

**From a Sasakawa Global 2000 Pilot Program to
Sustained Increases in Agricultural Productivity: The Critical Role of
Government Policy in Fostering the Ethiopian Transition**

By

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1. Introduction

Increasing population density and declining soil fertility in Sub-Saharan Africa (SSA) give rise to a need for agricultural intensification to increase crop productivity and rural incomes. The persistent challenge facing many SSA countries today is to rapidly introduce improved, profitable technologies to farmers through targeted pilot programs while simultaneously promoting the development of markets and other institutions that will ensure widespread, sustainable adoption of these technologies. The Sasakawa-Global 2000 (SG) program, in partnership with numerous African governments, began taking up this challenge more than a decade ago.

SG, in collaboration with national extension services, seeks to promote rapid adoption of new seed/fertilizer technologies by focusing extension efforts on closely supervised, half-hectare demonstration plots cultivated by individual farmers on their own land. After a year or two of program support (primarily credit for inputs and extension supervision) farmers are expected to recognize the superior performance of the technologies and possess the necessary skills to use them without continued program assistance. Although SG programs have often experienced early successes (rapid growth in the number of demonstration plots, increased yields for crops targeted), the sustainability of the technology adoption after the program ends -- particularly sustained use of fertilizers -- has been problematic. Surprisingly, there have been few systematic studies of the reasons for the subsequent "disadoption" (Farrington 1995, Putterman 1995, Yudelman 1991).

The potential for raising rural incomes in Ethiopia through increased agricultural productivity is significant due to the low level of current productivity. In 1996 GNP per capita

was US\$100, roughly half that of Sub-Saharan Africa (World Bank 1998). Approximately 86 percent of a population of 58 million people rely on rain-fed agriculture for their livelihood. In addition, agricultural practices are primarily characterized by use of retained, traditional seed and organic manure. In 1995/96 only 28 percent of Ethiopian farmers used inorganic fertilizer and 3 percent used improved seed (CSA 1995/96).¹

2. Research Objectives and Methods

This paper reports on a case study of one of the most successful SG programs to date -- the Ministry of Agriculture (MOA) program in Ethiopia. We first analyze the factors that contributed to the success of the SG pilot program. Next we examine how well public policy and investment are supporting the expansion and sustainable adoption of the technology, which is now being promoted by the government's New Extension Program (NEP), the successor to the MOA/SG pilot program. Key research questions include: (1) What are the modifications to the SG model that were introduced by the NEP? (2) How is the extension service handling this increased NEP demand? (3) How are input and credit markets responding to the demands of the expanded NEP, given the current policy context of market liberalization and government decentralization? (4) What changes in government policies or investments would improve the responsiveness and efficiency of these markets, and (5) What lessons does the Ethiopian experience provide for other SSA countries?

Analytical methods used include crop budgets to evaluate the financial and economic profitability of the SG/MOA technology packages; yield models to identify the relative importance

¹This figure may underestimate the number of farmers using improved seed because many farmers use improved tef seed but do not define it as improved.

of factors influencing yields (e.g., inputs, management practices, farm characteristics); and a subsector analysis, in combination with a fertilizer price determination model, to evaluate how well input and credit markets are responding to farmers' demand. Data come primarily from two sources: (1) a survey of SG participants and graduates in the Oromiya region (zones of East Shewa, West Shewa, and Jimma) conducted in 1997 and (2) 1998 structured interviews of actors involved in the provision of inputs, credit, and extension services (fertilizer importers and distributors, seed producers/distributors, extension agents, representatives of farmers' cooperatives, and Ministry of Agriculture officials).²

3. MOA/SG Successes Lead to Creation of NEP

Crop budgets prepared from survey data for MOA/SG demonstration plots (hybrid seed, DAP and urea) and control plots (farmer's usual practices of local seed and DAP) cultivated by MOA/SG maize program participants revealed that yields, returns per hectare, and returns to labor were significantly greater for the demonstration plots (Table 1).

Table 1. Summary Results of Financial Analysis for Maize by Program Type

	Jimma		West Shewa
	MOA/SG	Control (1)	MOA/SG
Yield (ton/hectare)	5.6	2.8	5.6
Net income (Birr/hectare) (2)	2,042	1,029	2,781
Returns per family and mutual labor day (Birr/hectare) (3)	15	11	18

(1) Control plots were surveyed only in the Jimma zone.

(2) Net income and returns to labor are calculated at January maize prices -- immediately following harvest when most farmers sell their crops. USD = roughly 7 Ethiopian Birr.

(3) Mutual labor refers to labor provide by extended family members. Average daily labor rates were 3-6 Birr/ha.

²Surveys were conducted by the Grain Market Research Project, a collaborative effort of the Ministry of Economic Development and Cooperation and the Department of Agricultural Economics, Michigan State University.

Farmers using improved seed and fertilizers for tef exceeded average regional yields by 50% while realizing good net incomes and returns to labor. Consequently, MOA/SG demonstration plots increased from 153 in 1993 to 3,185 in 1995. Economic analyses correcting for price distortions, taxes, and subsidies showed that these technologies are not only privately profitable to farmers but also profitable to society in general. Among the factors contributing to this success were: (1) the small scale nature of the program, permitting close supervision (e.g., an average of 11 extension visits per farmer per season); (2) input delivery largely through the private sector, but facilitated by MOA/SG (e.g., some transport of fertilizer to ensure timeliness); (3) credit (without interest) administered and guaranteed directly by SG and its agents; and (4) a focus on better-off farmers in high potential areas (Table 2).

Table 2. MOA/SG Tef Farmers in East Shewa Compared to Typical Ethiopian Tef Farmers in the Same Area

	MOA/SG	Typical
Mean hectares cultivated per capita	0.62	0.36
Percent of literate household heads	95	22
Mean number of draft animals per household	2.7	1.9
Mean livestock units per household (1)	5.1	4.7

(1) Calculated using the following weights: cattle=1, sheep/goats=0.5, horses/mules=0.7

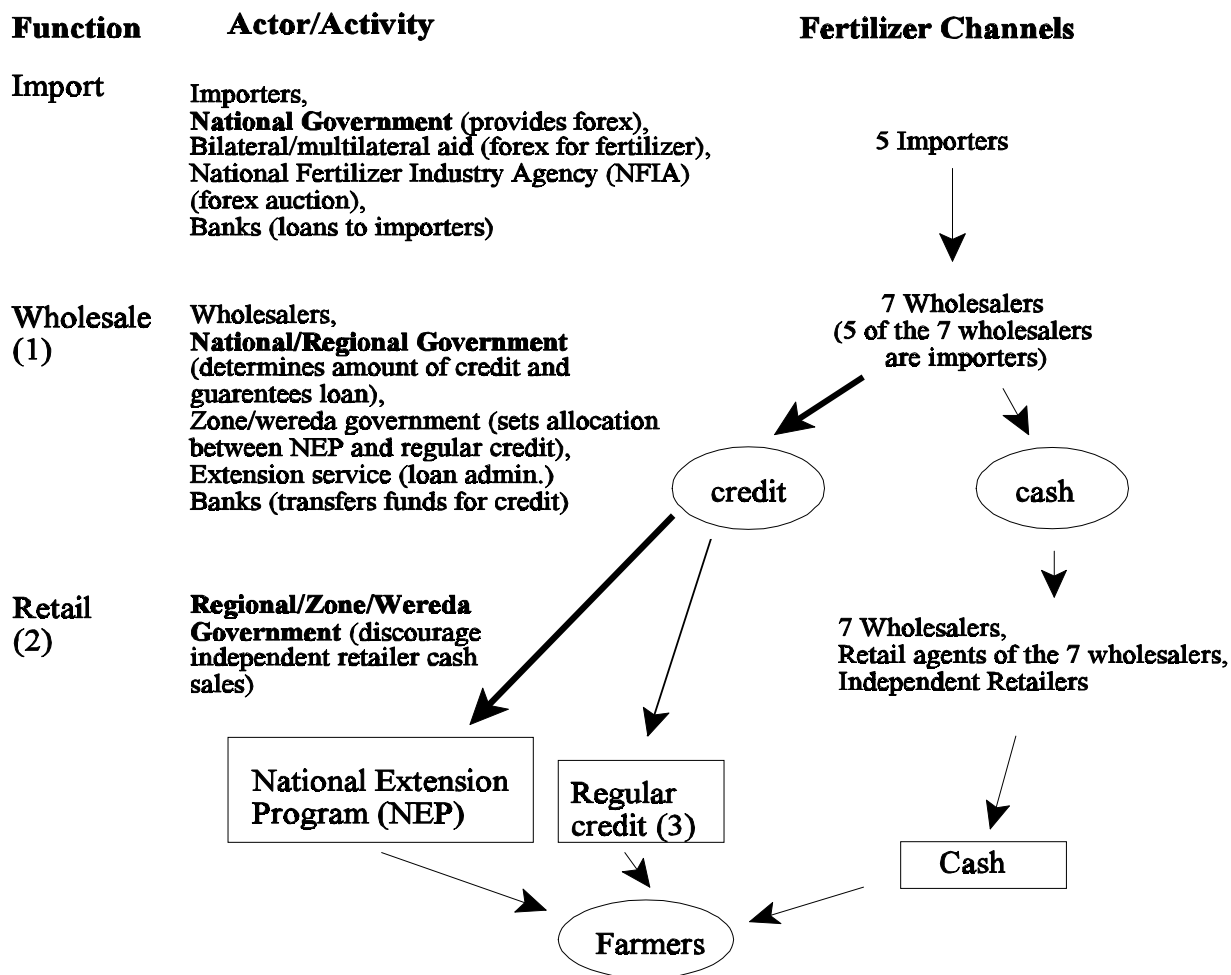
Although promoting the same technology packages as MOA/SG, the NEP focus is on increasing aggregate national production rather than just the introduction of new technologies. Thus the scale (number of demonstration plots) and the scope (breadth of regions and types of farmers covered) are both much greater under the NEP. The NEP began in 1995 with 32,046 plots, expanded to 600,634 in 1997, and was anticipating almost 3,000,000 in 1998. This rapid expansion has taken place at a time of major changes in markets, policies, and institutions

affecting the agricultural sector: a new credit system launched in 1994, gradual liberalization and privatization of the fertilizer market from 1991 to 1997 (when the last subsidies were removed), and government decentralization (administrative and fiscal responsibilities being shifted from the national to the regional level). Consequently, many aspects of NEP administration differ substantially from the earlier MOA/SG program. The NEP credit system is more complex: (1) there are multiple actors (banks provide credit, regional governments guarantee credit, and development agents (DAs) approve participants and collect payments.); (2) interest is charged; and (3) local police are used for enforcement. The NEP needs to deal with a fertilizer sector characterized by increasing retail prices due to subsidy removal and supply inefficiencies (often aggravated by local governments -- empowered by decentralization -- intervening in the market).

4. Factors Mitigating the Continued and Expanded Use of Improved Technology

Sustained and expanded use of new technologies is predicated upon how well the three functions of extension, credit, and input delivery meet the needs of farmers in particular and society in general. Figure 1 summarizes the general structure of the fertilizer distribution system in 1998 from importation to retail sales, identifying the principal actors at each level and showing how fertilizer flows tend to be tied to credit flows and NEP activities. The government, by fulfilling its assigned role of conducting foreign exchange auctions for fertilizer, providing extension services to implement the NEP and guaranteeing input credit, retains substantial control over (1) amounts of fertilizer imported, (2) credit allocated by zone, district, and program and (3) which distributors are awarded contracts -- all of this despite input market liberalization

Figure 1. The Structure of the Fertilizer Market in Ethiopia in 1998



(1) Wholesale distribution concerns primarily fertilizer sales covered by credit and sold to service cooperatives (regular credit) and the NEP, distributed by district agricultural officers to program participants.

(2) Retail sales are primarily cash sales to individual farmers.

(3) Regular program credit was the dominant credit program prior to 1994 whereby credit was provided to farmer service cooperatives for use by individual farmers.

and privatization. Our subsector analysis suggests that many aspects of input market structure and the institutional framework for providing credit and extension services are constraining adoption and sustained use of the technologies promoted by the NEP.

Quality of Extension Service. Two principal problems are evident in the NEP. First, there are now too many plots per extension agent. MOA/SG agents in 1997 covered 60-70 plots (the recommended level is 100), but in 1998 case loads ranged from 150 to 500 plots. Survey data for 1997 showed that MOA/SG agents made an average of 12 visits per farmer; this is no longer possible with greater than 150 plots per agent. Given that the broader population served by NEP will need more rather than less supervision due to lower literacy rates (25% literacy for household heads nationally vs. 90% for MOA/SG participants), less land, labor, and farm equipment, the substantial increase in plots per agent is worrisome (see Table 2). Analysis of 1997 survey data confirms that farmers must learn good management practices if they are to get the full benefits from improved technologies. For example, yield determinant models showed that for each week of deviation from ideal planting dates, yields declined by 194 kg/ha ($p=0.03$).

The second extension problem is that too many non-extension tasks are being imposed on extension agents (processing credit applications, collecting reimbursements, and dealing with fertilizer distributors). In some cases the credit workload is so heavy that it leads to delays in fertilizer distribution (due both to delayed repayment of prior credit and slow processing of current year demands). In 1998 all service cooperatives and agricultural bureaus interviewed reported late deliveries due primarily to delays in credit reimbursement and credit processing, with some cases of supplier inefficiencies that required government personnel to provide substitute services. For example, government personnel and vehicles were used when one supplier failed to

fulfill their NEP contract due to lack of transport and storage. District agricultural officers and extension agents interviewed in 1998 reported insufficient time to perform their normal duties due to these additional tasks and noted that their role in collecting credit repayments created an undesirable adversarial relationship between farmers and themselves.

At present the extension service attempts to serve as a surrogate for well-functioning credit, fertilizer and seed markets³ by providing administrative support to banks and fertilizer distributors without due compensation; many of these services should be provided by the private sector. For example, in one district, the distributor appointed to supply NEP fertilizer to participants delivered to the district headquarters instead of to the marketing outlets, forcing the agricultural bureau to incur the costs of transport to the outlying distribution centers. The overall impact of increased plots per agent and extra tasks is a lower quality extension message with increased (non-extension) costs attributed to the extension program.

Credit will become increasingly important as NEP expands to farmers who have fewer resources and lower incomes than MOA/SG participants, yet there are signs that the credit program is already failing to meet farmers needs. Credit problems are of two types: (1) those associated with the way the system is administered and (2) the amount of the credit portfolio made available to different zones and types of demand. The administration problems are linked to the time that agriculture personnel devote to processing credit (discussed above) and the regional government's use of the credit system to establish regional fertilizer monopolies that reduce competition and raise prices (see next section). This discussion focuses on survey evidence showing that the total amount of credit is inadequate to meet both NEP and regular

³Hi-bred maize seed is not commonly available on the open market, only through the NEP.

demand. Since 1994 credit has been guaranteed and administered by regional governments who determine allocations to zones who, in turn, determine allocations by district. Approximately 30% of farmers used fertilizer in 1995 when the NEP began and most were purchasing it with credit. With the expansion of the NEP the total credit available must now be divided between rapidly expanding NEP needs (fired by ever-expanding NEP targets) and regular credit for non-participants. For many zones/districts the total amount of credit has increased, but the amount left for regular credit has declined substantially or disappeared entirely; for some zones/districts the total credit allocation has declined. A few examples from survey data: (1) total credit sales for districts surveyed in Jimma zone fell by 43% and fertilizer disbursed through the regular credit program fell by 70 percent; (2) in one survey district of Jimma there is no regular credit available to farmers. When NEP becomes the only credit option or regular credit is severely limited, SG/NEP graduates and non-participants cannot obtain fertilizer credit unless they sign up for another year in the NEP, thus reducing the chance that a new farmer can join the program. Reimbursement rates also influence the size of the subsequent credit portfolio as regional governments must reimburse the banks from other sources, thus reducing their capacity to guarantee future credit. There is evidence that Government has toughen it's collection procedures (e.g., use of police, confiscation of assets) and stiffening its requirements for obtaining credit (e.g., farmers were denied credit for the highly profitable early maize crop in West Shewa due to a poor credit history).

Cash sales of fertilizer do not serve the needs of farmers now being denied credit. Some local governments are discouraging the development of a retail network for cash sales because they think the potential clients will be primarily those having defaulted on past credit. Others feel that if farmers have alternate sources of fertilizer they will not sign up for the NEP and targets will not be met. Even without these restrictions, however, the bulk of the farmers denied credit probably do not have the resources to purchase more than token amounts of fertilizer.

Low-cost input market. It is possible to reduce the cost of fertilizer through reorganization of fertilizer imports and distribution. Improved timing of imports could take advantage of seasonality in world prices and in Ethiopian transport rates (estimated savings of USD/MT of 6.50).

Improved transparency and competition in fertilizer distribution activities could also reduce farm gate fertilizer prices. In 1998 fertilizer retail and wholesale prices were liberalized for the first time; however, prices are not yet determined competitively. An econometric reduced form price model was estimated for DAP retail prices from March-August 1998 in the Oromiya region in which multiple prices are observed in each surveyed district (Stepanek 1999 forthcoming).

The model captures the structure of the market by including dummy variables for the type of pricing mechanism and distribution channels present in a district. Prices for credit sales may be determined privately between the government and the government-nominated distributor for a district, or through a fertilizer auction. Fertilizer auctions were present for the first time in 1998 in many, but not all districts, in the Oromiya region. Participating retailers (the large distributors who are also often importers) offered competing bid prices to distribute a specified type and

quantity of fertilizer to a district. Cash prices are set independently by large distributors (the same suppliers who also sell on credit) or by the small independent retailers (who do not sell on credit and purchase their fertilizer from the large distributors). Distribution channels are split by cash and credit sales (see Figure 1). As discussed above, credit sales are channeled through only the NEP or through both the NEP and regular credit program, depending on credit availability and local government decisions.

Estimation results reveal that in districts with only NEP credit, DAP prices for fertilizer sales by government-selected distributors were 11 Birr/quintal higher than prices for fertilizer sold in districts having conducted a fertilizer auction ($p=0.017$). Interaction effects revealed that prices are significantly higher in districts in which both the NEP and regular credit programs are available relative to districts in which only the NEP is present. The NEP and regular credit programs are separate administrative channels so perhaps suppliers charge higher prices when they supply both programs to compensate for the increased paperwork. Cash sales by the large distributors and small independent retailers are roughly 10 Birr/quintal higher than prices determined by auctions.

Fertilizer auctions show a greater potential for reducing prices than a number of other significant variables included in the model (e.g., transport costs and economies of scale proxied by the size of the fertilizer order -- both statistically significant but exhibiting very small downward impacts on prices). The model results lead us to conclude that improving transparency and competition can result in significantly lower retail prices relative to markets in which a distributor is appointed by the government.

5. Recommended Government Policies and Investments

For the NEP program to succeed in the long-run, the government needs to rapidly move its focus from the NEP to the development of input and credit markets to support NEP graduates. Specialization of services is critical for cost control and effective input market development. If the NEP continues to provide credit and inputs to participants, it is unlikely that it will have the financial means to simultaneously expand the program to enroll new farmers, continue to provide inputs and credit to farmers that have already adopted the new technology, and continue to deliver a high-quality extension message. Credit resources are limited, thus it is important to develop a mechanism that provides credit to the farmers that are extremely poor and simultaneously provide a reliable, low-cost fertilizer market for those farmers that can purchase fertilizer with cash. Expanded fertilizer auctions and open, competitive markets will challenge the private sector to develop timely and low-cost input markets. Government favoritism and retraction of stated policies only discourage private sector investment.

6. Lessons for Other Sub-Saharan African Countries

The experience in Ethiopia lends evidence to other SSA countries on how to develop a strong private/public partnership that promotes expansion of high-input technologies. The primary message is for governments to provide the political commitment to stay the course in liberalizing credit and input markets. Partial liberalization - for example, liberalizing input prices but then encouraging monopoly markets - is not likely to induce the development of a vibrant, low-cost, private sector. The success of extension services in introducing new technologies to farmers is highly dependent upon the development of private credit and input delivery systems that allow for long-term adoption of new technologies.

References

- Abate, Demeke. 1997. *Survey Supervisors Report*. Addis Ababa, Ethiopia.
- Abate, Habtemariam. 1997. Targeting Extension Service and the Extension Package Approach in Ethiopia. Addis Ababa, Ethiopia.
- Central Statistical Authority. 1995/96. *Rural Household Survey*. Addis Ababa, Ethiopia.
- Easterbrook, G. 1996. Forgotten Benefactor of Humanity, *Atlantic Monthly*, January 7, pp. 75-82.
- Farrington, J. 1995. Mobilising Science and Technology or Fostering Organisational Change: A Response to Borlaug and Dowswell, *Development Policy Review: Overseas Development Institute*, Vol. 13, pp. 131-133.
- Howard, J., Demeke, M., Kelly, V., Maredia, M., Stepanek, J. 1998. *Can the Momentum be Sustained? An Economic Analysis of the Ministry of Agriculture/Sasakawa Global 2000's Experiment with Improved Cereals Technology in Ethiopia*. Department of Agricultural Economics, Michigan State University, Staff Paper No. 98-25. E. Lansing, Michigan.
- Putterman, L. 1995. Economic Reform and Smallholder Agriculture in Tanzania: A Discussion of Recent Market Liberalization, Road Rehabilitation, and Technology Dissemination Efforts. *World Development: Great Britain*. Vol. 23, No. 2, pp. 311-326
- Stepanek, J. 1999 forthcoming. *How the Organization of the Fertilizer Sector in Ethiopia Affects Maize Productivity*. Ph.D. thesis, Department of Agricultural Economics, Michigan State University, E. Lansing, Michigan.
- World Bank. 1998. *World Development Report*. Washington, D.C.
- Yudelman, M., Coulter, J., Goffin, P., McCune, D., and Ocloo, E. 1991. "An Evaluation of the Sasakawa-Global 2000 Project in Ghana." in Russell, N., and Dowswell, C. (eds.) *Africa's Agricultural Development in the 1990s: Can it be Sustained?* Center for Applied Studies in International Negotiations (CASIN)/Sasakawa Africa Association (SAA)/Global 2000 Program of The Carter Center, Geneva.