

Mali Food Security Policy Research Program

Improving the Fertilizer Value Chain in Mali: Pathways Forward?

Veronique Theriault, Alpha Kergna, Abdramane Traoré, Bino Temé and Melinda Smale

1. Context

In Mali, agricultural growth mainly depends on intensification strategies. In fact, agricultural yields remain low, and so does the use of modern inputs, such as fertilizer. The average use of nitrogen and phosphate fertilizer is 14 kgs per hectare, which is low, compared to the average of 40 kgs per hectare in Eastern and Southern Africa (Theriault et al. 2015). Realizing the importance of farming intensification for the future of Mali, the Malian Government has made it one of its priorities by establishing a fertilizer subsidy program. The crops targeted by the program include rice, cotton, maize, wheat, millet, and sorghum.

2. Supply and demand

The bulk of fertilizer demand is met by imports, including ready-to-use fertilizer and raw materials used in the local manufacturing of blended fertilizer. Urea, which is used on all crops, remains the most popular fertilizer. Data on quantity demanded, and those actually supplied, vary substantially from one data source to another (See Theriault et al. 2015 for examples). The fertilizer quantities ordered in international calls for tender are the most closely tracked. However, input orders that are placed outside these tenders are not well known. The lack of reliable and easily accessible statistical data complicates the assessment of supply and demand of fertilizer.

3. Structure of the value chain

The Malian fertilizer value chain comprises four primary supply channels.

The first channel supplies farmers in cotton growing-areas. At the beginning of each cropping season, cotton farmers purchase subsidized fertilizer on credit through their

Key findings:

- There is a need to invest in data collection that will allow rigorous impact evaluations, including of the subsidy program.
- Farmers who are members of cooperatives/associations have better access to fertilizer.
- Incentives to use fertilizer vary with farming conditions, fertilizer quality and prices.

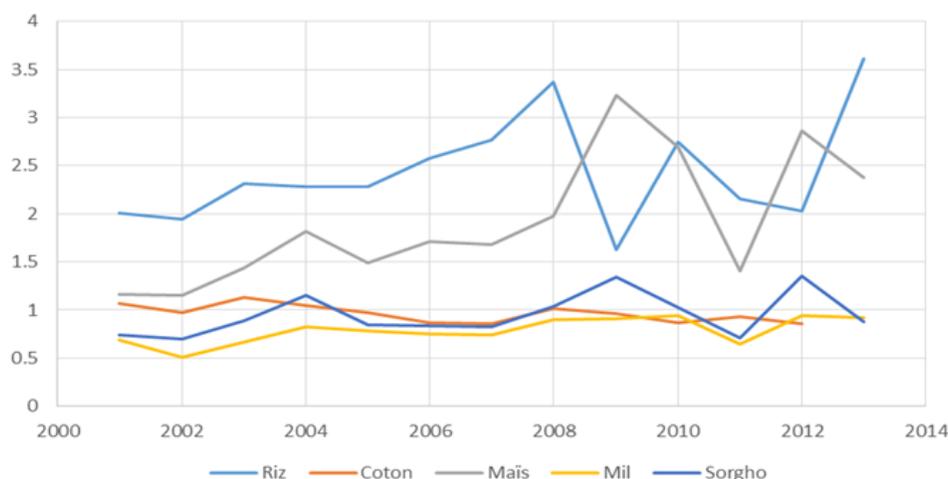
cooperatives with the promise to pay back at harvest. Fertilizers are purchased through international calls for tender.

The second channel supplies irrigated rice farmers through their farmers' associations. Subsidized fertilizers are obtained through networks of private wholesalers and retailers. Some rice farmers are able to access fertilizer loans from financial institutions through their associations.

The third channel supplies farmers who are eligible for subsidies but who are not affiliated to any farmers' associations/cooperatives. These farmers can receive subsidized fertilizers through the Regional Directorates of Agriculture (DRAs) after registering and completing a form called "*caution technique*". That form describes the farmer's needs per fertilizer type based on the areas of land devoted to the crops covered by the subsidy program. The amount of fertilizers available to farmers at the DRAs at subsidized prices often fall short of demand.

The fourth channel supplies farmers growing crops that are not covered by the subsidy program, and/or farmers who could not obtain the whole amount of fertilizers they

Figure 1. Yield trends (t/ha)



Source: Theriault et al. 2015

requested. Fertilizers are purchased cash at market prices through private networks of wholesalers and retailers.

4. Performance of the value chain

Productivity – Although it is expected that the fertilizer subsidy program will increase production and productivity, we are not currently in a position to comment on such impacts. In the absence of accurate farm household survey data, it is impossible to assess the effect of subsidies on yields. Our only observation is that cotton, millet, and sorghum yields have been relatively stable, while rice and maize yields have significantly fluctuated, exceeding 3t/ha for some years and falling below 2t/ha for others (Figure1).

Incentives - Crop yield responses and prices affect farmers' incentives to use fertilizer. Since we do not have data on crop responses to fertilizer in Mali, we report estimated rates for West Africa (Table 1). Crop responses are higher for irrigated rice and maize than it is for dryland cereal crops. Furthermore, incentives vary substantially between farmers of the same crop as indicated by the difference between the minimum and maximum response rates to fertilizer. For example, an additional kilogram of nitrogen increases, on average, maize outputs by 11 kilograms. However, for some farmers, an additional kilogram of nitrogen leads to no increase in output (0kg) while others can get up to 54 kg of additional output.

The profitability of fertilizer use varies substantially across crops and based on farming conditions. These depend on the crop response to fertilizer as well as the fertilizer-

output price ratio (here- urea converted into nitrogen nutrients). This ratio reflects the number of kilograms of outputs needed to purchase one kilogram of nitrogen nutrient (Table 1). The lower the ratio, the higher the incentive to use fertilizer. As an example, four to six kilograms of maize is required to purchase one kilogram of N at the subsidized and market prices, respectively. For maize farmers who can get the average crop response of 11 kgs, fertilizer application remains profitable with or without subsidies.

Prices - Although the subsidized price of urea is set by the Government of Mali, there are price variations between cotton-growing and irrigated rice areas, reflecting the influence of the various supply channels. Subsidized and non-subsidized fertilizers are sold at higher prices in remote areas. Maize and sorghum farmers who have access to subsidized fertilizers through their cooperatives/ associations purchase the kilogram of fertilizer at lower prices than farmers who get it through retailers (Smale et al., 2015).

Access - Since the establishment of the subsidy program, the total quantity of fertilizer used has increased significantly, reaching 250,000 tons over the last cropping seasons and so has the number of beneficiaries (> 800,000 farmers). Regarding the targeted cereal crops, nearly half of the subsidy program beneficiaries are rice farmers. Men remain the primary beneficiaries of fertilizer subsidies, accounting for nearly 80%, 90%, and 95% of the beneficiaries for rice, maize, and millet/sorghum crops, respectively. Furthermore, farmers who are members of well-organized farmer associations/ cooperatives benefit more from the fertilizer subsidy program.

Table 1. Incentives for fertilizer use per crop

Crops	Response to fertilizer application			Price ratio	
	P/N ratio			N Price/output price	
	Mean	Min	Max	No subsidies	With subsidies
Irrigated rice	11	7	16	4,08	2,81
Maize	11	0	54	5,93	4,09
Millet	7	2,8	21	4,34	2,99
Sorghum	6	3	14	4,89	3,37
Cotton	5	2	12	3,34	2,30

Source: Theriault et al. 2015 et Morris et al. (2007)

Competition - Since the establishment of the subsidy program, the number of fertilizer importers has more than doubled; going from two to seven. However, the import market remains dominated by a small number of companies. The number of wholesalers has increased significantly from nearly 200 to more than 800. The fertilizer subsidy program has contributed to increase competition among wholesalers and retailers.

5. Pathways forward

The Malian Government should pay closer attention to product quality, as it affects farmers' incentives to use fertilizer. With lower fertilizer quality, responses to fertilizer applications are lower and in turn, returns on investment are less appealing. Thus, the supply of high quality fertilizer constitutes a major challenge. Systematic control of imported and locally produced fertilizer before they reached farmers should be established and any substandard fertilizer should be removed from the value chain. Furthermore, appropriate enforcement measures should be taken against violators.

Harmonizing regulations on standards and norms as well as on fertilizer quality control at the regional level can promote regional fertilizer trade while allowing economies of scale through bulk purchasing. Increasing competition throughout the value chain can contribute to reduce prices and make fertilizer more affordable to farmers. New mechanisms should be developed to more effectively reach farmers located in remote areas and/or those not affiliated with any cooperatives/associations.

The standardization of fertilizer dosage should be revisited. When calculating dosages, it is important to factor in the country's broad diversity of agricultural systems and agro-climatic conditions. Sustainable agricultural intensification can also be achieved by

promoting the use of fertilizer combined with improved seeds, technical itineraries, and integrated soil management practices. A variety of methods and dosage combinations should be initially tested and then promoted based on various farming conditions.

Finally, reliable statistical information should be made available for an in-depth analysis of the fertilizer value chain, including the subsidy program. In fact, it is essential to strengthen the data collection system throughout the value chain, from import to fertilizer use. There is a need to invest in longitudinal farm household databases capable of taking into consideration the various farming conditions and factors affecting the demand and supply of fertilizer. Furthermore, it is important to conduct an impact evaluation of the subsidy program using rigorous methods.

References

- Morris, M., Kelly, V., Kopicki, R., and Byerlee, D., 2007. Fertilizer Use in African Agriculture. World Bank, Agriculture and Rural Development, 39037.
- Smale, M., Assima, A., Kergna, A. O., Traore, A., Keita, N., 2015. Survey Research Report: Diagnostic Survey of High Potential Sorghum Production Zone. Michigan State University, Food Security Group. Report, August.
- Theriault, V., Kergna, A., Traore, A., Teme, B., and Smale, M. 2015. Revue de la structure et de la performance de la filière engrais au Mali. Michigan State University. Food Security Group. Document Mali-2015-2.

About the Authors

Veronique Theriault (theria13@msu.edu), Assistant Professor in International Development in the Department of Agricultural, Food, and Resource Economics at Michigan State University (MSU), East Lansing, MI, USA.

Alpha Kergna (akergna@yahoo.fr), Researcher for Économie des filières (ECOFIL) at Institut d'économie rurale (IER), Bamako, Mali.

Abdramane Traoré (traoreabdramane01@gmail.com), Research Assistant for the Mali Food Security Policy Research Program (PREPOSAM), funded by USAID/Mali.

Bino Temé (temebino@msu.edu), Associate Professor in International Development in the Department of Agricultural, Food, and Resource Economics at Michigan State University (MSU), East Lansing, MI, USA.

Melinda Smale (msmale@msu.edu), Professor in International Development in the Department of Agricultural, Food, and Resource Economics at Michigan State University (MSU), East Lansing, MI, USA.

This research is made possible by the generous support of the American people through the United States Agency for International Development (USAID) under the Feed the Future initiative. The contents are the responsibility study authors and do not necessarily reflect the views of USAID or the United States Government

Copyright © 2016, Michigan State University and International Food Policy Research Institute. All rights reserved. This material may be reproduced for personal and not-for-profit use without permission from but with acknowledgement to MSU and IFPRI.

Published by the Department of Agricultural, Food, and Resource Economics, Michigan State University, Justin S. Morrill Hall of Agriculture, 446 West Circle Dr., Room 202, East Lansing, Michigan 48824