covers approximately 5,000 ha. It is a pioneer zone that enjoys more favorable climatic conditions than the others. The third zone, around Kaolack, covers approximately 41,000 ha. A dual-purpose variety (73-33) is grown there for both oil and food, as well as the GH-119-20 variety, which is more specifically an edible groundnut. The company chooses the farmers with whom it works based on a number of criteria, mainly the size of the farm, which must be between 2 ha and 4 ha, and the availability of farm equipment.

Normally, NOVASEN extends seasonal credit to the farmers with whom it works and gets reimbursed when these farmers sell their crops to the company. It also provides extension agents, who advise the farmers in the production process and handle collection of the harvest at the various collection points.

Appendix 1 shows that since NOVASEN was established in the early 1990s, production of edible groundnuts has practically tripled, reaching 64,247 tons of pods during the 1999–2000 season. In the middle of the 1990s, the volume of kernels exported annually as edible groundnuts had been approximately 10,000 tons. Subsequently, although the quantity harvested has still been close to 60,000 tons, the volume of edible groundnuts exported has barely exceeded 1,000 tons a year owing to the size of the kernels and the degree of contamination by aflatoxin.

Many factors contributed to this poor performance. The author draws attention to the following:

- o Lack of incentives for farmers, who get almost the same price from the company for edible groundnuts as for ordinary groundnuts. Normally, there is a substantial price differential between the premium-grade crops, which yield kernels more suitable for

export, such as confectionery groundnut and the other grades (A and B), which include a higher proportion of kernels whose size and level of contamination make them unsuitable for export and therefore are downgraded to oilseed groundnuts.

- It is becoming harder and harder for farmers to grow premium-grade crops because their seed capital is not being renewed. Increasingly, NOVASEN uses a skimming procedure to select the seeds to be planted for the next crops. The company has not renewed the seed capital for more than 15 years. Given the quality of seed available, it is difficult for farmers to achieve premium-grade harvests.
- The fact that in recent years the company has chosen to favor the processing business and has installed substantial machinery for this purpose can be understood as an alternative solution in lieu of agricultural practices that would meet the technical and quality standards for ARB. Instead of reconstituting the seed capital and putting more effort into advising farmers, which route could have improved the quality of edible groundnuts suitable for export, the company seems to have resigned itself to crushing the lower-quality groundnuts that farmers are delivering to it.
- The company has had a number of problems in the past few years involving collection on the loans that it makes to farmers. It must be understood that agriculture is an activity that remains highly uncertain in this country, particularly owing to its very heavy dependence on rainfall. In years of poor harvests, farmers' incomes decline drastically so that farmers are unable to pay their debts. The government frequently finds it necessary to step in and assume this debt. Usually, however, it is only the debts of farmers working with SONACOS that

are absorbed by the state, while the debts of farmers working with NOVASEN are left untouched. This government policy has led the company to stop extending credit to the farmers with whom it works and to tell them to turn to CNCAS for financing, as all the other farmers must do. This company policy has of course sharply reduced the company's hold on the production process of the farmers with whom it has ties.

III. Evolution of Sector Policies

The history of government policy in the sector can be divided in two phases: a phase of very far-reaching intervention by the state (1960–79) and a phase of liberalization of the sector beginning in the 1980s.

3.1. Period of State Intervention

Upon independence in 1960, Senegal established a marked preference for import substitution activities. The groundnut sector was supposed to play a prominent role in this strategy by generating the foreign exchange needed to finance imports of capital goods and other necessary inputs. The government also sought to make this sector the foundation of the country's industrial activity. A comprehensive intervention scheme was therefore developed around the sector. Very early on, a system of syndicated lending was introduced to ensure that farmers were supplied with seed and other inputs, and in 1980 the BNDS (*Banque Nationale de Développement du Senegal*, or National Development Bank of Senegal) was created primarily to finance groundnut cultivation. Farmers were also organized into cooperatives to take charge of distribution. ONCAD (*Office National de Commercialisation et d'Assistance pour le Développement*, or National Marketing and Development Assistance Office) was created in 1966 to centralize the various state-run functions in the sector. Owing to its monumental deficit, ONCAD was finally wound up in 1980, leaving behind

liabilities of CFAF 120 billion. SONAR (*Société Nationale d'Approvisionnement du Monde Rural*, National Rural Supply Company) took over the distribution function after ONCAD's dissolution and continued to pre-finance the acquisition of inputs by withholding a portion of the value of crops purchased. With the New Agricultural Policy (NAP) in 1984-85, SONAR in turn was dissolved, and a new bank, CNCAS, was created to provide loans to producers. At the same time, SONAGRAINES, a subsidiary of SONACOS, took over more and more of the crop collection and seed distribution functions.

On the marketing side, the OCA (*Office de Commercialisation Agricole*, or Agricultural Marketing Office) was established in 1960 to guarantee crop prices to producers. With the creation of SONACOS in 1965, almost all marketing activities came under the state's wing. Under the New Agricultural Policy (NAP), the birth of the Private Storage Operators (PSOs) marked a return of the private sector in oilseed marketing, although still under the control of SONACOS.

On the agricultural extension side, SATEC (*Société d'Assistance Technique et de Coopération*) was created in 1964 to increase crop yields. It was subsequently replaced by SODEVA (*Société de Développement et de Vulgarisation Agricole*) and later by PNVA (*Programme National de Vulgarisation Agricole*), which, however put less emphasis on groundnuts than its predecessors.

3.2. Reforms of the 1990s and Support from the EU

In the early 1990s, the EU's system of aid via the STABEX (*Stabilisation des recettes d'Exportation*) mechanism was changed in conformity with Lomé IV to allocate resources according to mutual obligation agreements (*Cadres d'Obligations Mutuelles*, or COMs) negotiated between the beneficiary country and the European Commission. Between 1992 and 1996, the Government of Senegal signed five such agreements with the EU, at a pace of one COM per year. The first two COMs (1992 and 1993) were

aimed at consolidating the sector's finances, whereas the next three sought to revive the sector.

Fiscal consolidation of the sector (COM 1992, 1993). The objective of the fiscal consolidation phase was to put in place a new organizational scheme for the sector. The sector had fallen into a severe crisis after the harvests of 1992 and the seven seasons that preceded it, which, with the exception of 1990, had all ended in deficit. World groundnut prices had collapsed from \$960 per ton in 1990 to \$610 per ton in 1992. Despite this price decline, the Senegalese government had raised its price from CFAF 70 to CFAF 80 per kilogram. This price increase provoked a huge deficit, estimated at CFAF 48 per kg of groundnuts, which the government's guarantee fund, instituted in 1986–87, could not cover. The themes of COM 1992 were much the same as those of the SAPA: privatization of SONACOS; privatization of seed production and marketing; reduction of costs in the sector in the collection, processing, and marketing stages; and institution of a more flexible mechanism for determining the prices paid to producers. In the very short term, the COM sought to achieve the following: get the producers involved in sector management, keep SONAGRAINES in the crop collection business, and restructure the industrial activities in the sector. To set prices, the COM called for establishing a guarantee fund with appropriate legal status and managerial autonomy. Thus, most of the resources under COM 1992 were to go to the guarantee fund to cover loans for the 1991–92 season and reduce the cumulative deficit from past seasons.

COM 1993, which was not actually signed until 1995, called for implementing an industry-wide association for groundnuts. As for pricing policy, the goal was to make it more flexible while ensuring a minimum income level to the farmer. It should be noted that privatization of SONACOS, which was the main objective of this phase,

still had not been accomplished, despite two abortive attempts to do so.

Revival of the sector (COMs 1994, 1995, 1996). Starting in 1994, the next three COMs sought to restore agricultural production. The diagnosis of the production problems emphasized soil depletion, late arrival of the rainy season, lack of suitable credit, and poor seed capital. A production target of 400,000 tons was set for 1994, and this was raised to 1,000,000 tons in 1997. To achieve this objective, it was decided to (a) set up a price-setting mechanism administered by an industry-wide association, which would announce and guarantee a price before the beginning of the season, and (b) implement a seed supply plan to ensure production of quality seed, by the private sector. COM 1995, signed in 1998, and COM 1996, signed in 1999, provided financial resources to support the industry-wide association and the seed program.

Toward the end of the 1990s, groundnut production increased significantly, rising from 578,768 tons in 1992–93 to 1,061,540 tons in 2000–01 and 943,837 tons in 2001–02, before it plunged to less than 300,000 tons in the 2002–03 crop year. However, this variation seems to have been entirely unrelated to actions under the program. In fact, prices were set without reference to the chosen plan; the seed program was compromised by massive distribution of seeds set aside from prior harvests; and although SONAGRAINES was finally liquidated, both it and SONACOS accumulated large deficits that were absorbed by the government.

Structural Adjustment Program for Agriculture (SAPA). The Letter of Development Policy for the Agricultural Sector sets forth principles for liberalization of the sector as part of the SAPA. These principles are fairly close to those in the various COMs, although they do diverge on several points (World Bank 1998, IDC 1999). Both call for establishing a floor price before planting begins, but whereas the SAPA speaks of a support fund financed by

levies on members of the industry-wide association, the COMs speak of a support fund financed by STABEX funds and levies on imports. The SAPA also includes a process for privatization of SONACOS, liberalization of the sector in respect of domestic commerce in groundnuts, and elimination of prior authorization requirements for imports of vegetable oils.

CNIA and the framework agreement. CNIA (*Comité National Interprofessionnel de l'Arachide*) was established in 1995 as a trade association. Its origin goes back to 1989–90 and the former rural development ministry, which wanted to foster more interplay among players in the industry. The necessity of creating an industry-wide association for the sector was subsequently recognized not only in the COMs but also in the SAPA. The members of CNIA are the producers' associations, such as UNCAS; the private organizations that perform crop collection, storage and transport; industrial processing companies (SONACOS and NOVASEN); and manufacturers of inputs (Senchim, UNIS, SPIA) and agricultural equipment (SISMAR). No government department or agency is a member of CNIA: the state must content itself with performing certain public service missions such as research. Relations between the state and CNIA are covered by a framework agreement signed in 1997 by the state, CNIA, and SONACOS; and amended in 2001. This agreement has now ended.

CNIA is responsible for determining how the resources available under the COMs are to be used. However, the EU suspended its financing of the sector in 2001, and discussions continue on what uses are to be made of resources available under the COMs and not yet committed. CNIA's role is primarily to facilitate concerted action by the various players in the sector. It must also commit to set the floor price for producers before the season begins and help to professionalize the sector. CNIA's funding comes mainly from the COMs and from the rather marginal dues paid by the rest of its members.

Its activities have slowed considerably in recent years, and its edible groundnut program has even been halted. The World Bank has stepped in by financing an experimental research program on edible groundnuts conducted by CIRAD in the river region.

IV. New Directions of Government Policy in the Sector

The reform measures of the 1990s, with the notable exception of the privatization of SONACOS, [scheduled for December 2003 but which only took place in 2005], have all reached a fairly advanced stage of implementation. However, some catastrophic reversals were seen at the beginning of 2000, notably in collection and marketing. Furthermore, the system faces a persistent crisis that calls for new measures on the part of the public authorities.

4.1. Assessment of the Reforms during the 1990s

The reforms undertaken since the 1990s have affected every segment of the production chain. Even so, many problems persist in the various segments, and new problems have emerged that the sector must address.

Groundnut production has been on a very pronounced downturn, which has persisted despite the successive waves of reform in the sector. Over a 15-year period, average annual production of oilseed groundnuts was 500,000 tons, and the average annual collection by SONACOS was 300,000 tons (Government of Senegal 2003). Over the past 16 years, collection of oilseed groundnuts has exceeded 300,000 tons only three times; the rest of the time, it has varied between 100,000 and 280,000 tons. The causes of this poor performance are varied and amply documented (Government of Senegal 2003a, 2003b, ASPRODEB 2002, 2003, Freud and others 1999). First, the seed capital has not been renewed in a very long time and consequently has deteriorated. In

addition, poor farming practices have greatly degraded soil quality. The production equipment is rudimentary and poorly maintained. On top of all of this, there are multiple institutional constraints.

In the area of distribution of inputs and collection of the crop, it must be noted that, despite the privatizations that have been undertaken, there have been enormous disturbances in recent years, and these have disrupted crop years considerably. When SONAGRAINES was eliminated, the system of delivery to the factory gate was instituted. This change has meant that the processing company is no longer involved in collecting the crop. Instead, authorized private operators seek financing from the banking system and deliver the crop to the processor. *One difficulty of this system is that it is not really operational:* the number of private operators who can raise the necessary funds is not sufficient for the system to operate as it should. Consequently, SONACOS has been obliged to pre-finance virtually all of its purchases delivered by the PSOs (70 percent), UNCAS (19 percent), SOSEN (9 percent), and others (2 percent). Another problem in this area is related to the equipment used in the collection phase, notably the antiquated sifting screens and the inadequate transport equipment. The crop is now transported to the factories by the private sector, which has a fleet of 500–600 trucks. This fleet consists mainly of old and dilapidated vehicles and operators have a hard time serving all of the collection points.

In the processing area, the major problem is insufficient supply. SONACOS, which has a theoretical production capacity of 960,000 tons, operates well below this level. It has even had to shut down its Diourbel plant (200,000 tons), closed since 1991. For edible groundnuts, the main problem is quality management and meeting aflatoxin standards.

The price-setting mechanisms also pose a problem. Their stated objective is to align the prices paid to producers

with prices on the world market. In practice, however, a difference of at least 20 percent is still seen between the two sets of prices. In 2001 CNIA set the producer price at CFAF 120 per kilogram, which the government later raised to CFAF 145. This action greatly displeased the European Union and was one of the reasons that the EU suspended its support for the sector.

4.2. New Directions for Reform

The new directions of government policy for the sector are set forth in two recent documents of the Senegalese government: the Agricultural Orientation Act and the Letter of Development Policy for the Groundnut Sector (Government of Senegal 2003b). The objectives are to ensure food security and increase the competitiveness of the sector to make it an important source of jobs and foreign exchange.

The Agricultural Orientation Act seeks to improve the institutional framework of the farm sector in general, and the groundnut sector in particular. It makes explicit mention of the objectives of increasing agricultural exports and improving the quality of products destined for export. It gives farmers a legal status that provides them with social security, as is done in the modern sector. A vocational training program tailored to their needs will be offered to them. The act also calls for strengthening the land use rights of agricultural operators. The state's role in agricultural research and sustainable soil management likewise is strengthened. It must be noted, however, that various criticisms have been leveled against the act, not only by the farmers' organizations but also by public interest groups and some donors.

Concerning the groundnut sector more specifically, the government's new strategy is set forth in the LPDFA (*Lettre de Politique de Développement de la Filière Arachide*), adopted by the Council of Ministers in May 2003. The LPDFA seeks to improve functionality in the various segments of the sector by addressing the failures observed in previous seasons.

On the production front, the government plans to develop small-scale irrigation to curb water use. A program to reconstitute seed capital with improved varieties will be devised, and the edible groundnut subsector will receive more attention. To this end, a price-setting mechanism more appropriate for this crop will be proposed. The government plans to foster the emergence of small and medium enterprises in the business of dehulling and artisanal or semi-industrial processing of edible groundnuts.

On the quality management front, the *seccos* will be rehabilitated⁴; the collection equipment will be replaced; and pedigreed seeds will be upgraded. ITA (*Institut de Technologie Alimentaire*, or Food Technology Institute) laboratories will be upgraded for quality control of groundnut products destined for export and imported vegetable oils. Quality standards will be established in conjunction with the Senegalese Institute for Standardization, and quality awareness campaigns will be conducted with the support of UNIDO (United Nations Industrial Development Organization).

V. Export Markets and Quality Standards for Groundnut Products

Senegal is one of the largest exporters of groundnuts in the world. If domestic supply were sufficient and quality were ensured, the earnings the country could make from the various secondary products of the groundnut sector would be substantial.

5.1. World Market for Oilseeds Oils

Groundnut oil commands the highest price on the world market after olive oil. In 1999–2000, for example, groundnut oil sold for \$655 a ton, compared with \$328

⁴ Seccos are open barns in which stored groundnuts are exposed to sun and dew, favoring the growth of fungi.

for rapeseed (canola) oil, \$330 for sunflower oil, \$245 for palm oil, and \$208 for soybean oil. However, in recent years, world trade in groundnut oil has followed a declining trend, partially, because there is an increased competition from other oils like sunflower oil and soybean. The European Union for example granted generous subsidies to EU farmers to encourage them to grow sunflower. It fell from 325,000 tons in the early 1980s to 275,000 tons in 1990, then to 225,000 tons in the late 1990s.

World production of oilseeds in 1999–2000 amounted to roughly 250 million tons, of which groundnut kernels represented only 4.7 percent; rapeseed (13.4 percent), cottonseed (11 percent), soya (55.5 percent), sunflower (9.4 percent). The rest of the oilseeds accounted for 6 percent. World trade in oils in the same year amounted to 50 million tons, of which only 500,000 tons was groundnut oil. Thus, virtually all of the world's production of groundnuts is consumed where it is produced and does not enter world trade. The United States, the world's largest producer of groundnut [peanut] oil, does not import any. India, the second-largest producer, targets mainly the Asian market. Argentina, which exports nearly 100,000 tons, targets the Latin American market. In Africa, Sudan, Mali, and Gambia are exporters of groundnut oil, with annual volumes of 50,000, 10,000 and 5,000 tons, respectively.

Senegal thus plays a leading role in the European edible oil market, which is estimated at 150,000–180,000 tons a year. Within the EU, the largest importers are France and Italy, which between them account for more than 80 percent of imports.

Senegal sells its groundnut oil either to industrial companies, which refine SONACOS's crude oil before putting it on the market, or to trading companies (brokers), which buy it for resale. For oil, Senegal's main manufacturing customers are Cereol-Lessieurs (France), Nidera (Netherlands), and Salov and Zucchi (Italy). The

trader most active in the Senegalese market appears to be Alimenta. It should be noted that Senegal exports no refined oil; it exports only unrefined oil and presscake. On the other hand, Senegal imports vegetable oil, which it refines to meet the needs of its domestic market.

5.2. Cake

In contrast to the market for groundnut oil, the market for groundnut cake has expanded markedly in the past few years, spurred by the prohibition on animal-based feed in Europe following the mad cow crisis and the impossibility of importing transgenic presscake from the United States. Furthermore, the EU's agricultural policy favors meeting domestic requirements for vegetable proteins with imports rather than with domestic production, which is costly and necessitates enormous subsidies. Groundnut cake sells for \$180 a ton, compared with \$210 for World price] soya. For groundnut cake, Senegal's main customers are Ballouhey (France), Evalis (France), and Tracomex (Netherlands).

5.3. Edible Nuts

The world market for edible groundnuts is quite large. Around the world, groundnuts are used in many ways. They are roasted in the pod and eaten as is; the large kernels of the *Virginia* variety are used for snacks (salted, coated); and the small kernels and broken kernels of the same variety are used to make pastes and peanut butters. In confectionery, medium Virginia kernels are used for sugar-coated candies, and large kernels are coated with chocolate. The medium kernels of the *Valencia* variety are used in biscuits, while the small kernels and split kernels go into pastes and butters. Last, the small-kernel *Spanish* variety is used to produce snacks and peanut butter. World demand for edible groundnuts is estimated at 1.2 million tons, including 500,000 tons in the European market alone. The main producing countries are Argentina, China, India, and the United States. Prices for the edible nuts are much higher than for oil or presscake—between \$480 and \$540 a ton for the first—whereas costs

of production are comparable to those for oil. The majority of Senegal's exports go to Europe, but smaller quantities are exported to the Maghreb (primarily Morocco) and Saudi Arabia. The problem with the Saudi market is that consumers want the skin removed leaving the kernel intact, a technique that has not been fully mastered in Senegal.

For edible groundnuts, the trading company Alimenta is again among the buyers, but Senegal's biggest customer in Europe seems to be J&JB, a British trader, which, it is widely rumored, sells the Senegalese groundnuts as bird feed—an allegation denied by the NOVASEN managers with whom the author has spoken.

5.4. European Market and Aflatoxin Standards

The food safety requirements of the European Union, Senegal's main customer for oilseed groundnuts, are contained in Directive 98/53/EC (16 July 1998) and Commission Regulation 1525/98. The rules set the maximum allowable aflatoxin content of foodstuffs (primarily groundnuts) that can be marketed in the EU. All EU Member States have been required since December 1999 to implement these legislative and regulatory provisions. The EU began to establish these common standards in the 1980s. At that time, almost every European country had its own regulations concerning allowable aflatoxin content in foodstuffs for human consumption. In the late 1990s, these standards were harmonized throughout the Union. Between 1991 and 1998, for example, the maximum allowable content of aflatoxin B in European countries varied between 2–10 ppb (that is, between 0.002 and 0.01 milligrams per kilogram of groundnuts). The subsequent harmonization seems to have been accomplished by leveling down rather than up.

Aflatoxin is a toxic substance secreted by a fungus named *Aspergillus flavus*. This fungus grows in the temperature and humidity conditions that are found in Senegal.

Experiments performed on animals have shown that aflatoxin is a powerful carcinogen. Furthermore, empirical medical research has shown that areas in which consumption of products contaminated by aflatoxin is greatest are also areas in which the prevalence of liver cancer is highest. Aflatoxin is not present in groundnut oil because it is completely eliminated in the crushing process; it is present, however, in the presscake and in edible groundnuts. The aflatoxin contained in the groundnut cake used as cattle feed, notably aflatoxin B1, gives rise to the aflatoxin M1 (highly carcinogenic, especially in young children), which is found in the milk of animals that have consumed the contaminated feed. There are four types of aflatoxins in groundnuts: B1, B2, G1, and G2. Type B1 is believed to be by far the most dangerous. According to the EU regulation, there is no threshold below which no harmful effect is observed. There is therefore no basis for setting an allowable daily dose. In the current state of scientific and technical knowledge, even with improvements in production and storage practices, it is not possible to completely prevent these molds from growing and therefore not possible to completely eliminate the presence of aflatoxins in foodstuffs."

On the strength of this finding, the EU has set the allowable standards at the lowest feasible level. It is indeed quite difficult to remove all aflatoxin from groundnut kernels. The limits therefore are set on the ALARA (As Low As Reasonably Achievable) principle.

The maximum aflatoxin contents allowed in the EU follow.

- o For direct consumption of edible groundnuts: 2 ppb for type B1; 4 ppb for the sum of the 4 types (B1+B2+G1+G2)⁵

⁵ 1 ppb (part per billion) is equivalent to 0.001 milligram of aflatoxin per kilogram of groundnuts.

- For indirect consumption of edible groundnuts: 8 ppb for B1; 15 ppb for the sum of the 4
- For groundnut cake: 20 ppb for the sum of the 4.
- Direct consumption occurs when the kernel is eaten as is with no further processing, for example, as in roasted groundnuts. Indirect consumption occurs when the kernel has received additional processing, as in confectionery. This distinction is taken into account in determining the maximum allowable content. Quality management of products exported to Europe is quite tricky. If the standards for the product are not met, the cargo is sent back to the country of origin. Moreover, imports of all such products from that country are suspended for a period of at least six months.

5.5. Aflatoxin and Senegalese Groundnut Products

The groundnut products that Senegal exports are oil, presscake, and edible groundnuts. Aflatoxin is a problem mainly for the last of the three product categories.

5.5.1. Groundnut Oil and Presscake

In principle, the unrefined groundnut oil that Senegal exports is not contaminated by aflatoxin. The substance is removed entirely from the oil during the crushing process, but it remains in the presscake. Since 1980, Senegalese groundnut cake has undergone a detoxification process that uses ammonia. This process, which has been approved by the European Union, was implemented with the assistance of INRA, the French Institute for Agronomic Research. In the 1980s SEIB had developed a different detoxification process, using chlorine and soda, with technical assistance from Texas A&M University. This process gave good results at the experimental stage, but it still had to be approved for animal consumption in Europe. Approval was requested, but the effort to obtain it was abandoned in 1984 when SEIB was absorbed by SONACOS. Obtaining approval is a

long and costly process that requires a great deal of experimentation and many trials before it can be completed. SONACOS, which already had a method of detoxification that was accepted in Europe, did not see fit to pursue the experiments with chlorine detoxification, which is widely used in the United States.

It must be noted, though, that SONACOS has a detoxification process that is protected by patent and is not available to the other oil processor, NOVASEN. Consequently, whereas SONACOS's groundnut cake meets European standards for aflatoxin content, NOVASEN's is sold as is, that is, in a contaminated state, and the European feed companies that buy it perform the detoxification themselves before putting in on the European market.

The product that arrives at SONACOS's factories is first dehulled, heated, and then crushed to extract the oil. The presscake that remains is subjected to a detoxification process that is different from the one described that is using ammonia and not soda.

5.5.2. Edible Groundnuts

The key point is that, at present, the same varieties of seeds that provide oilseed groundnuts also provide edible groundnuts to NOVASEN]. It is the quality of the kernel at harvest time that determines its final use. The groundnuts that arrive at the factory of the processor (NOVASEN) undergo the following process. They are first treated with phytosanitary products before being stored. Next, they are dehulled. The kernels are then subjected to a mechanical sifting step to eliminate the small kernels that have the highest probability of being contaminated by aflatoxin. After that, they undergo sorting, first by an electronic sorting machine and then by hand, to select the kernels suitable for direct consumption. The rest, which are called sorting culls, are sent for crushing. Groundnuts destined for export must meet certain technical conditions including degree of contamination. For groundnuts in the pod, shells must be intact, not

marred by insect attacks or stains, and strong enough to withstand the mechanical effects of transport and roasting. Depending on the botanical type, kernels must fall within certain intervals related to the grade and the number of kernels per 100 grams. Once the kernels have been selected according to this criterion, they must undergo a laboratory analysis to determine their aflatoxin content. Owing to inappropriate cultivation practices, a very low proportion of the harvest is sold as edible groundnuts. During good harvest years, only 8,000–9,000 of the 60,000 tons handled by NOVASEN are exported as edible groundnuts. The rest, not counting the shells, are sent for crushing, either industrial or artisanal.

This is explained by the fact that contamination occurs at each stage of the process, in the field and in storage.

- o In the field, the first problem arises from the groundnuts used as seed. The leading variety used for edible groundnuts in Senegal is GH-119-20, a Virginia type. This cultivar yields fairly large, good-quality kernels that are especially prized by the markets for edible groundnuts. Because the seed capital has not been renewed since at last 1988, even for edible groundnuts the crop seed consists of groundnuts skimmed from previous harvests. The result is that the seed loses all its qualities. Next, the fact that planting dates are not observed means that growers frequently have to harvest the crop before the rainy season is over. When that happens, the humidity due to the rains favors contamination by aflatoxin. Last, the traditional harvesting technique also poses problems. Growers very often begin by piling the harvest in small heaps, which are left exposed to moisture for days. They then pile them all together in bigger heaps (stacks) before threshing to separate out the pods. This technique subjects the groundnuts to moisture and heat that favor the development of aflatoxin. Furthermore, the threshing damages the shells, providing entry

points for insects and molds including the *A. flavus* fungus responsible for aflatoxin.

- o In the storage phase, the harvested groundnuts are collected by the PSOs and stored in seccos before being transported to the processors. Seccos are open barns in which the groundnuts are exposed to sun and dew, again favoring the growth of fungi. According to the experts with whom the author has spoken, if the groundnuts spent no more than one month in these barns, the practice would pose no problem, but NOVASEN's factories can receive only fairly limited quantities at a time. This capacity limitation, coupled with the transport difficulties in the sector, increases the storage time in the seccos to three or four months (appendix 7). This long storage means that the groundnuts arrive at the factory in a heavily deteriorated state with a high probability of contamination.

As can be seen from the above, most of the sources of contamination are upstream from the processing stage. If the harvesting and collecting are done in more appropriate fashion, the risk of aflatoxin contamination can be reduced considerably.

VI. Best Practices in Quality Management for Edible Groundnuts

To reduce the likelihood of aflatoxin contamination in products for export, observance of a number of best practices identified by research is recommended. To be sure, it is still quite difficult to eliminate aflatoxin altogether from groundnuts. Nevertheless, according to CIRAD, which is running a pilot project on edible groundnuts grown under irrigation in the Senegal river valley, virtually all export groundnuts can meet the European standards if the appropriate production itinerary is adhered to. The CIRAD officials with whom the author has spoken estimate that they have shipped 1,000

tons of edible groundnuts to Europe following the indicated practices, and the tests performed there show that the degree of contamination was well within allowable limits under the European standards.

6.1. Best Practices in Production and Collection

First, at the production level, good practices begin with the choice of seed.⁶ To have quality crop seed, NOVASEN must necessarily break with the skimming strategy it has been using and provide the farmers whom it advises with pedigreed seed of the GH-119-20 variety, which is more appropriate for edible groundnuts than ordinary seed. Furthermore, the company needs to favor seed varieties that develop greater natural resistance to the fungus.

Next, the agricultural extension service needs to be strengthened. The company makes extension agents available to the farmers with whom it deals in part to oversee application of the techniques required for proper production of edible groundnuts. According to the assessment of the company's experts, for proper supervision of the production activities, the ratio of ha to agents should be no more than 300 to 1, whereas at present it is approximately 1,200, or triple the accepted level. This lack of extension agents does not make for effective oversight of the farmers.

Third, as regards soils, deep phosphate treatment is needed to halt soil degradation and make it possible to obtain higher yields.

Fourth, concerning planting, the recommended timing must be observed. Seeding must be done after the first useful rain, that is, between June 15 and July 15. Premature planting can result in having to harvest the crop during the rainy season, which exposes the pods to moisture that favors the development of aflatoxin. In

⁶ A discussion of best practices in the production and storage of edible groundnuts is presented in CIRAD 2002.

addition, a minimum spacing between the seedlings must be observed. For the edible groundnut variety (GH-119-20), the appropriate spacing requires 20-notch seeding disks. In practice, as pure seeds of this variety have become scarcer, farmers have adapted by using ordinary seeds and 30-notch disks (appropriate for oilseed groundnuts but not for edible groundnuts) in their seed drills. Using the right disk at this step makes it possible for the groundnuts to grow to the required size. The recommended seeding depth must also be observed. For edible groundnuts, it is 7 cm, compared with just 4 cm for oilseed groundnuts. The extension agents need to ensure that farmers use their appropriate seeding share for this depth on their seed drills. The size of the farmer's operation is another important element to consider in this context. In general, the window of time during which planting can be performed is quite short. Reckoning on the basis that one can cover at most 1 ha per day of planting with a seeder drawn by a horse, or 0.8 ha using a burro, or 0.5 ha using an ox, the ideal recommended size for a single farm is 4 ha maximum.

As regards harvesting, there is a real oversight deficit on the farms that supply NOVASEN. The company's extension agents are also its crop collectors, and, at harvest time, just when they are needed most to supervise what the farmers are doing, they are at the collection points. In edible groundnut production, it has been shown that most of the contamination occurs during the harvest. In the harvesting step, the pods must be stripped when the plant is still green, and threshing must be avoided in order not to damage the groundnuts. To avoid contamination, any damaged, immature, or perforated pods, which have a higher probability of being infected, must then be separated from the other groundnuts. Next, drying to reduce the moisture content should last no longer than five days. If the moisture content is still high (over 10 percent) after 5 days, it is recommended that the groundnuts be downgraded.

As regards storage, the pods should be sent for processing no longer than one month after the harvest. To avoid becoming contaminated while in storage, the groundnuts should not spend a long time in the seccos. Furthermore, the seccos should be cleaned and the remnants of previous harvests removed before any new batch of groundnuts is stored in them.

6.2. Best Practices in Processing

Once the groundnuts have been collected by NOVASEN and transported to the factory, they undergo a number of steps. They must be unloaded, dehulled, put through a mechanical sifter to eliminate undersized kernels, sorted by hand, bagged, and fumigated to prevent attack by insects. After each of these steps, they must be tested for aflatoxin content. The company's capacity to take delivery is limited and appears to be insufficient in periods of good harvests. As a result, loaded trucks must sometimes wait a long time before they can be make delivery. During this time, large quantities of groundnuts sit in the seccos, waiting to be transported to the factory. These delays could be reduced if NOVASEN acquired conveyor belts to facilitate storage at greater height. The sifting machinery should then be renovated for greater efficiency.

At the post-processing stage, groundnuts with no visible anomalies undergo tests to determine their aflatoxin content. SONACOS has its own laboratory for this purpose, and NOVASEN also has machines to perform the testing, although their reliability is rather doubtful. What matters most in this regard, however, is not the availability of equipment to perform the tests so much as the recognition accorded to those tests in export markets. To date, no laboratory in Senegal has been accredited by the European Union, which is Senegal's main groundnut customer. The aflatoxin laboratory of the food technology institute ITA was established in Senegal in 1973. Originally, it was intended only for aflatoxin; subsequently, its activities have been extended to other mycotoxins such as ochratoxin, a contaminant of cereals.

With the support of donors, notably the European Union, the laboratory is in the process of being re-equipped to make it a national lab accredited by Senegal's export customers to conduct testing for aflatoxin content in groundnut products. With this in mind, high pressure liquid chromatography (HPLC) equipment was installed in 2000. Recently, other equipment such as an evaporator and a crushing machine for test samples has been installed. According to the lab technicians with whom the author has spoken, the problem now lies not with the reliability of the tests that are performed but with acceptance of the results by Senegal's trading partners. The lab is seeking accreditation by the EU, and to this end, besides the equipment upgrades noted above, the staff is undergoing training to meet the European standards. A manual of procedures and quality requirements is being written.

Accreditation of this lab by Senegal's export customers would enhance, in one stroke, the outside world's perception of the quality of Senegalese products. The government could then require every exporter of groundnut products to Europe to have a clearance from this lab before shipping the product. Such accreditation and required clearances are made all the more necessary by the fact that any importation into Europe of products found to be contaminated will cause all products coming from Senegal to be quarantined for at least six months.

VII. Cost/Benefit Analysis of a Groundnut Sector That Meets Export Market Quality Standards

In this section, the author performs a cost/benefit analysis of groundnut production that meets quality standards in export markets. The author does the analysis separately for each of the subsectors affected by aflatoxin: the oil and presscake subsector and the edible groundnut subsector. The author also considers each of the activity segments in the subsectors.

7.1. Groundnut Cake

In this subsector, Senegal exports unrefined groundnut oil and presscake, mainly to the European market. Aflatoxin is not an issue with the oil, but it is with the cake. The author will not consider here the quality problem upstream, that is, in the field, given that the product that is exported is an industrial product that can be detoxified. Furthermore, the author will look only at SONACOS's activity, since NOVASEN's output in these two product categories is marginal. Furthermore, unlike SONACOS, NOVASEN does not have a detoxification process, so the results for the SONACOS case could readily be generalized to the NOVASEN case.

For this analysis, the author will compare the situations when SONACOS meets the standards (the actual case that the author observes) and when it does not (the theoretical case). This approach is all the more relevant in that the presscake detoxification process can be completely separated from the crushing process. The capital costs and recurring expenses that detoxification entails are separable. Thus, at each step, the author takes the difference in cash flows between the base case (meets the standards) and the test case (does not meet the standards). The working assumption is an annual volume of 500,000 tons of groundnuts.

The private costs of the presscake detoxification activity comprise the following⁷ (table1):

- o The capital cost of the equipment installed for detoxification: a machine with a capacity of 1,000 tons per day acquired at a cost of CFAF 2 billion. Its normal service life is approximately 10 years.
- o The additional recurring expenses associated with the detoxification activity, which represent approximately 15 percent of total production cost.

⁷ The data used in the cost/benefit analysis for oil and presscake come directly from SONACOS

The total production cost for presscake is estimated by the Ministry of Agriculture (2003) at CFAF 33,000 per ton. Thus, for 500,000 tons in the pod, the author has: 500,000 tons x 42 percent⁸ x CFAF 33,000 x 15 percent = CFAF 1,039,500,000.

The benefits of the presscake detoxification are:

- o The price differential vs. nondetoxified cake, which is roughly 30 percent or CFAF 110,250 per ton
- o The quantity differential, which is equal to the average quantity of cake sold by SONACOS less the maximum quantity, would have been able to sell without detoxification, which is 25,000 tons. For 500,000 tons in the pod, the quantity of cake produced is: 500,000 tons x 42 percent = 210,000 tons.

Table 1: Values from the presscake detoxification activity (CFAF)

	Value	Present value
A. Capital cost	2 billion	1,860,000,000 ^a
B. Variable cost		
<i>With detox</i> 500,000 tons x 42% x CFAF 33,000 x 1.15	7,969,500,000	53,276,107,500
<i>Without detox^b</i> 25,000 tons x CFAF 33,000	825,000,000	5,663,625,000
Difference		47,612,482,500
C. Annual production		
<i>With detox</i> 500,000 tons x 42% x CFAF 110,250 x 1.3	30,098,250,000	206,624,486,250

⁸ As a percentage of weight in the pod, groundnuts yield 35 percent crude oil and 42 percent presscake (Government of Senegal 2003a).

Without detox 25,000 tons CFAF 110,250	x	2,756,250,000	18,921,656,250
<i>Difference</i>			187,702,830,000
D. Net present value			138,230,347,500

Source: Author.

Notes:

a The present value is derived by discounting over 10 years at 7.5%. The chosen discount rate reflects the cost of financing in this segment of the subsector. This is the rate at which CNCAS lends to farmers.

b The author starts from the assumption, derived from their inquiries of SONACOS, that, without detoxification, it would be impossible for Senegal to sell more than 25,000 tons of groundnut cake annually in export markets.

7.2. Edible Groundnuts

In this subsector, the author must consider all segments of production: cultivation, processing, and laboratory testing. Crop collection is done not by private operators, as in the oilseed groundnut subsector, but by agents employed by NOVASEN itself.

7.2.1. Cultivation Segment

It is at the level of agricultural production that the situation is most critical. Quality management during this phase would significantly reduce the possibilities for contamination in the later phases. As mentioned in the preceding section, contamination can be reduced to its simplest expression by following a number of cultivation practices. Here the author is concerned with measuring the costs and benefits of adhering to the recommended steps and timetable.⁹ As in the previous case, the author takes the difference in cash flows between the case in which good practices are observed and the case in which they are not.

⁹ These costs and benefits have been determined on the basis of discussions with NOVASEN and the Department of Agriculture.

The costs associated with observing good cultivation practices are (table2):

- Purchase of pedigreed seed. The price per ton of pedigreed seed is CFAF 190,000, vs. CFAF 138,000 for ordinary seed.
- Treatment of the seed with granox: CFAF 22,125 per ton.
- Deep phosphate treatment: 500 kg per ha at a cost of CFAF 23 per kg, for all crops. The last deep phosphating operation occurred in 1999 and was carried out by the Senegalese government. For quality cultivation, the author assumes that NOVASEN performs deep phosphate soil treatment every three years and passes the cost on to the producers.
- Fertilizer: 150 kg per ha at CFAF 106 per kg, vs. 36 kg per ha currently.
- Crop density: 160 kg per ha, vs. 200 kg per ha currently.
- Mean yield: 1.5 tons per ha, vs. 1.2 tons currently. The author can estimate production from yield per ha.
- Supervisory labor: one extension agent per 300 ha, vs. one per 1,200 ha currently. The agents are paid CFAF 1,200,000 per year on average.
- Field labor: the field labor requirement to meet the recommended timetable is 30 percent greater than the normal practice, which is estimated at 31 person-days per ha at a cost of CFAF 1,000 per person-day.
- Price differential (to the producer): CFAF 35 per kg between premium grade (top quality) and grade B (lowest quality).

Table 2: Values from the cultivation segment (CFAF)

	<i>Value per year</i>	<i>Present value (CFAF)</i>
A. Cost		
<i>With good cultivation practices:</i>		
Deep phosphate treatment (every 3 years): 0.5 tons x 60,000 ha ^a x CFAF 23,000	690,000,000	
Seed: 0.16 tons ^b x 60,000 ha x CFAF 190,000	1,824,000,000	
Supervisory labor: (60,000 ha/300 ha) x CFAF 1,200,000	240,000,000	
Field labor: 40 person-days x 60,000 ha x CFAF 1,000		
Granox: 9,600 tons x CFAF 22,125	2,400,000,000	
[How was 9,600 derived, using "fertilizer" assumption? No the assumption on fertilizer: 0.16 (160 kg per ha) tons x 60,000 ha Fertilizer (with different cost) not included in computations? Does include the cost of fertilizers: 150 kgf x 60000 ha x 106 f = 954,000,000]	221,400,000	
Total (without phosphate treatment)	The total changes accordingly 4,685,400,000	33,739,851,000 ^c (including phosphate)
<i>Without good cultivation practices^d</i>	60,000,000	

+ 1.2 tons x 60,000 ha x 10% x CFAF 128,000 (how were the prices derived? idem)		
<i>Difference</i>		
C. Net present value		48, 223,718,100

Source: Author

Notes:

a Author assumes 60,000 ha under cultivation. Figure corresponds approximately to the observed situation in years of good harvests of edible groundnuts.

b Following the crop density for good cultivation practices, 160 kg of seed are needed for each ha. Currently, 200 kg of seed are used for each ha.

c The present value is derived by discounting over 10 years at 7.5%. The chosen discount rate reflects the cost of financing in this segment of the subsector. This is the rate at which CNCAS lends to farmers.

d The author starts from the assumption, derived from their inquiries of SONACOS, that, without detoxification, it would be impossible for Senegal to sell more than 25,000 tons of groundnut cake annually in export markets.

e When recommended technical practices are followed, it is reasonable to assume that 90% of the harvest is premium grade, and 8% is classified as grade B.

f Practically no premium-grade edible groundnuts have been produced since 1995–96. Furthermore, estimates are that only 66% of the groundnuts delivered from farmers to NOVASEN are grade A; 10% of the remainder is sent for crushing to make oil; the rest is scrapped as waste.

7.2.2. Processing Segment

At NOVASEN's processing plants, most of the necessary equipment is already in place. The company just needs to increase storage capacity to avoid the long waiting lines at delivery, which prolong the time that the groundnuts spend in the seccos, losing even more of their quality.

To increase storage capacity, investments are needed for a conveyor belt to store groundnuts in higher piles and a scalping machine. To these must be added the expenses incurred at the ITA laboratory for measuring aflatoxin content (table 3).

On the benefit side, still starting from the assumption of 60,000 tons (has this been previously discussed? If not, please explain why 60,000) of groundnuts in the pod with a reject rate of 10 percent (kernels that do not meet the technical specifications for edible groundnuts), the author gets 37,800 tons (60,000 tons x 90 percent x 70 percent – please explain 70 percent the whole peanut is constituted of 70% grain and 30% hull) of dehulled groundnuts.

The author assumes that, after the various sorting steps, the author is left with 36,000 tons (37800 x 95 percent) of kernels that meet European standards. This is 26,000 tons more than NOVASEN has been able to export as edible groundnuts in years of favorable conditions. The sorting culls that go to the crushing plant will amount to 6,090 tons (37,800 tons x 5 percent + 60,000 tons x 10 percent x 70 percent).

Last, the author assumes that NOVASEN gets 40 percent crude oil and 60 percent presscake from the sorting culls. These figures equate to 2,436 tons of oil and 3,654 tons of cake. The nondetoxified cake is sold at CFAF 110,250 per ton (30 percent less than SONACOS's detoxified cake). The unrefined oil is sold at CFAF 390,000 per ton (ASPRODEB 2002). The edible groundnuts that meet European standards can be sold at CFAF 360,000 per ton, according to CIRAD (2002), for the grade that Senegal exports (60–70 kernels per ounce).

Table 3: Values from the processing segment

	<i>Value (CFAF) per year</i>	<i>Present value (CFAF)</i>
Costs:		
Conveyor belt	20,000,000	
New scalping machine	100,000,000	
	120,000,000	111,600,000 ^a
Additional expenses for measuring aflatoxin content: ^b (14000+18000) x 3 x 300	28,800,000	197,712,000
Total additional costs		309,312,000
<i>With good practices:</i>		
Exports of edible groundnuts CFAF 360,000 x 36,000 tons	12,960,000,000	
Exports of unrefined oil CFAF 390,000 x 2,436 tons	950,040,000	
Exports of groundnut cake CFAF 110,250 x 3,654 tons	402,853,500	
Total exports	14,312,893,500	98,258,013,877
<i>Without good practices: ^c</i>		
Please explain why the year 1995 (the reference here was 1999 not 1995, we took this year because the quantity of harvested CG was the most important in that year for the five last year if we start from 2003, and in 1999, out of the 58.000 CG harvested, only 2810 tons could be exported, so 2810 is the maximum we can consider for exporting in the situation without was used	944,160,000	
	1,771,156,800	
	5,070,000,000	
	7,785,316,800	53,446,199,832
		44,811,814,045

for 'without good practices', and why 'production' (not exports) was used Production of edible groundnuts (2,810 tons) Exports of cake (18,900 tons) Exports of unrefined oil (13,000 tons) Total		
Difference		
Net present value		44,502,502,045

Source: Author.

Notes:

a Author assumes 60,000 ha under cultivation. Figure corresponds approximately to the observed situation in years of good harvests of edible groundnuts.

b Assumptions:

(i) CFAF 14,000 per batch for aflatoxin B1; CFAF 18,000 per batch for the sum of the four types (B1+B2+G1+G2).

(ii) To meet European standards, one must consider 3 x 10 kilograms per batch. The author assumes that there are 300 batches per year of edible groundnuts.

c The benchmark year used was 1999, when the volume of groundnuts processed was 58,000 tons, the highest figure of the past 5 years.

7.2.3. ITA Laboratory

As noted in the preceding section, this lab performs several kinds of analyses, on cereals as well as on edible groundnuts. The author will consider here only the portion of the lab's activity relating to edible groundnuts.

Table 4 presents the incremental total investment required to test for aflatoxin. Investment includes the acquisition of an HPLC line and incidental equipment, and the training of staff on the European standards and the preparation of a manual of procedures. If the total investment is set against revenue from the analyses (CFAF 197,712,000), exclusive of the lab's other activities, the resulting deficit is a present value of CFAF 550,573,000.

Table 4: Values for laboratory procedure (CFAF)

	<i>Value</i>	<i>Present value</i>
Investments:		
HPLC line and other equipment	40,000,000	
Staff training, preparation of manual	60,090,000	
	100,090,000	748,285,000
	correct	
	Please check	
Total		197,712,000
	Present value can be changed accordingly	-50,573,000
Revenue from laboratory analyses		
Deficit		

Given that the lab has a public service mission, this deficit is understandable and should be charged to the cost of managing the “Product of Senegal” label for edible groundnuts in Europe.

In summary, the aggregate benefit of implementing best practices throughout the production chain to ensure that edible groundnuts meet European standards is CFAF 65,938,921,138 (may have to be adjusted). The present value of the aggregate benefit for both the edible groundnut and detoxified groundnut cake subsectors is CFAF 204,169,268,638.

Conclusion

In this document, the author considered the problem of quality management in the groundnut sector in Senegal. Production of groundnut oil for export is a relatively long-established activity in Senegal, dating from the beginning of the nineteenth century. Production of edible groundnuts is more recent, dating from the early 1970s. The latter crop soon experienced major difficulties (declining area under cultivation and output), which led the government to privatize it in 1990. Since then, NOVASEN, which is a private export

processing enterprise required to sell at least 80 percent of its production in foreign markets, has had control of practically the entire edible groundnut subsector. After a fairly short period of expanding production, which at one point attained 10,000 tons of exports to Europe, the company has had a great deal of difficulty achieving even 1,000 tons of exports in recent years. The reasons for this 90 percent drop seem to be closely related to the decline in output and yields in the entire sector, which affects both edible groundnuts and oilseed groundnuts. This decline has been so pronounced that no one hesitates to speak of a groundnut crisis.

Government policy in the sector has moved from a phase of marked intervention to a phase of liberalization, which began in the 1990s with the support of the European Union. However, this wave of reforms has not arrested the declining trend in the sector. Indeed, the trend has continued become even steeper in recent years, with the notable exception of the 2000 and 2001, when ample rainfall sharply increased production. The new directions of government policy in the sector call for further withdrawal by the state, which will increasingly confine itself to public service missions, and giving greater responsibility to the industry-wide association.

The world market for oilseeds is large and growing, especially for groundnut cake and edible groundnuts. The main difficulty that Senegalese products run up against in foreign markets, in Europe, particularly, is product quality in regard to aflatoxin standards. In principle, aflatoxin is not a contaminant of the unrefined *oil* that Senegal exports because any toxin present in the groundnuts is entirely eliminated from the oil in crushing. Senegalese *groundnut cake* undergoes a detoxification process that reduces its aflatoxin content to a level that easily meets the European standards. The problem is primarily with *edible groundnuts*, for which the standards are stricter, and Senegal seems to have more difficulty meeting them. The contamination of the edible crop occurs

mainly in the field, and it can be reduced dramatically by strict application of good cultivation practices.

The author performed a cost/benefit analysis to evaluate the net gain that could accrue to each of the three subsectors from a production process that meets quality standards. The author found that the present value of the net benefit of production that meets standards is CFAF 138 billion for SONACOS's groundnut cake and CFAF 92 billion for edible groundnuts. This benefit is explained by the higher prices fetched by higher-quality products and by the possibility of selling greater quantities when products meet the quality standards of increasingly demanding markets.

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