Inorganic fertilizer is an agricultural technology that has immense potential for raising the productivity of poor smallholder farmers, enabling them to increase income, accumulate assets, and set themselves economically on a pathway out of poverty. The low prevalence of fully-commercial fertilizer use by Tanzanian farmers is evidence that they find it difficult to access the input for their crops at prices that will allow them to obtain sufficient, reliable returns from their investment in fertilizer.

This brief presents the results of a study to investigate supply-side constraints for fertilizer use by smallholder farmers in Tanzania in which the government is implicated. Government actions that could constrain the supply of fertilizer include policies, regulations, or taxes that result in higher prices for fertilizer for farmers. Government inaction that could have a similar result is primarily in the area of missing investments in public goods that, were they in place, would reduce the costs or risks to farmers of using the input. The objective of the study is met by taking a broad look at how fertilizer is supplied to farmers. The study involved a review of the literature of fertilizer supply, demand, and use; interviews with key participants in fertilizer importation and marketing in Tanzania; and two surveys—one with farmers and the other with input suppliers—in three farming areas where fertilizer is commonly used by smallholders.

**CONTEXT**

The economics of fertilizer use by many Tanzanian smallholder farmers can be challenging. In 2008, only 9 percent of farmers in Tanzania regularly used the input on their crops (National Bureau of Statistics et al. 2010), although this level will have gone up with the agricultural input subsidy program in place since then. There are several reasons for this:

- **The input is costly,** being a bulky commodity produced overseas and shipped inland from Dar es Salaam.
- **Information for farmers as to how they can make most efficient and profitable use of fertilizer is limited.** What knowledge exists on yield response patterns to the application of fertilizer is not communicated in a manner that can be understood easily by farmers or by agricultural extension staff.
- **Inadequate credit and household cash constraints present added barriers to fertilizer use by smallholder farmers.** Weak credit markets in Tanzania also make it difficult for importers and traders to efficiently supply fertilizer at low cost.
- **On the crop output side, variability in seasonal rainfall is an added source of risk in the use of fertilizer.** Output markets are volatile. Uncertain crop prices and government policy on those sales mean farmers are uncertain that they will obtain a sufficient return from the sale of the additional harvest that they obtain from the use of fertilizer to pay for the input.

- **Finally, the country as a whole still has uncultivated arable land.** Therefore, opening new land to cultivation to produce more crops is generally less costly for Tanzanian farmers than investing in yield-enhancing technologies, like fertilizer, on existing cultivated land. Nonetheless, the output prices for crops that are traded in local markets will be determined in part, due to market integration, by the lower costs of production in the land-surplus areas. The lower output prices that result consequently render profitable use of fertilizer more difficult for smallholders to achieve.

It is within this challenging economic context of fertilizer use by smallholder farmers that our study is situated. The government has adopted a consistent interventionist approach to the use of fertilizer by smallholder farmers. From the late 1960s to the early 1990s, the government regularly provided significant subsidies on fertilizer. With a liberalized agricultural input market starting in 1994, no subsidies were offered for several years. Starting in the early 2000s, however, subsidies on transport of fertilizer were provided to dealers. In 2008, a more ambitious subsidy scheme at the farmer level, the National Agricultural Input Voucher Scheme (NAIVS), was introduced for maize and rice production, covering about half of the districts of the country, primarily in high agricultural potential areas.

**FERTILIZER SUPPLY AND USE IN TANZANIA**

Except for Minjingu Rock Phosphate, currently all of the inorganic fertilizer used in the country is imported. The annual total fertilizer imports for both large-scale agricultural enterprises and smallholders as recorded by the Tanzania Revenue Authority between 2006 and 2010 are graphed here. There has been...
considerable volatility in the amounts imported during the past 20 years. Much of this is due to the starting and stopping of subsidy programs. For example, total imports of nutrients during the period from 1992 to 2000 varied between 20,000 and 42,000 mt. However, without any fertilizer subsidy in place in 2001 and 2002, imports fell to about 10,000 mt. Imports increased significantly to 160,000 in 2004 with the introduction of a new subsidy program. The increase in 2008 in fertilizer imports corresponds with the introduction of NAIVS (see text box).

Briefly considering fertilizer produced in Tanzania, Minjingu Rock Phosphate (MRP) is produced from a phosphate deposit just east of Lake Manyara in northern Tanzania. The deposit has a P<sub>2</sub>O<sub>5</sub> content of between 22 and 25 percent, with reserves estimated at more than 9 million mt. While it is considered to be among the highest-quality rock phosphates exploited in Africa, the agronomic response is not observed immediately but in the season following application. Consequently, farmer demand for MRP is lower than might be desired—this in spite of a cost per unit of P<sub>2</sub>O<sub>5</sub> 35 percent less than for the principal phosphate fertilizer used in Tanzania, DAP.

The average of 250,000 mt of fertilizer used in recent years corresponds to national application levels of 25.5 kg/ha on arable land. These rates are in the middle of the range for the region—less than Kenya and Malawi but considerably more than Uganda and Mozambique. The National Sample Census of Agriculture 2007/08 found that only 7.2 percent of smallholder cropped area in the long rains of 2008 received inorganic fertilizer and 9.2 percent of smallholders who planted annual crops applied any inorganic fertilizer (NBS et al. 2010). Although this prevalence of fertilizer use will certainly have increased in recent years with the implementation of NAIVS, levels of use are still relatively low and uncommon among smallholder farmers.

Because fertilizer is an imported commodity from international suppliers, global commodity and transport prices are the primary determinants of the price that fertilizer users in Tanzania pay. A 2006 study estimated the average delivered cost of fertilizer to up-country regional trading centers to be US$ 419 per mt. The free-on-board (FOB) commodity price at the source accounted for 65 percent of the total price. Transport from the shipping port to Dar es Salaam and on to the trading centers accounted for 22 percent. The margins obtained by the importers and traders accounted for an estimated 6.1 percent of the cost, suggesting a relatively competitive market (Chemonics & IFDC 2006). The table here compares average international export prices with local Tanzania retail prices (average for several market centers) for the period August 2010 to January 2011, and finds the price at source makes up a similar proportion of the final price as in the 2006 study.

Tanzania is a price taker for fertilizer from international markets, so can do little about that element of the landed cost of fertilizer in the country. However, there is more scope for action related to transport cost, including improving port operations in Dar es Salaam and improving domestic transport infrastructure to reduce the costs of distribution.

### FERTILIZER LEGISLATION AND REGULATION

The Fertilizers Act of 2009 was enacted to regulate the importation, distribution, storage, and marketing of fertilizer in Tanzania, with the objective of ensuring that the fertilizers that farmers in Tanzania obtain for use are of the quality advertised. All fertilizers manufactured, imported, or sold in Tanzania must be registered, packaged, and labeled in accordance with the Act. All dealers in fertilizers must be registered, with a minimum level of knowledge concerning the products in which they deal. Finally, all premises used for activities related to fertilizers must be registered. Importation of fertilizers into Tanzania, as well as exports of fertilizer from the country, requires a permit. The Act establishes a framework for a comprehensive set of regulations to govern how fertilizers are to be made available to Tanzanian farmers. Although draft regulations have been developed, they still have not been approved by the Minister of Agriculture. In consequence, many of the details of the regulatory regime are not yet in place—notably, the establishment of the Tanzania Fertilizer Regulatory Authority, which will considerably scale up oversight on the fertilizer sector in Tanzania. In addition to a national office for the authority, two part-time inspectors are to be trained from the staff of the District Councils in each of the more than 125 districts in Tanzania.

In reviewing the legislation, three policy issues arise:

#### THE NATIONAL AGRICULTURAL INPUT VOUCHER SCHEME (NAIVS)

Following a successful pilot the previous year, the NAIVS was launched in the 2009 long rains with about 750,000 farmers in 53 districts, expanding to 74 districts in 2010 and 87 districts in 2011. The peak years for the program as designed were 2010, when greater than 2 million farmers were to have received vouchers, and 2011, with 1.8 million beneficiaries. NAIVS is to wind up in 2014. Farmers are selected for participation by a Village Voucher Committee. Given the significant cash outlay required from beneficiaries, the program is targeting middle-income smallholders.

The vouchers enable farmers to acquire at a 50 percent subsidy either one 50-kg bag of DAP or two 50-kg bags of MRP for a basal dressing, one 50-kg bag of urea for top-dressing, and either 10 kg of improved maize seed or 16 kg of rice seed. Farmers take the vouchers to local input dealers to acquire the inputs. The input dealers then take the redeemed vouchers for reimbursement to a branch of the National Microfinance Bank. Dealers obtain their stock of inputs from private wholesalers. The government of Tanzania itself has not engaged in any procurement or distribution of fertilizer under the NAIVS program.

| FERTILIZER PRICES, TANZANIA RETAIL PRICE TO FREE-ON-BOARD PRICE FROM INTERNATIONAL SUPPLIERS COMPARISON, US$ PER MT, AUG 2010-JAN 2011, AVG |
|---|---|---|---|---|
| Source | Local retail price, US$ | int’l export price, US$ | Export price component of local price, % | Export source |
| Urea (46:0:0) | 592 | 381 | 64.3 | Arab Gulf |
| Ammonium Sulphate (21:0:0 + 24S) | 424 | 190 | 44.7 | Black Sea |
| Diammonium Phosphate (18:46:0) | 872 | 573 | 65.8 | Baltic Sea |

Source: http://www.amitsa.org

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**Note:** The table above compares average international export prices with local Tanzania retail prices (average for several market centers) for the period August 2010 to January 2011, and finds the price at source makes up a similar proportion of the final price as in the 2006 study.
• First, there is no nationally representative, objective evidence about the degree to which adulterated fertilizers are sold in Tanzania. In assessing the significance of farmer complaints about fertilizer, one cannot separate out farmers’ misuse due to their possessing insufficient information about proper use or about the likely response pattern they should expect. Given the weak evidence for much adulterated fertilizer on the market, for the act to be implemented in a proactive manner would seem to be against the interests of fertilizer traders and farmers. Doing so would raise the cost of fertilizer either through regulation-related fees. Moreover, a vibrant and competitive agricultural input market will be somewhat self-regulating of the quality of products marketed. Firms that sell adulterated or otherwise poorly performing fertilizer are unlikely to retain their customer base in subsequent farming seasons. If the act will restrict the levels of competition by placing higher hurdles for firms to participate in the fertilizer business in Tanzania, then the chance of adulterated products being sold will increase.

• Second, the Act gives only a very small role for the Tanzania Bureau of Standards (TBS), the statutory agency responsible for enforcing product standards for public health and safety. The primary activity of TBS concerning fertilizer has been to establish the quality of fertilizer at the port upon importation. Although no quality checks by TBS are made further along the fertilizer distribution and marketing chain, TBS has the legal basis, the statutory responsibility, and the ability to respond to complaints or do spot checks to assess fertilizer quality between the Dar es Salaam port and the farmer’s field. TBS has market surveillance inspectors up-country who could take on this role. Placing the quality assurance of high-analysis fertilizers within the responsibility of TBS, rather than the Ministry of Agriculture, would permit a wider set of distribution and marketing channels to be used for the sale of fertilizer, improving farmer access. However, doing so would require also increasing the information made available to consumers about proper use of fertilizer.

• Finally, there are potentially significant indirect costs associated with following the proposed regulations for the importation and marketing of fertilizer. All of these procedures impose costs for fertilizer importers or traders—costs that will be put into the retail price of the fertilizer. The benefits in terms of public health and safety from imposing these sorts of regulatory costs on the importation, distribution, and sale of a standardized global product like high-analysis inorganic fertilizers are quite small. The regulations should be applied judiciously and lightly, so that farmers benefit from lower prices - benefits that are likely to exceed the value of any benefits from close and strict regulation of fertilizer in Tanzania. The regulatory system in Tanzania for fertilizers that are standardized global commodities as designed is excessive. Policy reform is needed to reduce the regulatory burden faced by importers and dealers of these fertilizers.

OPERATIONS OF FERTILIZER IMPORTERS AND WHOLESALERS

In 1994, the government of Tanzania opened the fertilizer market to the private sector. By 2011, 10 firms, both importers and wholesalers, made up the membership of the Fertilizer Society of Tanzania, their trade association. These include the government-owned Tanzania Fertilizer Company, local private agro-business with varying levels of specialization in trade in fertilizer, and a couple regional and international firms. Although most of these firms have engaged in some importing of fertilizer in the past, in 2010/11 only three were consistently importing fertilizer – two international and one Tanzanian firm. The principal constraint that most of the others face is import financing. The other firms obtain their stocks from these three importers. Overall in 2011, the business of fertilizer importation in Tanzania was competitive. However, particularly given the greater access that the international importing firms have to finance, there is considerable risk of monopolistic conditions emerging in fertilizer supply to Tanzania.

Fertilizer comes into the country through the port of Dar es Salaam. The port is a choke point because of an inability to achieve economies of scale in the orders of fertilizer shipped in and insufficient off-loading facilities in terms of berths and product handling equipment. Although major fertilizer ports elsewhere are able to unload more than 10,000 mt per day, in 2007 the average unloading rate for fertilizer at the Dar es Salaam port was 1,560 mt per day. However, private investments now developing two separate fertilizer-handling facilities for the port will improve this situation in coming years.

The total costs of clearing fertilizer from shipboard over the docks and out the port gates amount to about US$40 per mt according to importers. These costs are not wholly rationalized and are changed quite frequently. However, no one felt that the costs at Dar es Salaam were inconsistent with charges incurred when importing fertilizer through other ports in southern and eastern Africa. Tanzania imposes no import duty on inorganic fertilizer. This zero rating is in common with the other countries of the East African Community. Similarly, no value-added tax is charged on sales of fertilizer. However, a 20 percent value-added tax is levied on most port-related fees and service charges, as well as on transport up-country.

All but one of the member firms of the Fertilizer Society of Tanzania engage in the wholesale distribution of fertilizer up-country. Transport costs up-country are high but competitive – transport of fertilizer from Dar es Salaam to the main wholesale centers in the Southern Highlands costs US$30 to US$50 per mt. Little fertilizer is transported by rail due to the inflexibility in place of delivery and the opportunity costs associated with delays in the operations of the rail network in Tanzania.

Most firms integrate their fertilizer marketing with agricultural output trade: Those firms with trucks will ship fertilizer up-country and bring back agricultural commodities. Most firms have wholesale depots in the principal farming areas of the country. Fertilizer is stocked in these depots for sale to retailers before planting. However, after harvest the depots are used for bulking commodities for shipment to Dar es Salaam.

A common pattern is for wholesalers to promote and maintain networks of private retail dealers from the farming area served by each of their depots. The firm offers fertilizer to them on credit terms—generally expecting full payment within 30 or 90 days of delivery, depending on the firm involved and the strength of the relationship with the retailer.
FERTILIZER RETAILERS

The number of retailers of fertilizer in Tanzania is not known exactly. Estimates were given during the study of 3,000 retailers, but no census has been done. Moreover, respondents highlighted that the distribution of retailers across the country is patchy, with large numbers in districts with high agricultural potential. In contrast, in some districts in the drier regions of central and coastal Tanzania and in the more remote western areas, no input retailers may be present.

In undertaking this study, two surveys were conducted—a trader survey and a farmer survey—in three farming areas of Tanzania where more fertilizer is used by smallholders than is the norm for the country as a whole: Hai district on the western slopes of Mount Kilimanjaro in the north, and in Iringa rural district near Iringa town and Songea rural district near Songea town, both in the Southern Highlands. The trader survey involved 31 fertilizer traders in the three study areas.

Here we present selected findings from this trader survey.

- The median annual sale of fertilizer per trader is 3,500 bags or 175 mt of fertilizer. The composition of their business sales is specialized in agriculture—nonagricultural items were reported on average to make up only 11 percent of the value of annual sales.
- The traders surveyed use more than one supplier—26 percent reported using only one supplier, whereas 48 percent use three or more. Smaller-scale traders tend to obtain several small orders from their suppliers during a season—the median number of orders was 3.5. However, for large-scale traders, a single order was more common.
- The quality of the fertilizer they market is not a major concern for most traders. Nine traders mentioned some problems including customers not obtaining the anticipated crop yield response, poor packaging, or caked fertilizers.
- The majority of customers are farmers, primarily small-scale farmers. Nonetheless, the amount of fertilizer purchased by small-scale farmers is significant, with median sales to individual farmers of five 50-kg bags. Half of all sales of fertilizer were estimated to involve the use of a subsidy voucher to cover some part of the cost of the fertilizer purchase.
- Fertilizer is generally marketed in 50-kg bags. Slightly more than half of the traders sampled sold fertilizer to customers in smaller quantities do so. For those traders who do so, sales of less than 50 kg account for 21 percent of the fertilizer sales of the traders surveyed. However, few of these traders obtained prepacked smaller packets of fertilizer—rather, they break 50-kg bags and either repack the fertilizer into smaller standard-weight packets or sell it loose by weight.
- Virtually all traders offer advice to farmers on the recommended use of fertilizer. However, how they obtain this information is quite varied, and the quality of the information that they obtain is difficult to judge. Of traders, 42 percent stated that TAGMARK, the national agro-input dealers’ association, was their most important source of information, whereas 29 percent reported principally relying on information provided by their fertilizer suppliers.

FERTILIZER USE BY SMALLHOLDER FARMERS

In the farmer survey for our study, 193 smallholder farmers were randomly selected in communities in the four survey areas, most of whom were fertilizer users—only 10 farmers in the sample reported not using any fertilizer, likely because of the subsidy voucher program. Maize is the principal fertilized crop—the median application rate is 220 kg/ha.

- Most farmers purchase fertilizer only once a year, with most doing so just before they apply it. Three bags of fertilizer was the median amount noted as being obtained in a single purchase. Most used input subsidy vouchers to purchase at least part of their fertilizer. However, one-fifth reported not receiving vouchers.
- The average distance to the fertilizer retailer from the farm of the surveyed farmers was 4.8 km, which is likely much closer than for most farmers in Tanzania. The median cost of transporting the fertilizer per kilogram per kilometer for those sample farmers who paid for transport was TShs 4.00.
- The government extension service was the most commonly mentioned source of information on how farmers obtain information on how to use fertilizer on their crops, followed by farmers’ own experience and training and information received through participation in farmers’ group.

CONCLUSION

The government of Tanzania has taken several actions that have been conducive to improving farmers’ access to fertilizer. The liberalization of agricultural input markets has increased private-sector participation in these markets. Although the pool of importers and wholesalers of fertilizer in Tanzania remains quite small, all indications are that a competitive market exists. Although observers might question in principle the high level of intervention by the government in agricultural input markets in Tanzania by its providing expensive fertilizer subsidies for several million smallholder farmers, the design of NAIVS, when compared to most of the other fertilizer subsidy programs in other African countries, generally does not work against the interests of private firms selling fertilizer. Although a few direct taxes and fees on fertilizer supply activities remain that seem difficult to justify, in general fertilizer importation and marketing activities in Tanzania are relatively unencumbered in this way. Progress can certainly be seen in the development of a wholly private-sector-led agricultural input market in Tanzania serving the needs of its smallholder farmers.

However, government inaction is having an adverse effect on efforts to increase use of fertilizer in some areas. The most important of these missing public goods are not specific to fertilizer but are implicated in broad development efforts in Tanzania. These include improving Dar es Salaam port operations and strengthening transportation links within the country to reduce transport costs for both input and output markets both regionally and locally; expanding and strengthening credit markets; and improving the flow of market information that farmers and traders need to make sound commercial decisions.

However, the government of Tanzania also can undertake several fertilizer-specific initiatives to enhance farmer uptake of the input:
There are two areas where a lack of information about fertilizer use results in either higher costs or inefficient use of inorganic fertilizer for smallholder farmers in Tanzania.

• Farmers generally have limited scientific information about the proper agronomic use of fertilizer. Farmers need to know for the particular agroecological zone in which they farm what nutrient deficiencies may be limiting crop yields and how those nutrient limitations can best be addressed using fertilizers as part of a comprehensive soil fertility management approach.

• More information on the economics of fertilizer use on the various crops grown by smallholder farmers is needed. An effort to compile, validate, and disseminate a consistent and robust set of crop- and area-specific fertilizer recommendations is required. Such recommendations need to be adaptable for changing input and output market conditions. They also should be useful for resource-constrained farmers who need to choose which elements of a recommended fertilizer package they should prioritize in their farming.

Reform regulations. We suggest that, at least for the standard, high-analysis fertilizers that are most commonly used in Tanzania, the fertilizer regulations being proposed, if comprehensively implemented, would be a poor fit for the public benefits sought through them. A considerably lighter regulatory regime would allow more high-analysis fertilizer onto the Tanzania market in more places, resulting in lower costs for Tanzanian farmers. The Ministry of Agriculture should be judicious in its implementation of this legislation.

Policy inconsistencies: In the context of fertilizer, the actions of the government to promote the use of commercial inputs for higher agricultural productivity are regularly subverted by state intervention in crop output markets that curtail the returns that farmers using commercial inputs might obtain from their investments. It is illogical that the government of Tanzania spends a substantial portion of its budget for agriculture on fertilizer subsidies at the same time that it restricts the market for the maize and rice produced using that fertilizer by closing its borders to trade in staple foods in the interest of national food security. For the purposes of moving smallholder farmers in Tanzania to a sustainable higher level of agricultural production, the government of Tanzania must seek other mechanisms to ensure national food security than restricting the output markets for its farmers.

In summary, there is clearly need for intensification of agricultural production in several areas of Tanzania where the population density has risen to levels that make it difficult for sufficient production to be generated from existing cropland using traditional production methods. The government of Tanzania must continue to pay attention to how it can enable smallholder farmers to profitably and appropriately make use of inorganic fertilizer, improved seeds and planting materials, and other improved agricultural technologies for higher agricultural production by smallholders on current cropland. Paying attention to supply-side factors related to the use of inorganic fertilizer and the other technologies is an important element of such efforts.


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