

THE NEED TO LINK SOIL FERTILITY MANAGEMENT TO INPUT/OUTPUT MARKET DEVELOPMENT IN WEST AFRICA: KEY ISSUES

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1. INTRODUCTION

In West Africa, as permanent cultivation proceeds under population pressure, a sustainable foodgrain production which could ensure both food security and preserve natural resources will require a significant increase in the utilization of extra soil nutrients. A food crop takes between 300 and 600 kg/ha per crop of N, P₂₀₅, K₂₀, MgO, S (Antoine 1993). Currently, the main sources of extra soil nutrients in foodgrain production are labor-intensive crop residue recycling, biological soil improvement and soil conservation measures. Fertilizer as a source of extra soil nutrients remains marginal as only between 11 and 22% of area planted to foodgrain receive fertilizer (see Gerner and Harris 1993).

Organic and biological fertilization and conservation measures cannot compensate for the export of soil nutrients. Thus, foodgrain production faces a serious problem of soil fertility depletion. The extent of the problem is illustrated by Sanchez et Leakey (1996) who report soil nutrients budget deficits of 700 kg of nitrogen, 100 kg of phosphorus, and 450 kg of potassium per hectare during the last three decades over 100 million hectares of cropped land in Sub-Saharan Africa. Overcoming these deficits will require an increased use of fertilizers in subsistence foodgrain production to complement labor-intensive organic and biological fertilization and soil conservation measures. However, for subsistence farmers to use fertilizer, they must become part of the cash economy (Shaikh 1993). The question is how to develop the input/output markets in order to move larger numbers of subsistence foodgrain producers into commercial foodgrain production.

The present paper tackles the above question by raising some key issues involved in the process of input/output market development. The objective of the paper is to highlight key issues related to the development of input and output markets, suggest possible ways of overcoming some of the problems and suggest areas for further investigation. The first section addresses the issues related to the promotion of the market for foodgrain. The second section deals with input market issues. In section 3, institutional problems related to input/output markets development are highlighted. Section 4 concludes the paper.

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1. OUTPUT DEMAND ISSUES

Investment in agriculture, whether in the form of intensification inputs or any other type, depends to some extent on the prospects of returns. For cash crops, such as cotton in the sudano-guinean zone of West Africa, profitability, as partially indicated by the output/input price ratio, is key to the development of cotton production (Traoré 1996). For the food crops, most of which constitute basic staples for the rural population, the issues involve both returns and own-consumption needs. If the goal is to expand the production of these staples beyond farm needs, the problems of effective demand and prices loom at the horizon.

1.1. Low Effective Demand for Local Foodgrain

Three issues are considered here. The first two are how product competitiveness and consumers preferences affect effective demand, and the third explores ways to enhance effective demand through the development of new markets.

1.1.1. The Issue of Product Competitiveness

The three main sources of demand for the domestic production of foodgrain are rural, urban and cross borders. Both the urban and the cross borders markets face the competition from internationally imported products. In the case of the Franc zone countries of West Africa, the main importations are rice and wheat, which, over the seventies to the eighties, have reshaped the consumption patterns of urban consumers (Savadogo and Brandt 1988). The success of the imported products in domestic markets, i.e. the loss of competitiveness of local staples, stems from three reasons.

First, distorted relative prices, in favor of the imported rice and wheat (Delgado and Miller) have played a role. Price distortions have been helped by the highly overvalued exchange rate situation in the Franc zone countries, which made imports cheaper. The devaluation of the CFA francs that occurred in 1994 helped to correct this situation: "getting prices right". Indeed, the importation of rice by a country such as Burkina dropped by 40,000 tonnes in 1996, i.e. by about half the level of pre-devaluation volumes.

Second, farm-level unit costs of production are high, compared to the competing countries of Asia. These high costs per unit are in part due to low yields, which, unfortunately and as in a vicious cycle, are partially the result of a low utilization of fertilizers (see below).

Third, and reinforcing the preceding, marketing costs are high in most of the countries. For Burkina, Savadogo et al. (1992) found evidence of the existence of high transaction costs in the form of bribery and other illicit costs, and that transport costs per unit were particularly high.

1.1.2. The Issue of Urban Consumers Preferences

The urban market is a potential large outlet for the local cereals. Competition on this market and changing consumer preferences have however, over the past decades, contributed to the decline of market size.

Preferences can be either primary or induced. Induced preferences, such as the shift from maize/sorghum/millet to rice due to relative prices, are reversible in the advent of a large shock, as the devaluation of the CFA.F. One could argue that even primary preferences (such as the preference by the northern residents of Burkina for millet over sorghum) could be reversed by still a large enough shock. Changing consumers choices in favor of local staples requires the knowledge of the factors that affect preferences.

Convenience, coupled with the increasing opportunity cost of time of urban residents, is important in consumers choices. Wheat products (bread in particular) and rice are easier to prepare than maize or sorghum. As a consequence, a noon-time meal is more likely to be based on rice than on the local cereals. Surveys show that rice for lunch and maize for dinner is common among many households (Ouédraogo 1996). The behavior of away from home food consumption strengthens this pattern. In the case of Burkina many urbanites, in particular low income and in the informal sector, tend to work farther and farther away from their home. Meals eaten away from home are usually rice based, but recent surveys show that cowpea and maize flour are becoming common dishes too (Soil Fertility Management Unit on-going surveys in Burkina 1996).

It has been long agreed that processing the local cereals to make them both more convenient to prepare and more palatable is a way to reverse consumers preferences. This belief has for example led CILSS to create its unit PROCELOS to encourage research on the processing of local cereals. This is the right path to take. Products such as millet and cowpea have a high protein content, comparable to or more than any of the imported foodgrains. Careful and devoted research should lead to new products easy to use and of good taste. Bezuneh et al. (1996) illustrate a case of an industrial induced cowpea market development.

1.1.3. What about Alternative Outlets?

Besides the domestic, urban market, there may be the need to push for alternative markets. Outlets at the regional level should be developed. For example, freeing regional markets and promoting trade between the Sahel and the coastal countries of West Africa may increase the effective demand of traditional products and increase food security (Savadogo 1996).

Just as on domestic markets however, local crops face competition from international products on regional markets and hence the need to develop a region-wide competitive drive through infrastructure building (roads and information) and the elimination of trade barriers, both legal and illegal.

Another alternative for increasing effective demand is to encourage the use of surplus product as animal feed. Sanders (1996) documents the rise of sorghum as a feed crop in Honduras, from 4 percent of total concentrate use in 1985, to 25 percent in 1993. This was obtained under conditions of rapidly growing demand for poultry (8.4% per year) which translated into a derived demand for sorghum. The devaluation of the CFA franc and the resulting increased demand for local meat products in West Africa may justify the intensification of livestock raising. Using sorghum or maize as a feed supplement is foreseeable in this era.

1.2. Harvest Time Price Collapse

Agricultural, and in particular foodgrain prices in Africa are known to fluctuate widely, both seasonally and inter-annually. The relevant issue however is not the seasonal price changes, but the annual fluctuations which result in large harvest time price collapse in good years. This situation, due to an inelastic demand for the products, affects farmers' decisions on target output and by ricochet on input utilization.

As Johnson (1995) argues, it may not be so much the observed level of prices as their alignment with farmers' expectations, that is the central issue of agricultural price policy. Farmers make their decision at planting time based on known input but only expected output prices. In the case of the semi-arid countries of West Africa, these expectations diverge significantly downward from observed harvest time prices in good years, and this uncertainty negatively affects the decision to produce beyond the household needs.

Sanders and Vitale (1996) argue that governments have the responsibility to prevent these large harvest time collapses of crop prices. They note that in developed countries, governments do not allow farm prices to collapse, unless farmers are compensated through income transfers. This is a key issue, yet overlooked by policymakers in developing countries, in particular in the era of government withdrawal from various areas of the economy such as price stabilization.

What can be done to reduce harvest time price collapse? One alternative is to try to stabilize prices through credit. Research suggests that farmers sell at harvest time even at very low prices because of immediate need for cash. If a functioning credit market existed which could lend money, this could delay the need to sell the crops at harvest. The resulting tension on the market due to reduced supply could lead to higher prices. Some farmers would sell at these prices, others would wait for further increases.

Another alternative is to stabilize prices through inter-annual storage. Most countries still run a national security stock. This stock could be built at harvest time, concentrating on buying from surplus regions in bumper crop years.

The security stock could thus play a secondary role of a price stabilization stock, without bearing the burden of the latter in trying to reach pan-territorial price stabilization, which is known to have been a failure in most African countries which attempted to implement it.

The final way of stabilizing prices is through the increase of the effective demand for the local crops, as discussed above.

2. INPUT MARKET DEVELOPMENT ISSUES

Input markets development strategies in West Africa tend to focus on supply side issues. Examples include the decontrol of prices and the liberalization of fertilizer procurement and distribution. The objective has been to reduce the cost of delivered fertilizer to farmers through greater efficiency in procurement and distribution. However, Narayan and Bumb (1994) and Boughton et al. (1994) report that fertilizer use on foodgrain decreased following the liberalization of fertilizer distribution, currency devaluations, and the removal of subsidies. Thus, gains in procurement and distribution efficiency by themselves will not increase farmers' effective demand for fertilizer use on foodgrain unless the key issues of profitability, risk, and availability and accessibility are correctly addressed.

2.1. Profitability.

Empirical evidence indicates that profitability is an important determinant of farm-level fertilizer use. Conceptually, farmers determine the quantity of fertilizer that will maximize revenues given achievable crop response rates and prevailing fertilizer/output price ratios. Thus, the level of profitability of fertilizer use is function of both agronomic and economic factors. Indeed, the profitability of fertilizer use is generally measured by the ratio of the value of the additional output to the cost of fertilizer (VCR).

For rainfed, foodgrain production, it is generally accepted that the VCRs (value cost ratios) must exceed 2 to motivate farmers to use fertilizer given the level of risk involved. However, reported VCRs of fertilizer use on rainfed foodgrain in West Africa rarely exceed this critical value. The VCR of fertilizer use on maize went from 2.3 in 1993 to 1.7 in 1994 in Mali and from 1.5 to 1.1 in Ghana (Gerner 1994). Only in Nigeria did the VCRs for fertilizer use reach 4.2 on maize and 3.6 on sorghum in 1993. These figures indicate that returns to fertilizer use in Mali and Ghana were too low to expand farmers' effective demand for fertilizer use in rainfed foodgrain production.

An analysis of the VCRs reported by Gerner indicates that maize response rates to 1 kg of nutrient applied were higher in Mali and Ghana than in Nigeria (10 kg on average against 4.9 kg). However, the ratios of fertilizer/maize prices in 1993 were 0.8 in Nigeria compared to 5.2 in Mali and 6.1 in Ghana.

The favorable fertilizer/maize prices ratio made fertilizer use profitable in Nigeria despite the low response rate. In contrast, fertilizer use on maize was not profitable in Mali and Ghana despite the high response rates because of unfavorable fertilizer/maize prices ratios.

What emerges from the above analysis is that the relative importance of agronomic factors versus economic incentives in raising farmers' effective demand for fertilizer use depends on the situation. In Mali and Ghana, efforts to raise the profitability of fertilizer use on foodgrain must focus on reducing the cost of delivered fertilizers to farmers or raising the price levels of foodgrain or a combination of the two. Thus, information is needed on the relative efficiency of the input distribution system and the cost effectiveness of the foodgrain marketing systems. In contrast, Nigeria needs to focus on agronomic factors to raise its current maize response rates to fertilizers to expand further farmers' effective demand for fertilizer use.

In many countries of West Africa, the fertilizer/food crop price ratios have been rising since the mid 1980s (Gerner and Harris 1993). Thus, returns to fertilizer use on foodgrain have been falling in many countries with the liberalization of input/output markets, the decontrol of agricultural prices and the removal of fertilizer subsidies. If current fertilizer and crop prices are determined on competitive markets, fertilizer market development strategies will have to put more emphasis on improving the agronomic environment to enhance the efficiency of fertilizer use.

The efficiency of fertilizer use on foodgrain can be improved through the development of high fertilizer response seed, the formulation of fertilizer application rates based on soil analysis, and the adoption of good agronomic practices and the use of organic manure and water harvesting techniques to conserve soil moisture. Here, governments will have to invest in adaptive research and extension services. These investments are needed to reduce the cost of fertilization through increased efficiency of fertilizer use. Given the public good nature of these investments, only governments can provide them at a socially optimal level.

2.2. Risk in Fertilizer Use on Foodgrain

In much of West Africa, food security is the primary concern of subsistence farmers. This concern over household food security and poverty translates into risk averse behavior towards fertilizer use. Such risk averse behavior has been found to account for up to 20% reduction in the optimal fertilizer application rates among farmers who use fertilizer (Binswanger and Sillers 1993).

Fertilizer use requires that farmers incur cash outlays or arrange for credit in advance of product sale. Under the conditions of random rain-fed grain production and the inelastic nature of coarse grain demand in West Africa, the commitment of such cash outlays or credit in advance of product sale involves high financial risk that may exceed the bearing capacity of poor farmers. In the semi-arid regions, this financial risk is exacerbated by production risk.

The main source of production risk is the erratic nature of rainfall pattern. In the Sahel where drought spells characterize the growing season, the use of fertilizer may be perceived by farmers as too risky if it adds more to output during good rainfall year than in drought years. Indeed, Horowitz and Lichtenberg (1993) report that "The marginal product of nitrogen [fertilizer] is low

or negative at low rainfall levels.” However, phosphorus and potassium fertilizers in combination with deep ploughing and adequate weed control have been found to reduce the variability of millet yield in the semi-arid regions (Pieri 1982).

The reduction of production risk involved in fertilizer use will require the expansion of irrigation and the implementation of water and soil conservation technologies. Given the high cost of irrigation in West Africa and the shortages of investment funds, labor-intensive capital formation in the forms of water and conservation infrastructures and the use of manure to conserve soil moisture will be needed to expand the agronomic potential for fertilizer use in the short run. In the semi-arid regions, this process of labor-intensive capital formation has been induced by the decline in land fertility and availability as a result of high population pressure (Sanders et al. 1996).

Where labor-intensive capital formation has created an important agronomic potential, low and unstable market prices prevent the conversion of this potential into effective demand for fertilizer use on foodgrain (see Sanders et al. 1996). As large numbers of subsistence farmers will need to use fertilizer as source of extra nutrients to restore and raise soil fertility, governments will have to provide price stability. Indeed, Timmer (1993) argues that free markets are good at providing growth, but not price stability.

2.3. Availability and Accessibility

Following the liberalization of fertilizer procurement and distribution, aggregate fertilizer supply has decreased in many African countries (Narayan and Bumb 1994). In Ghana, fertilizer use went from 40,000 tons in the late 1980s to 11,600 tons in 1994 (IFDC-Africa 1995). Although inadequate effective demand for fertilizer use at the farm-level has been a contributing factor, foreign exchange shortages have been identified as major constraints to aggregate fertilizer availability (Narayan and Bumb 1994). In many semi-arid countries, governments have focused on conservation technology, manure and local mineral soil amendment instead of allocating the adequate amount of foreign exchange to import fertilizer (Dembélé 1996)².

At the farm-level, poor infrastructure and the slow development of dynamic private distribution systems in many countries have been identified as major problems (Gerner et al. 1996). These problems constrain the timely availability of the right types of fertilizer at convenient locations to farmers.

To increase the availability of the right types of fertilizer at convenient locations to farmers, government will have to improve rural road infrastructure, access to foreign exchange and the financing of fertilizer dealers operations and inventories. Unfortunately, few governments in West Africa have committed themselves to assuring the availability of fertilizer to foodgrain

²The foreign shortage argument did not however apply to most of these countries, as the convertibility of their currency (the CFA francs) allowed access to the international market.

producers despite the urgent need to intensify subsistence farming in areas with a growing deficit in ecological carrying capacity (Shaikh 1993).

Assuring the availability of the right types of fertilizer must be complemented by increased accessibility for the resource poor subsistence farmers through special credit lines. As fertilizer must be paid for in advance of crop sales, low income farmers need adequate credit arrangements to purchase fertilizer. According to Wierer and Abbott (1978), "an important characteristic of fertilizer demand is its close link with agricultural credit and the need for technical advice." Thus, reducing distribution cost through improved road infrastructure and greater efficiency in fertilizer marketing is not enough. Unfortunately, few countries in West Africa have set up special credit programs for fertilizer purchase in rainfed foodgrain farming after the liberalization of input and output markets.

With regard to private source of credit, Dembélé (1996) reports that fertilizer dealers in Burkina Faso do not want to extend credit to farmers in rainfed agriculture because of the high production risk involved. Furthermore, the same dealers argue that the costs of administering such credit arrangements are too high relative to the expected returns and that a crop failure will undermine their capacity to import fertilizer the following year. This unwillingness of the private sector to extend credit to subsistence farmers point to the limited role of supply side measures in promoting the use of fertilizer in rain-fed food-grain production.

Fertilizer, as opposed to consumer goods, is a complex technology-embodied input that demands adequate support services for its promotion such as technical advice to farmers on how to use it, as well as credit extension and reliability of output markets.

These services are costly to provide on a large scale and the margins realized on fertilizer distribution may not be high enough to allow the private sector to finance these services. Moreover, the addition of the costs of these services to the price of fertilizer which has risen following the removal of subsidies and currency devaluation in many countries may further depress farmers' effective demand for fertilizer use.

3. INFORMATION SUPPORT SYSTEM AND INSTITUTIONAL FRAMEWORK

The foregoing sections show the need for an appropriate information system and institutional setting to strengthen the working of both the input and the output markets. Because of observed poor performance of the public sector, African governments have been urged to privatize the delivery of marketing services, sometimes too quickly and without the appropriate transition phases. Countries need to carefully define the respective roles of the public and private sectors, identify key areas of comparative advantages for each, and design the appropriate mechanism of transition from public to private. This has been so often said (see for instance Savadogo and Larivière 1994), yet the facts point to the disregard of these basic principles.

Putting in place the appropriate institutional framework for input and output marketing and service provision is a key to increasing the overall efficiency of agriculture and promoting the utilization of soil fertility technologies. At present times, agricultural services are dominated by public agencies. An attempt to quickly replace the parastatals with the private sector runs the risk of taking agriculture backward (Bezuneh et al. 1996). For instance, analysis shows that market reforms have been accompanied by reduced profitability of fertilizer use on foodgrain, without improvement in fertilizer availability and accessibility (Gerner 1996). To induce an increased use of extra nutrients derived from fertilizer in rain-fed food-grain production, governments will have to provide price stability, invest in fertilizer promotion, and provide adequate incentives to induce labor-intensive capital formation to raise the agronomic potential for fertilizer use.

Information on performing technologies and on product markets is essential for farmers' decision. Allowing information to flow is the responsibility of government, at least until a private entity can take over. In Burkina Faso, a recent study by the SFMU (soil fertility management unit) found that private traders handle about eight different types of complex fertilizer NPK without the proper technical knowledge of fertilizer use. Thus, the government will have to set up adequate quality control mechanisms to assure that only high quality fertilizer of the right types are supplied to farmers.

4. CONCLUSION

This paper has highlighted key issues related to the development of input and output markets, a prerequisite to a successful soil fertility management initiative. The issues are both economic and institutional.

Economic issues include the farm-level profitability of the use of inputs, the production risk involved, and the availability and accessibility of inputs. Profitability in turn depends on the output/input price ratio and the agronomic performance of the input. The price received by the food-grain farmer is subject to two types of problems. The first is the harvest time price collapse in good years, and the second is the downward pressure put on food-grain prices by competitively advantageous imported substitutes. These issues of the low effective demand for the product and the year-to-year price instability have to be addressed for any effort to increase input utilization to be successful in a sustained way.

The production risk involved in input use will have to be addressed through the adoption of soil and water conservation technologies and the use of organic fertilizers to raise the agronomic potential for fertilizer use. Governments will have to improve road infrastructure, allocate foreign exchange for fertilizer imports and to set up special credit programs to increase the availability and accessibility of inputs.

The institutional problems are related to the proper passage from the public to the private sector in handling key agricultural services, products and information provision. A too quick

withdrawal of the public sector from areas long dominated by parastatals runs the risk of taking agriculture backward, in particular in low potential, subsistence oriented farming. This is unfortunately the dominant production mode of most Sahelian countries of West Africa. The challenge is to define the respective areas where the public and the private sectors each has its comparative advantage, and to ensure a smooth transition out of the public sector where it still holds a non-appropriate role.

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