

Senegal Fertilizer Assessment

In Support of
The African Fertilizer and Agribusiness Partnership



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List of Acronyms

AFAP	Africa Fertilizer and Agribusiness Partnership
AfDB	African Development Bank
AGMARK	Agricultural Market Development Trust
AGRA	Alliance for a Green Revolution in Africa
ALT 2000	[Senegal’s Post-2000 Alternative Political Regime]
ARMP	Autorité de Régulation des Marchés Publics
AU	African Union
CAADP	Comprehensive Africa Agriculture Development Program
CPSP	Caisse de Péréquation et de Stabilisation des Prix
CFA	Communauté Financière Africaine (Franc/currency)
CIF	(c.i.f.) Cost, Insurance and Freight
CNCAS	Caisse Nationale de Credit Agricole du Senegal
CREI	Cour de Répression de l’Enrichissement Illicite
CSPT	Compagnie Senegalaise des Phosphates de Taiba
DAP	Diammonium Phosphate
DSRP	Document de Stratégie de Réduction de la Pauvreté
DA	Director of Agriculture
ECOWAP	Economic Community of West Africa Agricultural Policy
ECOWAS	Economic Community of West African States
FAOSTAT	Food and Agriculture Organization Statistical Databases
FO	Farmers’ Organization
FTF	Feed the Future (USAID initiative)
GDP	Gross Domestic Product
GoS	Government of Senegal
ha	hectares
ICS	Chemical Industries of Senegal
IFFCO	Indian Farmers Fertilizer Cooperative Limited
IFDC	International Fertilizer Development Center
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
ISRA	Institut Sénégalais de Recherches Agricoles
LOASP	Loi d’Orientation Agro-Sylvo-Pastorale
MAER	Ministère de l’Agriculture et de l’Equipement Rural
MDG	Millennium Development Goal

MDR	Ministère du Développement Rural
MoA	Ministry of Agriculture
MOP	Muriate of Potash
mt	metric tons
NAP	New Agricultural Policy
NAIP	National Agriculture Investment Plan
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organization
NWAFD	[IFDC] North West Africa Fertilizer Division
OFNAC	Office National de Lutte Contre la Fraude et la Corruption
ONCAD	Office Nationale de Coopération et d'Assistance au Développement
OP	[IFDC] Office of Programs
PASA	Programme d'Ajustement du Secteur Agricole
PMIA	Projet de Modernisation et d'Intensification Agricole
PNVA	Programme National de Vulgarisation Agricole
PPP	Public-Private Partnerships
PSAOP	Programme des Services Agricoles et Organisations de Producteurs
PSE	Plan Sénégal Emergent
RAIP	Regional Agriculture Investment Plan
SATEC	Societe d'Aide Technique et Cooperation
SEMAC	Société Senegalaise de Marchandises Diverses et de Céréales
SEPAC	Société d'Exploitation des Produits Agricoles et Chimiques
SENCHEM	Société de Commercialisation des Productions des Industries Chimiques du Senegal
SNDES	Stratégie Nationale de Développement Economique et Social
SODEFITEX	Société de Développement des Fibres Textile
SODEVA	Société de Développement et de Vulgarisation Agricole
SONAGA	Societe Nationale de Garantie
SSA	Sub-Saharan Africa
SSP	Single Superphosphate
TSE	Tractor Service Equipment
TSP	Triple Superphosphate
UEMOA-AP	West African Economic and Monetary Union Agricultural Policy
USAID	United States Agency for International Development
WAFP	[IFDC] West Africa Fertilizer Program
WB	World Bank

Executive Summary

For Senegal to achieve the goals of accelerating agricultural sector productivity and addressing poverty, food insecurity and malnutrition as stated in the National Agriculture Investment Plan (NAIP) in line with the Comprehensive Africa Agriculture Development Program (CAADP) framework and the millennium development goals (MDGs), it is important to encourage adoption of relevant soil fertility management technologies and practices in order to raise production for smallholder farmers.

This report explores fertilizer markets and provides estimates of the levels of fertilizer consumption required to achieve the NAIP agricultural growth targets, analyzes the challenges in the fertilizer supply chains and recommends policy reforms to improve fertilizer markets. Results from the estimation indicate that Senegal must increase its consumption of fertilizer almost threefold, from the current annual level of 87,000 metric tons (mt) to 239,400 mt of fertilizer products, in order to meet the agriculture sector growth targets. This requires some changes in the current supply chain in order to accommodate larger volumes of fertilizers.

The fertilizer value chain in Senegal faces a number of challenges that need to be tackled in order to bolster fertilizer consumption and raise agricultural productivity. Perhaps the major challenges are related to the implementation of the current fertilizer subsidy. Demand-side constraints include knowledge, research and extension. To encourage use of fertilizer requires improvements in financing, logistics and research, extension services, and building the capacity of agro-dealers and farmers. Due to its landlocked location, fertilizer imports into Senegal traverse neighboring countries with overland transport transactions and storage costs, adding to retail price levels. Good roads and rail network can encourage private investment in businesses and services in the rural markets such as food processing plants, which will provide a pull factor for increased demand for fertilizer. In addition, the enactment and implementation of fertilizer laws and regulations with necessary enforcement capacity is expected to create a conducive environment to attract private investment and increased access to fertilizer by farmers.

Senegal Fertilizer Assessment

1.0 Introduction

This study will provide an overview of the agricultural sector in Senegal, summarize key policy elements as related to agriculture, describe the fertilizer markets in Senegal, estimate the fertilizer requirements to meet the national development goals in National Agriculture Investment Plan (NAIP) and provide recommendations for improving the fertilizer markets and raising agricultural productivity. This report will draw on previous literature on Senegal, including Fuentes et al. (2011), and on data and information collected during in-country rapid assessment in March 2014, which included interviews with the main market players (private importers, manufacturing/blending plants, distributors, representatives of banking institutions, research, customs, port, ministry of agriculture, etc.).

The rest of this report is organized as follows: a review of agricultural policies (Section 2); the current fertilizer value chain is presented in Section 3, including a description of the market structure, main actors and the government subsidy program; Section 4 looks at the main bottlenecks in the supply chain, followed by policy recommendations to address these constraints in Section 5.

1.1 Overview of Agriculture Sector

Senegal is located in West Africa with approximately 13 million people (preliminary results of 2013 census) living on 196,000 km² of land. Its economy is agriculture-based; at least 60 percent of its total active population is employed in the sector, mostly organized as family farms.

Though there has been a significant increase in agricultural funding between 1998 and 2013 (CFA 41 billion to CFA 134 billion), the sector's contribution to GDP declined from 10 to 8 percent during this period. With increasing population and declining land per capita, agricultural productivity holds the key to feeding the urban and rural population in Senegal. The Ministry of Agriculture (MoA) is working to achieve this goal by striving to fulfill its functions:

(a) improve food security, (b) increase foreign exchange earnings, (c) raise incomes for rural people, (d) create skilled and remunerative jobs for youth, and (e) preserve the resource base and environment.

1.2 Evolution of Agricultural Policies

Diagana et al. (2008) breaks policy evolution in Senegal into two distinct trends – 1960-80 and post-1980. The former is labeled “all state,” characterized by state intervention in the economy, and the latter period as the era of structural reforms and liberalization, what Hugon (1991) calls “less or better state.”

During the period 1960-80, the state controlled agricultural activities directly or through state-run agencies or parastatals and cooperatives (Dieng, 2007). These interventions took several forms:

- a. Setting pan-territorial prices for cash crops (peanut and cotton) and cereal crops through the CPSP (Gaye, 2000; Kelly et al., 1996; Gaye, 1994; Martin and Crawford, 1987; Martin and Dieng, 1986; MDR, 1986; MDR, 1977).
- b. Provision of agricultural inputs as subsidy and with credit repayment arrangements. Low loan repayments led to termination of this program (Gaye, 2000; Kelly et al., 1996).
- c. Investment in rural infrastructure – roads, warehouses, water wells – as well as encouraging processing through state agencies like ONCAD and SONAGA (Gaye, 2000).
- d. Research and extension to promote animal traction, fertilizer use, seed adoption (SATEC, SODEVA) and agricultural research development.

Toward the end of the 1970s, the Government of Senegal (GoS) faced huge fiscal deficits from these public interventions. This – combined with low economic growth, the 1973 oil crisis and the mid-1970s drought – ushered in profound structural reforms.

The post-1980 period was accompanied by policy reforms toward liberalization. The era of SAPs by the World Bank (WB) and International Monetary Fund (IMF) led to phasing out of state intervention by divesting from public enterprises and allowing for private-sector participation in markets. The state continued to administer the cereal and cash crops but allowed a parallel private sector under a liberalized price regime (MA, 1994; MA, 1998a; MA, 1998b; Gaye, 2000).

Important and significant milestones in the liberalization of the Senegalese economy were: (a) the implementation of the New Agricultural Policy (NAP) and the creation of the National Agricultural Credit Bank (CNCAS) in 1984, (b) the creation of the Cereal Plan in 1986, (c) the 1994 currency devaluation, and (d) the 1995 Agricultural Sector Adjustment Program (PASA). The government tightened credit provision to farmers and terminated the subsidy program which led to reduced fertilizer use and area planted (Gaye, 2000; MDR, 1995).

This period saw increased drilling of wells and access to water in rural areas, and PMIA was launched to stimulate agricultural investment through access to credit (Gaye, 2000). Research and extension has mostly been in support of managing the natural resources through improved farming practices using demos and visits funded by the WB and other development partners. The WB funded the PNVA program for dissemination of improved farming practices and PSAOP to strengthen institutions like farmers' organizations.

The period following 2000 has been a mix of private-sector and government intervention including subsidies (Box 1). The focus of the state has morphed as peanut crops have seen reduced acreage and production while that of cereals has gone up (Figure 1 & 2).

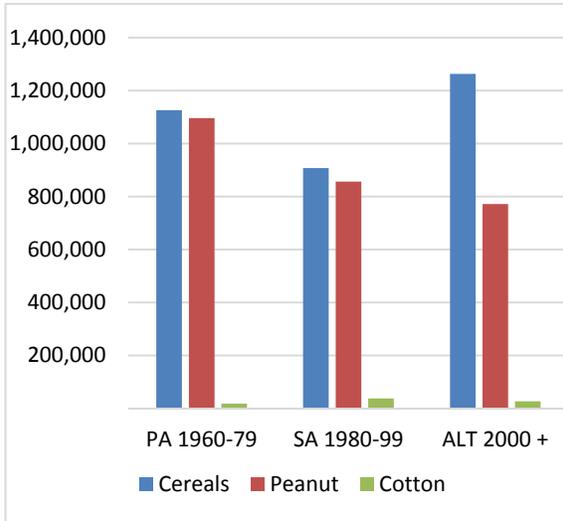
Box 1. Public Intervention in Agriculture

State-run agricultural sector (1960-1980): controlled prices, socialist orientation.

Structural adjustment and open market (1980-2000): (reforms under NPA, PASA, etc.) with new forms of intervention marked by shrinking role of State and emergence of the private sector, liberalization of markets (especially cereals), free prices, and eliminated subsidies.

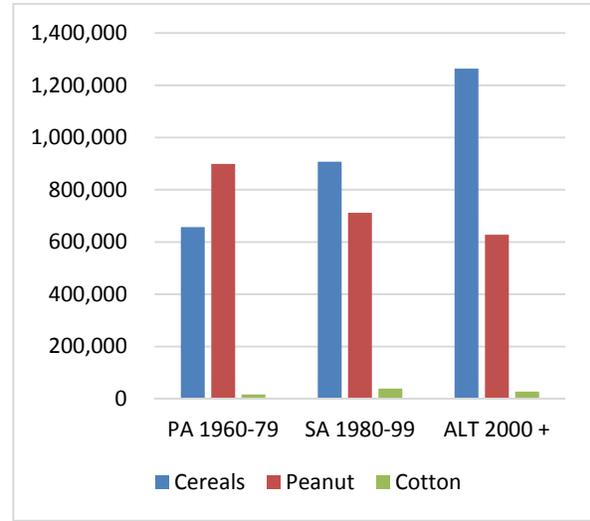
A mix of reforms and state intervention (from 2000): market regulatory agencies, important public resources devoted to agriculture and return to subsidies.

Source: Adapted from Dièye, 2008; Faye, 2008.



Source: crop statistics compiled from various sources.

Figure 1. Area (ha) of Main Crops: 1960-2010



Source: Crop statistics compiled from various sources.

Figure 2. Production (mt) of Main Crops: 1960-2010

1.3 Current Agriculture Sector Policies

Senegal has committed and signed onto continental and regional policy initiatives under the African Union (AU) umbrella. The Maputo Summit of African Heads of States in 2003 culminated with a commitment for all African governments to allocate at least 10 percent of their national budgets to agriculture. This was then followed by the *Abuja Declaration* in 2006 by African Heads of State to declare fertilizer a strategic commodity and therefore called for removing custom duties and other taxes for fertilizer imports and increase the level of fertilizer use to 50 kg/ha by 2015.

At the regional level, the Economic Community of West African States (ECOWAS) formulated a regional agricultural policy (ECOWAP), which was validated as the framework to implement the CAADP. Associated with this policy are the Regional Agriculture Investment Plan (RAIP) and NAIPs of the constituent countries. The Senegal NAIP estimates that the agriculture GDP will grow at an annual average rate of 6.7 percent during the 2010-2020 period. The RAIP includes an agriculture intensification component that consists of implementing a set of actions to facilitate input access (fertilizer and improved seeds), among other programs. Concurrently, among francophone countries, it is the common Agricultural Policy of the West African Economic and

Monetary Union (UEMOA-AP), with convergent objectives and comparable axis of intervention as the ECOWAP.

At the national level, the new 2012 government set in motion a regulatory framework to ensure good governance fighting corruption through specific institutions (ARMP, CREI, OFNAC, etc.). On the economic side, the newly approved Plan for Senegal Emergence (PSE) follows a stream of strategic initiatives (DSRPII 2002, SCA 2006, LOASP 2004-24, SNDES, etc.) over the last decade to accelerate economic growth, mostly in the agricultural sector to fight food insecurity, alleviate poverty and reduce unemployment, especially for youth, etc.

There are a number of programs or initiatives to raise agricultural productivity through intensification, centered on providing modern input packages that are accessible to farmers. Fertilizer products constitute a central piece of these packages and, as shown in the section below, specific efforts have been made and significant resources invested through programs and projects to secure their availability and improve their accessibility to Senegalese farmers for increased use.

2.0 Overview of the Senegal Agriculture Sector

Total arable land is estimated at 3.9 million hectares (ha), out of which 78 percent (about 3.05 million ha) is arable land, equivalent to 0.3 ha per capita. Production is dominated by millions of small-scale farmers on farms of 0.5-1.5 ha, down from 1.5-2.4 ha in the early 1990s.

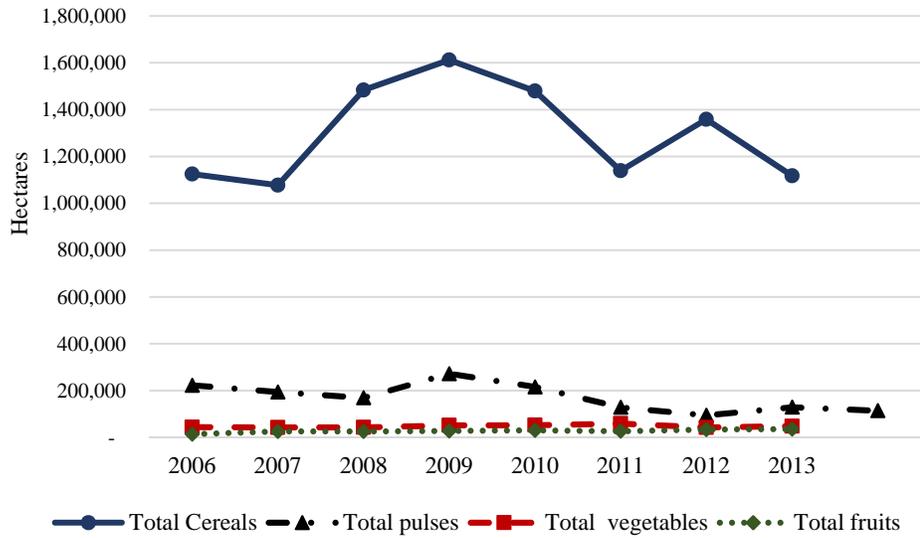
The main agriculture activities are for the production of food crops (millet, sorghum, maize, rice and fonio), commercial/export crops (peanuts, cotton and sesame), pulses or legumes (cow peas), and vegetables dominated by tomato production. Others include fruits (bananas, oranges, mangoes, etc.).

Table 1. 2008-2012 Average Crop Areas, Production and Yields in Senegal

Crop	2008-2012 Averages			Crop Area as Percentage of Total Area for All Crops
	Production	Area	Yield	
	(mt)	(ha)	(mt/ha)	
Maize	246,530	155,991	1.5	5.8%
Rice, paddy	477,393	128,253	3.7	4.8%
Sorghum	176,927	197,119	0.9	7.4%
Millet	681,160	927,339	0.7	34.6%
Fonio	2,444	3,688	0.6	0.1%
Other cereals	3,697	5,864	0.6	0.2%
Total Cereals	1,585,707	1,414,566	1.1	52.8%
Cow peas, dry	69,011	167,974	0.4	6.3%
Other pulses	93	158	0.7	0.0%
Total Pulses	69,104	168,132	0.4	6.3%
Mangoes, guavas, others	109,000	16,765	6.5	0.6%
Oranges	41,000	6,820	6.0	0.3%
Bananas	38,800	1,686	23.2	0.1%
Other fresh fruits	24,148	5,577	5.3	0.2%
Total Fruits	212,948	30,847	6.9	1.2%
Cassava	359,198	50,308	7.1	1.9%
Vegetables	683,067	50,799	13.6	1.9%
Peanuts	781,888	912,895	0.9	34.0%
Cotton	31,490	30,529	1.0	1.1%
Sesame	10,618	23,355	0.5	0.9%
Total Commercial Crops	823,996	966,779	0.9	36.1%
Totals	3,734,020	2,681,431		100%

Data Source: ISRA, MAER and FAOSTAT.

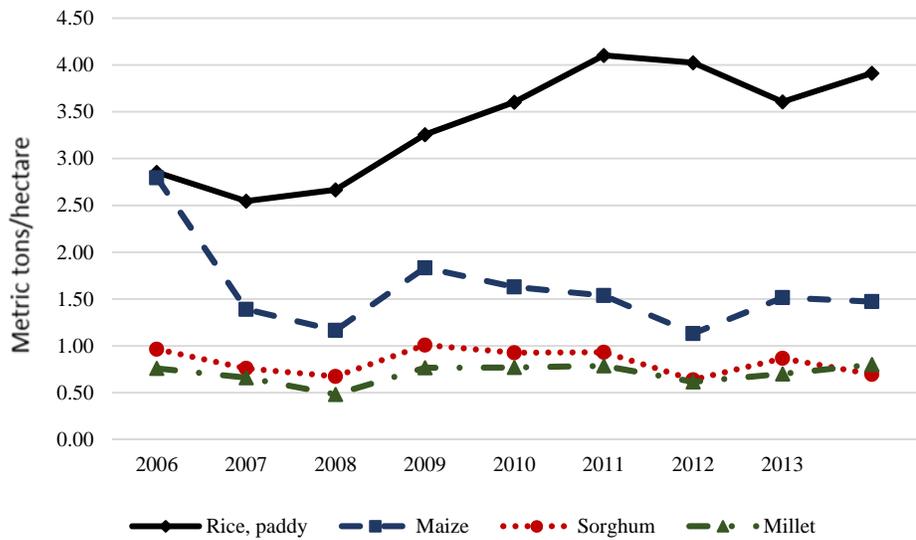
Cereals account for a significant part of planted area (Table 1) followed by commercial/export crops and pulses. Within the cereal group, area under millet is the largest. After 2006, there was significant increase in planted area under cereals (Figure 1) and production, which declined in 2009 due to drop in area planted (Figure 3).



Source: MAER and FAOSTAT, 2014.

Figure 3. Evolution of Crop Groups Planted and Harvested Areas

Average group crop yield trends for cereal crops are presented in Figure 4.



Source: ISRA, MAER and FAOSTAT, 2014.

Figure 4. Evolution of Cereal Crops Yields

3.0 The Senegal Fertilizer Market

3.1 Legal and Regulatory Framework

Senegal lacks a defined national policy on fertilizer other than a mining code set by decree at the level of the Ministry of Agriculture and Rural Equipment (MAER) (Fuentes et al., 2011). The country has not developed a legal framework to control and regulate the fertilizer market, but it has adopted and drawn upon ECOWAP regulations and aims at creating a legal environment under which quality fertilizers can be produced or imported and traded and building capacity at the regional and national levels to enforce the regulations.

An inter-ministerial committee was formed in 2007 to monitor fertilizer imports and quality. A recent IFDC report on the quality of fertilizers traded in West Africa recommends the need for improved controls and increased capacity for the National Fertilizer Committee to fulfill its assigned functions. The USAID-funded West Africa Fertilizer Program (WAFP), implemented by IFDC, is working with ECOWAS on these issues of capacity building, enforcement of adopted regulations, establishment of the baseline situation and assessment of the impacts of adopted and implemented regulatory frameworks.

3.2 Trends in the Domestic Fertilizer Market

3.2.1 Production and Exports

Senegal is one of the major phosphate producers in the West African region with main deposits in Taïba and Thies Lam Lam; therefore, most of its exports are phosphate-based products and other NPK formulations/blends. These phosphate deposits have been exploited by the parastatal Compagnie Senegalaise des Phosphates de Taïba (CSPT), created in the late 1950s. Output of the Taïba mine is estimated at 2 million mt of commercial phosphate per year, with reserves estimated at more than 100 million mt. In 1976, GoS created the Chemical Industries of Senegal (ICS) for manufacturing phosphoric acid out of the phosphate rock mined by CSPT to be used in the processing and production of soluble compound fertilizers such as diammonium phosphate (DAP), single superphosphate (SSP), triple superphosphate (TSP) and NPK complex formulations for export. Fertilizer production was done at the ICS Mbao factory located near

Dakar, which had a production capacity of 250,000 mt per year, making it the largest manufacturing unit of phosphoric acid and fertilizer in West Africa at the time.

In the late 1980s, ICS created SENCHIM as its subsidiary for marketing its produced fertilizer formulations in the domestic and international markets. In efforts to transfer part of the subsidy received from GoS, ICS provided the product to SENCHIM at cost or at a price below market price to allow it to make profit and maintain its operations. In the 1990s, while the Senegalese government was reducing its intervention in the agriculture sector, ICS-SENCHEM remained the principal parastatal entity for production and marketing of fertilizer. In the early 2000s, ICS suffered serious financial problems attributed (Fuentes et al., 2011) to inefficiencies in the production process, poor management and losses in the SENCHIM private fertilizer distribution system as a result of marketing procedures that minimized costs. These caused a deficit of more than CFA 70 billion (U.S. \$151.8 million) by 2006 – affecting production and revenues and threatening its survival.

3.2.2 Imports and Consumption

Despite Senegal having a natural resource base for producing fertilizer (mainly phosphate rock), the country imports the bulk of fertilizer it consumes, while its resource base is being used to produce intermediate products such as phosphoric acid (P_2O_5) for production of compound fertilizers and exports.

A noteworthy issue related to fertilizer import and export data is the discrepancies in figures across data sources; though the exhibited trends across data sources are almost similar, absolute levels are very different. This raises a critical question of the dearth of reliable data in the agricultural sector, especially on input import, use and exports, and problems of different sources providing differing estimates for the same measure.

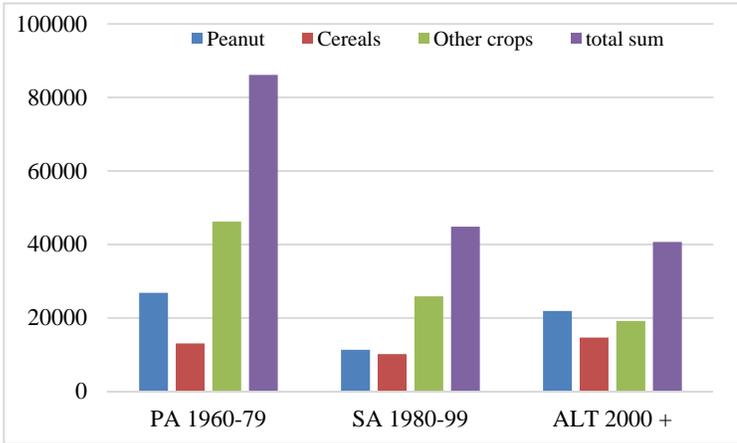
Imported fertilizers, mostly non-phosphates, are blended with local fertilizer products for use on export crops, including peanuts, cotton, sugarcane, sesame, horticultural crops and cereals (rice, corn, milo and cassava). Fertilizer use dropped when the government liberalized the sector and continued after 2000 as a result of various external economic factors such as the cotton crisis in

the late 1990s and early 2000s and the 2007-08 fertilizer crises in spite of the government subsidy on fertilizer (Table 2 and Figure 5).

Table 2. Average Fertilizer Consumption (mt)

Period	FAO	National
1961/1970	31,885	68,946
1971/1980	56,882	99,910
1981/1990	26,784	55,791
1991/2000	42,192	33,870
2001/2013	49,668	38,205

Source: FAO 2008 study in Dieme and Ndour, 2013.

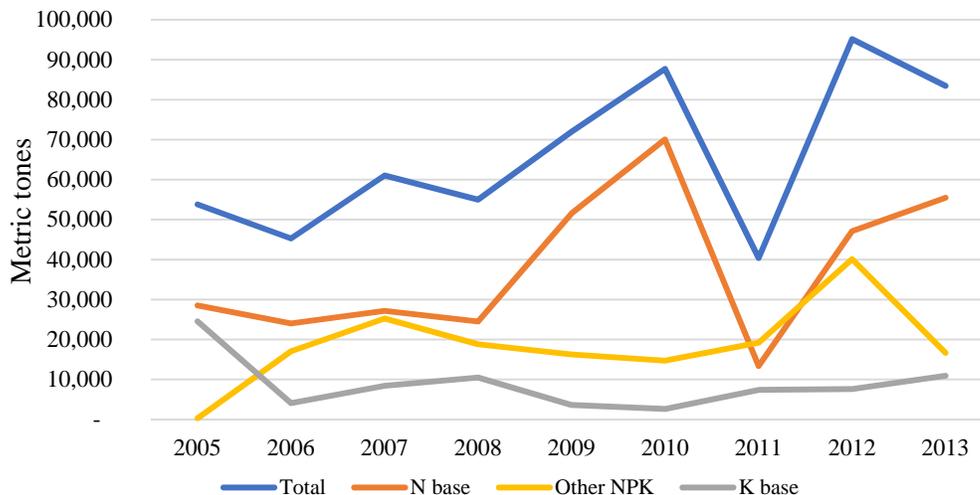


Source: Compiled from various national sources.

Figure 5. Fertilizer Consumption (mt) by Crops and Policy Era by Decade and Data Source

Fertilizer consumption has declined from around 80,000 mt in the 1960s to 60,000 mt in 2009 compared with the potential demand of 120,000 mt with state subsidies (Fuentes et al., 2011). Since 2005, imports of fertilizer and area under crops (Figure 6) have been following a similar trend dominated by nitrogen products.

Most of the fertilizer imported during this period was used on cash and commercial crops and, to a lesser extent, corn production for industrial/commercial purposes.

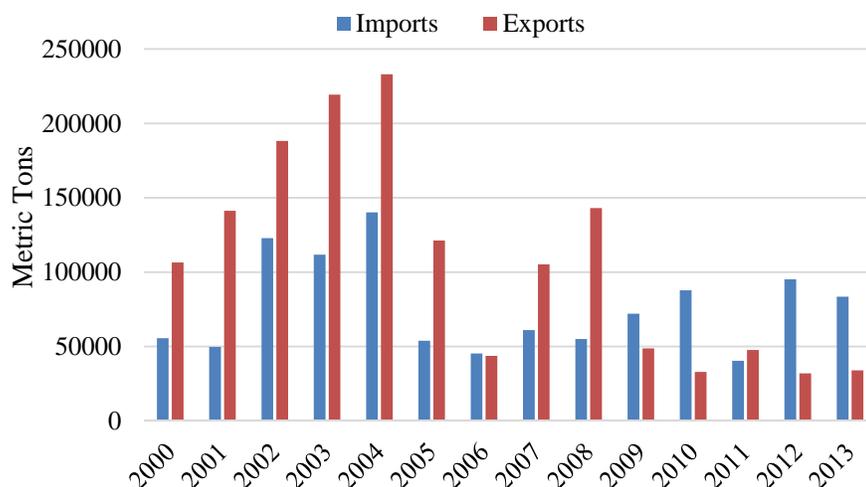


Source: ISRA, MAER and FAOSTAT, 2014.

Figure 6. Evolution of Fertilizer Import in Senegal, 2005-13

It is important to note that it is difficult to get a clear estimate of domestic consumption in Senegal since there is a significant export of fertilizers from the country.

Figure 7 depicts the trend in fertilizer exports and imports during the last decade. Trends show 2004 as a break year. Between 2000 and 2004, exports by ICS increased steadily to more than 230,000 metric tons while imports also increased to more than 140,000 tons. After 2004, export levels fell sharply and hit a low in 2006 and then stabilized after reaching another peak in 2008. The sharp decline in exports was the result of the GoS removal of a subsidy to the manufacturing industry and ICS financial problems. A reduction on exports from ICS implied a reduction in production even for local consumption, which was compensated in part by increases in importation after 2006. The bulk of ICS exports include products such as phosphate products, potassium chlorite, urea, etc., while urea, ammonium sulfate, potassium chlorite and NPK fertilizers are imported to cover needs of the domestic market and neighboring countries as well, especially Mali through Toguna Agro-industries.



Source: Statistics compiled from various sources.

Figure 7. Fertilizer Imports and Exports in Senegal (tons)

Table 3 below shows the quantities and type of fertilizer used by crop and sub-sector and subsidy regimes for the crop season 2008-09. The quantity of subsidized fertilizer represented about 58 percent of the total imports in 2009. This included cotton subsidy, excluding DAP for commercial crops. From these totals, 49 percent represent NPK formulations, 34.5 percent urea, 11 percent DAP and 5.5 percent muriate of potash (MOP).

Table 3. Estimated Quantities of Fertilizer Imported per Crop, 2008-09 Season

		Fertilizer Products										Total/crop
		Crops	Urea	D.A.P.	15 15 15	10 10 20	23 14 14	6 20 10	9 23 30	15 10 10	KCl	
Subsidized products	Groundnuts						12,000					12,000
	Maize	4,500		6,000								10,500
	Mil/ Sorghum	1,000							2,500			3,500
	Tomato	1,500						3,000				4,500
	Others Vegetables	4,000			3,000							7,000
	Rice	7,000	6,000									13,000
	Other crops	2,000	1,000			3,000						6,000
	Sub-total 1	20,000	7,000	6,000	3,000	3,000	12,000	3,000	2,500			56,500
Private consumption	Sugarcane	1,000						2,000				3,000
	Horticulture (Tomato)	4,000	1,000							4,000		9,000
	Sub-total 2	5,000	1,000					2,000		4,000		12,000
Public tender	SODEFITEX	200									4,400	4,600
	Sub-total 3	200									4,400	4,600
Total/fertilizer product		25,200	8,000	6,000	3,000	3,000	12,000	5,000	2,500	4,000	4,400	73,100

Source: Fuentes et al., 2011.

3.2.3 Quantities of Fertilizer Supplied Versus Needed

Table 4 presents quantities of different fertilizer formulations or products distributed over the last five crop seasons under the government subsidy program. Note that fertilizers meant for use on cotton are not included since these are managed under a separate program by SODEFITEX. Over the last five years, urea accounted for an average 34 percent of the total government subsidy, followed by fertilizer formulation for peanut (25 percent) and then for cereals maize (14 percent) and millet/sorghum (12 percent).

Table 4. Fertilizer Distributed in Recent Years Under the Government Subsidy Program

Crop Season	Fertilizer Formulas (mt)							Total
	6-20-10	15-15-15	15-10-10	10-10-20	9-23-30	18-46-0	Urea	
2009/2010	10,788	9,593	2,563	3,000	2,000	0	13,701	41,645
2010/2011	9,130	8,103	3,663	5,000	3,000	0	20,000	48,896
2011/2012	16,500	10,300	9,500	5,700	4,000	0	23,200	69,200
2012/2013	24,000	10,000	13,000	5,000	2,000	0	30,000	84,000
2013/2014	28,000	12,000	14,000	5,000	2,000	2,000	32,000	95,000
5-year average	25%	16%	12%	7%	4%	0.4%	35%	100%

Source: Compiled from MAER/DA notes and reports.

According to MAER estimations for 2011 and 2012 (Table 5), these fertilizer quantities fall short of country consumption requirements. Need coverage is high for vegetables (especially tomato), average for maize and low for the other crops. This observed average coverage rate of 10 percent is not too far off from the 15-20 percent estimation made by the ICS respondent during the March 2014 field visit. Moreover, these figures confirm the low average fertilizer rate use by crop. For the main crops, in terms of area and production, average fertilizer use was estimated over the 1962-2013 period at 19 kg/ha for peanut and 10 kg/ha for cereals.

Table 5. Fertilizer Estimated Needs Versus Distributed in Senegal in 2009, 2011 and 2012

Fertilizer Formulas/Crops	Estimated Area (ha x1,000)	Estimated Fertilizer Needs (ha x1,000)	Application Rate (kg/ha)	Distributed Quantities (ha x 1,000)			Covered Needs (percentage)		
				2009	2011	2012	2009	2011	2012
6-20-10/peanut	1,300	195	150	12	17	24	6	9	12
15-15-15/maize	123	24.6	200	6	11	10	24	45	41
15-10-10/millet sorghum	1,250	187	150	3.5	10	13	2	5	7
10-10-20/other vegetables	-	8	222	4	6	5	50	75	63
9-23-30/tomato	6	2.5	417	4	2	2	160	80	80
Urea/all crops	1,715	285	166	20	25	30	7	9	11
DAP/Rice	-	-	-	7	-	-	-	-	-
Totals		702.6		56.5	71	84	8	10	12

Source: compiled from MAER/DA reports.

3.3 Structure, Conduct and Performance of the Fertilizer Supply Chain

3.3.1 Fertilizer Supply Chain Structure

Up until 2004, ICS and its counterpart SENCHIM captured the manufacturing and marketing of NPK fertilizer in Senegal and the West Africa region. These agencies faced financial constraints and could not supply products, especially DAP and 15-15-15. Consequently, in 2005 the government created an accreditation system for those companies wishing to import and/or distribute fertilizers to farmers under a government tender and authorized SENCHIM-affiliated independent distributors to import fertilizer directly, initiating fertilizer market liberalization. Since then, considerable advances have been made to reform fertilizer markets, giving rise to a private-sector distribution network that has been playing an increasing role in fertilizer importation and distribution. During the last cropping year 2013-14, seven private companies involved in importation and distribution (namely SEDAB Sarl, AGROPHYTEX SA, SEPAC, TSE, MATIX Ets, SEMAC and ECOTRA) shared the bulk of the government fertilizer program.

Despite private-sector participation, the provision of fertilizer continues to be dominated by a government subsidy that is causing distortions in the market and leaving limited incentive for private initiative to expand the market among small farmers who are also beneficiaries of the subsidy. Therefore, the fertilizer supply chain is still characterized by the following:

- The dominance of the GoS annual subsidy program that accounts for most of the fertilizer distributed and used nationwide.
- Few importers and distributors supplying the needed fertilizer products.
- The small size of the market in terms of quantities marketed.
- The involvement of the CNCAS, the national agricultural credit bank, as the only financial institution active in financing the agricultural sector.

3.3.2 Conduct of Key Players

The role of key players depends largely on their participation in the government subsidy program. Each year, the MAER develops the “agricultural program” through its technical offices, in which, based on results from the previous season, it sets production targets for the new season by crop and region and estimates, among other things, the quantities of fertilizer needed. On the basis of this plan, GoS launches the subsidy program through MAER to meet these targets.

3.3.2.1 Subsidy Program: Flow of Fertilizer and Payments

- MAER selects importers/distributors who have participated in tenders before, based on their capacity, bid price and experience. Selected suppliers commit to deliver quantities at agreed prices, as specified in the tender, to areas and locations determined by MAER. GoS provides these suppliers with accreditation letters and guarantee notes that can be used to get financial support from CNCAS bank.
- Total quantities are disaggregated by regions by the MAER Director of Agriculture (DA) and plans sent to its regional office for disaggregation by rural towns or communities. The final plans are sent back to the DA, who aggregates and submits them to selected suppliers with set deadlines and delivery points. Weekly reporting is required from suppliers to monitor timeliness and to identify deficit or surplus zones to initiate stock re-allocation.
- The allocation of subsidy by region and the distribution of fertilizer relies heavily on MAER and its network. MAER, through its regional, departmental and rural committees (consisting of administrative authorities, technical institutions, non-governmental organizations [NGOs], farmers’ organizations [FOs], and women’s and youth groups), makes estimates of regional subsidy needs and then works with suppliers to deliver product at local warehouses managed by the committees. Farmer beneficiaries pay at the warehouse, sign the document and receive

their subsidized fertilizer. The list of recipients with quantities, payment and supplier name is passed on to MAER for verification, and payment of the unsubsidized portion of the price is paid to the supplier.

ICS-SENCHIM, which participates in the tender process alongside private companies, is now operating at less than one-third of its production capacity, estimated at 250,000 mt per year. In an effort to complement its production, ICS-SENCHIM imports raw materials for blending and distribution of NPK products in the domestic market. In 2008, the Indian Farmers Fertilizer Cooperative (IFFCO) Ltd. bought 85 percent of the ICS-SENCHIM shares, effectively taking control since Senegal holds minority shares of 15 percent.

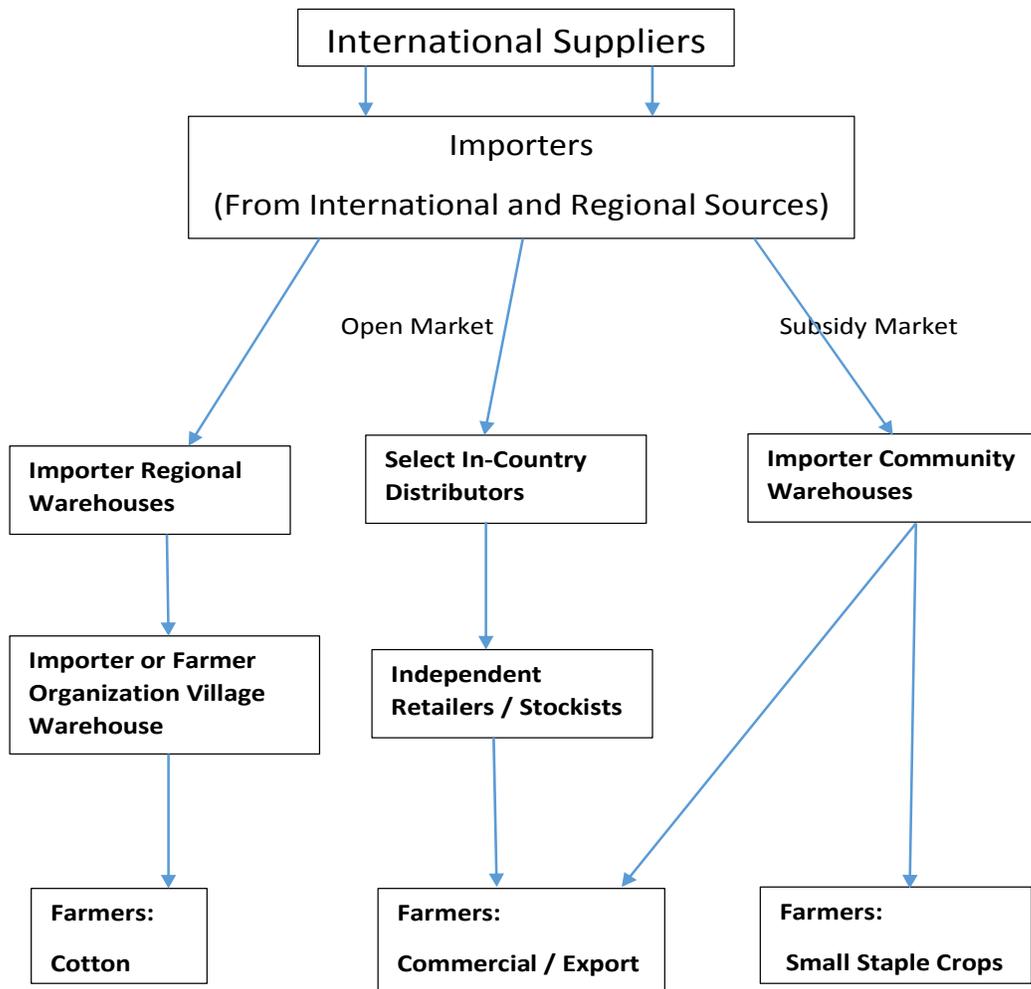
CNCAS plays a dual role in the functioning of the government subsidy program. It provides finances to suppliers to import fertilizers and also gives credit to beneficiary farmers to pay the non-subsidized portion of the fertilizer price. The CNCAS funds committed to this program run into millions of dollars, and interest on loans is subsidized by the state.

Fertilizers that are not subsidized constitute a relatively small market intended for sugarcane, large cotton plantations and horticulture. In 2009, approximately 9,000 mt went to horticultural production while sugar production consumed about 3,000 mt. This open fertilizer market is covered by a number of suppliers (ICS, SEDAP, AGROPHYTEX, Louis Dreyfus Commodities, etc.); in 2012-13, this non-subsidized/open market was estimated at 7,500 tons (Dieme and Ndour, 2013) compared with 84,000 tons supplied under the GoS subsidy program.

3.3.3 Distribution Channels

There are various fertilizer distribution channels in Senegal, depending on whether the fertilizer is being subsidized or not and on the type of crop (staple food crops and cotton) and the farmer type (small/subsistence versus large and commercial farmers). Large farmers and producers of commercial cash and export crops (with the exception of cotton) are not beneficiaries of the subsidy program; instead, they must meet their crop fertilizer needs through private-sector suppliers in the open market, outside the subsidy program. However, the same suppliers serve

both the subsidized and non-subsidized market. Figure 8 depicts the fertilizer distribution structure in Senegal.



Source: Authors.

Figure 8. Senegal General Fertilizer Distribution Structure

The subsidized fertilizer prices in Senegal are not determined in an open market but are the results of a tender process in which the government negotiates a pan-territorial price with providers for each fertilizer product or formulation.

Table 6 presents the evolution of fertilizer prices for the last three years (2011-2013) with the respective retail prices, subsidy rates and farmer's payment. Although the overall 2011-2013

average subsidy rate for all formulations is more than 50 percent, this rate has been decreasing from year to year. The 2013 average per unit subsidy rate for all formulations and crops is around 47 percent, down from 55 and 58 percent in 2011 and 2012, respectively. Fertilizer for peanuts and for sorghum/millet have been receiving the highest levels of subsidy.

Table 6. 2011-2013 Fertilizer Retail Price, Subsidy, and Farmer Payment Under the GoS Subsidy Program (CFA/50 kg)

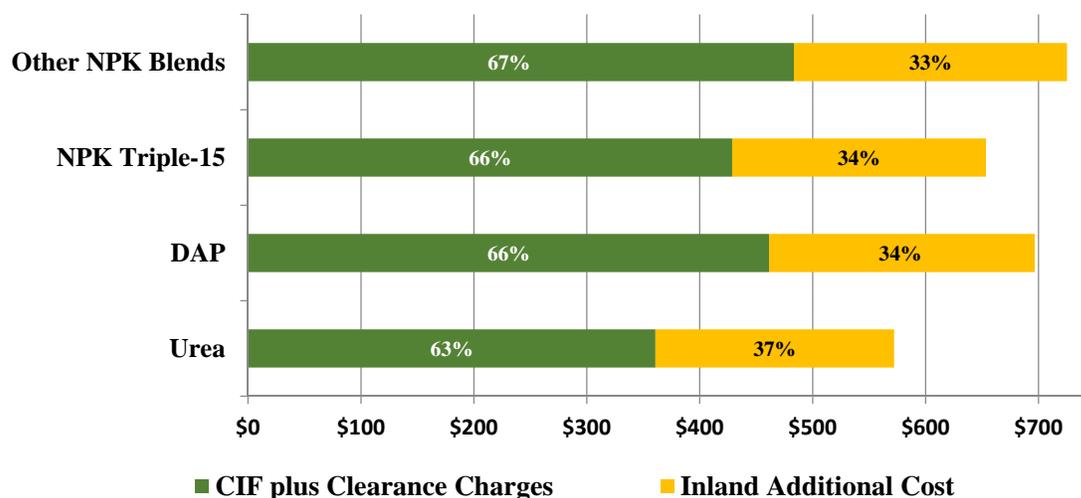
Fertilizer Formula	Non-Subsidized Retail Price		GoS Subsidy			Subsidy Price to Farmer			2011-13 Average Subsidy Rates
	2011 & 2012	2013	2011	2012	2013	2011	2012	2013	
6-20-10	14,925	13,550	9,220	8,925	7,300	5,705	6,000	6,250	58%
15-15-15	18,113	16,850	9,790	10,113	7,850	8,323	8,000	9,000	52%
15-10-10	15,800	14,600	9,740	9,800	7,100	6,060	6,000	7,500	57%
10-10-20	18,425	16,550	10,500	9,225	6,550	7,925	9,200	10,000	49%
9-23-30	20,600	19,150	11,000	10,800	9,150	9,600	9,800	10,000	51%
Urea	19,250	16,200	7,585	13,250	7,200	11,665	6,000	9,000	51%

Source: MAER-DA.

Note: 2011 and 2012 supplier's negotiated cost/price did not change.

Fertilizer Cost/Price Structure

With respect to the cost structure for fertilizer in Senegal, Fuentes et al. indicated that prices increase by an average of 34 percent of CIF cost, from import to distribution to the final consumer (Figure 9). This increase mainly concerns inland costs incurred from entry point/port to retail point. This observation seems to be still valid from interviews during the country visit in March 2014. There is no evidence to indicate significant change in these increased proportions.



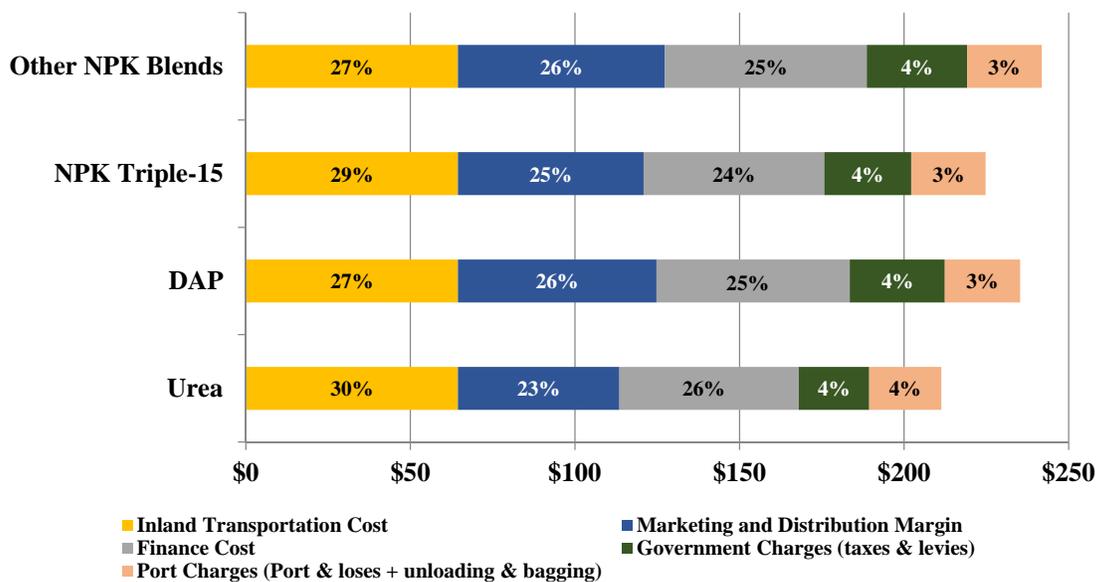
Source: Fuentes et al., 2011.

Note: proportions are based on per ton international fertilizer prices and costs as of 2009-10.

Figure 9. Proportion of Fertilizer General Cost Components in Senegal

Inland costs (Figure 10) as estimated by Fuentes et al. (2011) are made up by the following:

- Transportation cost (from 27-30 percent of the total domestic cost), mostly by road with truck at an average rate of CFA 40 per mt/km.
- Marketing and distribution margins (from 23-26 percent of the total domestic cost), of which 64 percent is importers' share and 36 percent is distributors' and retailers' share.
- Finance cost (between 24 and 26 percent), consisting mostly of interest rates applied on input credit.
- Port charges and product handling related to vessel unloading and bagging are the smallest cost component (from 9.4-10.4 percent). Vessel unloading costs are part of the port charges since most fertilizer is imported in bags and account for 2.5 percent of the inland costs.



Source: Fuentes et al, 2011.

Note: Proportions are based on per ton fertilizer costs as of 2009-10.

Figure 10. Proportion of Inland Fertilizer Cost Components in Senegal

3.4 Estimating Fertilizer Requirements

In this section, we estimate quantities of fertilizer required to meet the agricultural production targets in the NAIP. First, we analyze the gap between the 2008-2012 average and target crop production levels based on 6.7 percent average annual growth (Table 7). This gives an indication of the incremental production from increasing fertilizer use. The next stage estimates the fertilizer needs that will generate this increase in production (discussed in the next section).

Assuming no significant change in cultivated area over this period, production would have to increase by 38 percent to meet the 2017 targets, which implies an incremental production of about 1.43 million mt of produce. The crops included in Table 7 were selected based on available data and represent almost 100 percent of the total planted area, which includes cereals, pulses and legumes, roots and tubers, and fruits and vegetables, in addition to commercial export crops (groundnuts, sesame and cotton).

Table 7. Yield and Production Gaps Based on NAIP Targets

Major Crops	Area (‘000 ha)	Yield		Production		
		Current*	NAIP Target	Current	NAIP Target	Gap (NAIP Less Average)
		(mt/ha)		(‘000 mt)		
Maize	156	1.5	2.1	239	330	91
Rice, paddy	128	3.7	5.1	477	660	183
Sorghum	197	0.9	1.2	172	239	66
Millet	927	0.7	1.0	676	935	259
Fonio	4	0.6	0.9	2	3	0.9
Other cereals	6	0.6	0.9	4	5	1.4
Beans/pulses, dry	168	0.4	0.5	66	92	25
Mangoes, others	17	6.5	9.0	109	151	42
Oranges	7	6.0	8.3	41	56	16
Bananas	2	23.2	32.1	39	54	15
Other fresh fruits	6	5.3	7.4	30	41	11
Cassava	50	7.1	9.9	359	497	138
Vegetables	51	13.6	18.8	690	954	264
Groundnuts	913	0.9	1.2	782	1,081	299
Cotton	31	1.0	1.4	31	44	12
Sesame	23	0.5	0.6	11	15	4
Totals	2,685			3,727	5,155	1,428

Source: Authors’ calculations based on data from FAOSTAT, 2014.

*Note that the yield and production estimates are based on averages over several years (2008-2012).

The second step after quantifying the gap in crop production is to construct estimates of nutrients required to meet this gap, based on crop nutrient removal rates. This method estimates fertilizer requirements based on nutrients removed by harvested crops, adjusted to reflect fertilizer-use efficiency. Nutrient levels contained in the incremental harvested crops were estimated and adjusted using efficiency factors for nitrogen (N), phosphate (P₂O₅) and potash (K₂O). The approach assumes good management practices on the part of farmers and that fertilizer application is for maintaining soil fertility levels rather than building them.

Table 8 shows the results from this approach. The analysis indicates that incremental nutrient removal associated with the increased output of targeted crops would total 37,000 mt of nutrients (23,500 mt N, 6,800 mt P₂O₅ and 6,600 mt K₂O).

Table 8. Using Nutrient Removal Factors to Estimate Fertilizer Requirements

Major Crops	Incremental Crop Production (‘000 mt)	Nutrient Removal			Total Incremental Nutrient Removal (‘000 mt)
		N	P ₂ O ₅	K ₂ O	
Maize	91	1.3	0.6	0.3	2.2
Rice, paddy	183	2.2	1.1	0.9	4.2
Sorghum	66	1.1	0.4	0.3	1.8
Millet	259	5.0	1.9	1.1	8.0
Fonio	0.9	0.0	0.0	0.0	0.0
Other cereals	1.4	0.0	0.0	0.0	0.0
Beans/pulses, dry	25	0.9	0.3	0.4	1.6
Mangoes, others	42	0.1	0.0	0.1	0.1
Oranges	16	0.0	0.0	0.0	0.1
Bananas	15	0.1	0.0	0.3	0.5
Other fresh fruits	11	0.0	0.0	0.0	0.0
Cassava	138	0.2	0.1	0.2	0.4
Vegetables	264	0.3	0.1	0.8	1.2
Groundnuts	299	11.9	2.2	1.9	16.0
Cotton	12	0.3	0.1	0.2	0.6
Sesame	4	0.1	0.0	0.1	0.2
Totals	1,428	23.5	6.8	6.6	37

Source: Data from MAER and FAOSTAT and authors’ calculations using representative nutrient removal factors.

Table 9 below is derived from Table 8 by adjusting nutrient removal for fertilizer-use efficiency factors and then expressing them as metric tons of fertilizer products. In this analysis, we use efficiency factors of 50, 35 and 70 percent for N, P and K, respectively. Therefore, based on these factors, for the crops to remove 37,000 mt of nutrients as shown in Table 8, the corresponding total incremental quantity of nutrients needed to be applied to the targeted crops is approximately 76,100 mt, which is equivalent to 152,400 mt of urea, DAP and potash (Table 9).

Table 9. Incremental Nutrient and Product Requirements

Crops	Nutrient*	Product
	(‘000 mt)	
a. Total Crops in Table 8	76.1	152.4

Sources: Authors’ estimates based on nutrient removal factors. The nutrients are converted to the equivalent tons of urea, DAP and MOP products.

The estimated additional amount of fertilizer nutrients necessary to meet the NAIP agricultural production targets will require a gradual increase in consumption of 76,100 mt of nutrients, which

is equivalent to about 152,400 mt of fertilizer product (urea, DAP and MOP). Incorporating the current consumption of about 87,000 mt brings this to nearly 239,400 mt of fertilizer products, more than double the current fertilizer consumption.

4.0 Issues and Constraints Facing the Fertilizer Market

This section draws on the opinions and suggestions made during recent interviews by the major actors in the supply chain. It summarizes key issues that have been raised and ought to be addressed to achieve objectives of increased use of fertilizer in Senegal.

4.1 Fertilizer Policy and Subsidy Implementation Challenges

The GoS subsidy program has been providing incentive to import the amount of fertilizer contracted by the government, which covers a small percentage of the total estimated potential needs and about 50 percent of the expressed needs by the subsidy beneficiary farmers. The GoS subsidy program acts as a disincentive to importers who would like to satisfy the unmet demand of both subsidy and non-subsidy beneficiaries who are willing to pay market prices. The allocated fertilizer quantities are three bags of 50 kg per farmer, which may not always be enough to supply all their needs. In addition, the subsidy program provides an incentive for some farmers not to consume fertilizer from the open market once they learn about the subsidized price. The subsidy crowds out the private-sector market in addition to facing the following issues:

- Potential market entrants/importers perceive the tender process to be opaque as the same companies win each season.
- Late delivery to farmers as the tender process and procurement run late into the season, partly due to bureaucracy.
- Field-based input distribution commissions are comprised of representatives of too many organizations with conflicting agendas and vested interests, making it difficult to allocate fertilizer with the principles of fairness and equity.
- Leakages occur as beneficiaries re-sell their fertilizers some of which gets across borders into other countries.

- Potential competition is stifled as suppliers receive payment from GoS after long delays, thus incurring additional costs, which deters potential importers from entering the market.
- Poor implementation of subsidy leads to fertilizer going to those who can afford to pay full price.
- No cost-benefit analysis has been done to assess sustainability of the subsidy program alternative investments for the subsidy funds.

4.2 Weak Institutional and Regulatory Environment

Although Senegal does not have a specific fertilizer law, the country does have a set of laws and regulations for the importation, control, sale and distribution of major chemical products, including agro-inputs, which can also be applicable to fertilizer. Key regulatory problems include the non-existence of a law specifically applied to fertilizer; the inconsistent application of regulations for input distribution and sales, and, more importantly, the lack of institutions for implementing the law and enforcing the regulations for quality control and the industry's operation.

However, the government created the National Fertilizer Committee for monitoring the quality of imported fertilizer, an activity that has been stifled due to the lack of resources.

4.3 Poor Infrastructure

Domestic transportation cost is among the major constraints facing fertilizer importation and distribution in Senegal. This cost contributes greatly to the total cost of fertilizer, increasing the price to farmers and affecting the profitability of distribution. Road transport is the main mode of transportation as railroad transportation is faced with obsolete infrastructure and equipment due to low maintenance and investment. Railroads are mainly used for the transportation of passengers rather than for cargo, with limited routes to the northeastern region and to the furthest point in the western region. Therefore, costs are higher in remote villages that inhibit fertilizer use.

4.4 Poor Access to Finance

According to the industry players, a major issue facing the development of the fertilizer distribution network in Senegal is the availability of and access to credit, despite the government-subsidized credit under the agricultural programs channeled through the CNCAS.

Low accessibility to credit, especially at the farmer level, is the result of a high default on agricultural loans and the tightening on lending based on credit history, a criterion that eliminates a high percentage of small agricultural producers in Senegal.

Interest rates are high and the late reimbursement from GoS for suppliers of subsidy fertilizer adds to the cost of finance.

4.5 Poor or Lack of Technical Services and Low Productivity

There is inadequate capacity for research and extension. The inadequate training of retailers/farmers on agronomic aspects of fertilizers and potential benefits of using fertilizer hinders demand for improved inputs. In some cases, farmers lack access to physical markets or to market information in terms of input or output prices and demand.

Domestic capacity in terms of lab facilities and trained human resources to control quality of imported and traded fertilizer is weak. Despite the adoption of regional regulations, this constitutes a serious constraint to ensuring that good-quality fertilizer enters the country and is appropriately used.

As a result of high costs of fertilizer and respective low use, productivity is low, which perpetuates low use of improved inputs.

5.0 Summary, Conclusion, Policy Implications and Recommendations

Like most countries in the region, Senegal has the potential to increase productivity and production by adopting improved production technologies. GoS has committed itself to intensifying agricultural production through increasing the efficient use of agricultural inputs, such as fertilizer, to meet its strategic goals in alignment with regional and continental objectives.

GoS has made commitments over the years to supplying fertilizer and seed to raise productivity through subsidies. Apart from fertilizers, investments in complementary inputs – seed, finance, extension, output markets, etc. – are important in raising output/input ratios significantly to increase farm incomes. GoS needs to put in place a spectrum of actions, policy or otherwise, to deal with challenges in the fertilizer value chain and improve efficiency to lower costs. Better subsidy implementation, increased import competition, rural distribution network development and investments to lower distribution costs will benefit farmers.

This report outlines the main policies, beginning with changes in the implementation of the subsidy program, to help lower credit and transaction costs for doing business and encouraging more competition among importers, distributors, and rural agro-dealers and/or traders. This is followed by the consideration of longer-term complementary investments that will help lower transportation costs while increasing the consumption of fertilizer over time

5.1 Implement Targeted Subsidies !

Despite years of subsidy implementation, yields for smallholder farmers have not shown an appreciable increase. Subsidy should be targeted better and in a more business-friendly manner in order to encourage use by both selected beneficiaries and non-subsidy users.

The creation of an enabling environment by GoS will help raise demand through increased competition at all levels of the value chain. GoS should eliminate the tender in favor of a more open competition in the importation and distribution to increase the amount of fertilizer in the market and promote the expansion of the distribution network closer to farmers. If the tender system continues to be implemented, it is important to make it more transparent with clear rules.

An important policy measure is to allocate an adequate amount of funds in a timely manner to give more access to credit in support of agriculture production activities. The level of subsidy must be set within the country's budgetary constraints in ways that will not discourage domestic private sector participation in the subsidy program due to late/non-payment.

5.2 Financial Reforms

To help increase accessibility to credit, policies are needed to strengthen domestic financial markets. This will provide incentives for business development and innovative financial instruments (e.g., special savings accounts for agricultural loans, risk management or crop insurance instruments) to promote lending rural farmers and traders. Ideally, the instruments would be designed to protect the financial institutions' lending portfolios and farmers' incomes from adverse weather conditions (i.e., drought or excessive rain), thus ultimately helping to guarantee the reimbursement of bank loans. Such measures should be coupled with proper technical assistance to support agriculture production and market access. Without eliminating major credit constraints facing both farmers and input dealers, the expansion of the fertilizer market within and outside the subsidy program will remain very limited. A more open market is needed to promote and nurture a healthy competition among importers and distributors, in which producers will have access to credit and the freedom to purchase fertilizer at the lowest possible price in the market.

5.3 Establishing a Sound Regulatory Framework

Establishing a rule of law with the necessary enforcement capacity is important to protect consumers, producers and traders. Quality control and truth-in-labeling, although not serious issues currently, are critical for the proper development of a market, particularly when it becomes more dynamic. The government needs to enact and approve a fertilizer law and regulatory system and establish the proper institutions needed to enforce the laws and regulations in order to induce investment confidence and assure consumers that the agricultural inputs they purchase are not compromised and lead to loss of confidence or trust by farmers.

5.4 Increase Long-Term Rural Investments

Although improving the macro-economic environment is a necessary condition for market development, it is not sufficient to reduce transaction costs and increase fertilizer consumption unless supplemental policies and investments supporting the development of efficient rural input and output marketing systems throughout the country take place also. In the long run, it is important to improve on rural infrastructure, including developing input/output markets and linking farmers to the same. This will act as a complementary incentive to adoption of improved technology. Increased competition in the trucking system can help reduce transportation costs (USAID West Africa Trade Hub, 2010).

Policies are also needed to incentivize private-sector investments in a number of areas over time. Some policy considerations include the following:

- (1) Public-private partnerships (PPP) help develop thriving input and output markets in rural areas and for the provision of other goods and services. These PPPs could include infrastructure investments for improved transportation, feeder roads, storage, communications and energy.
- (2) There is real potential to continue exploiting the large resource base of rock phosphates in Senegal in order to produce fertilizer for domestic consumption. However, the right incentives need to be in place to attract potential large investors, whether domestic or international.
- (3) Investments are also needed for irrigation projects that take advantage of the water conservation along the Senegal River to promote the use of productive complementary inputs (such as fertilizers and seeds) and consequently support input market development.
- (4) Investments in improved soil management technologies are also needed to restore and improve natural soil fertility and maximize the benefits from using improved seeds and fertilizer in a more sustainable and environmentally friendly way.
- (5) Finally, investments to improve access to market information and extension services can go a long way toward helping establish a more competitive and open market for inputs and outputs. In the process, both farmers and agro-dealers (including output traders) can make better and more informed decisions about what to produce and markets.

5.5 Investment in Human Resource Development

Lack of knowledge (technical and otherwise) is another barrier to increasing the use of agricultural inputs, such as fertilizer, and to increasing agricultural and economic development. The most important factor is the basic knowledge of technological and management skills that farmers need for proper use of their resources and fertilizer/inputs. This knowledge can be achieved by investing in research and extension programs with a farmers' participatory approach to address crop-specific and location-specific issues, with a training component for farmers and by farmers. This participatory approach is expected to create a better link among researchers, extension agents and farmers in which farmers will be empowered and have better participation in the market as buyers and sellers of inputs, produce, services and factors of production. The training can be extended to suppliers so that they can serve as private extension agents in support of the small farmer. Training topics for input suppliers can include business management and the proper use of inputs.

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