AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

MARKET ANALYSIS NOTE #3

Grain Market Research Project
Ministry of Economic Development and Cooperation
January 1997

THE DEREGULATION OF FERTILIZER PRICES: IMPACTS AND POLICY IMPLICATION[1]

This note assesses how the recent deregulation of fertilizer prices will affect the profitability of fertilizer use on various crops throughout Ethiopia. The note also identifies other policy measures that can increase the cost-effective use of fertilizer to promote productivity growth throughout the food system. Results are based mainly on the derivation of value-cost ratios (VCRs) for the use of DAP fertilizer on selected crops in 51 cereal production areas of Ethiopia. The VCR is an indicator of profitability of fertilizer use (measuring the value of additional crop ouput relative to the cost of a given application of fertilizer). The factors that affect the VCR are the agronomic response of crop yields to the application of fertilizer, the cost of fertilizer to the farmer, and the price of the crop to which fertilizer is applied.

Increasing crop yields is the only realistic option for improving food availability in Ethiopia.[2] At present, cereal yields are among the lowest in the world. Yields of teff, wheat, and maize average 8, 12, and 16 quintals per hectare, respectively. However, it has been shown through national and donor extension programs that cereal yields on peasants' farms can be increased two- to three-fold using on-shelf technology.[3] Increased use of fertilizer and improved seed types are critically important in achieving this production growth. Hence, the focus of this study on identifying the factors affecting the profitability of fertilizer use.

The main findings of the report are as follows:

- ***Payoffs to Increased Fertilizer Use:*** Using national average figures, the payoffs to society of increased fertilizer use appear to be very high. Data in Table 1 demonstrates that about 10 million quintals (12% of total cereal output)in 1995/96 was attributable to the use of fertilizers. This is roughly 46% of the total cereal marketed in 1995/96. This volume of cereal output, valued at average 1996 producer prices, is about 1.18 billion birr. The full unsubsidized cost of the fertilizer used on cereals in the 1995/96 meher season was 0.56 billion birr.[4] Hence, even at relatively low yields and fertilizer response rates, the use of fertilizer on cereal crops in Ethiopia contributed over 0.60 billion birr ($94 million) to agricultural GDP. This is about 3.5% of average agricultural GDP during 1993/94 - 1994/95.

- ***Profitability of fertilizer use by crop, by region, and by type of household:*** The major factor determining fertilizer use is the agronomic response of crop yield to fertilizer application. The average response rate varies greatly by crop and region, as shown in Column B of Table 2. For example, the incremental response rate of wheat can be as high as 10 quintals per quintal of DAP

Table 1. Incremental yield obtained as a result of fertilizer use in 1995/96 compared to not using fertilizer at all

Crop	(A) %of total fertilizer use in 1995/96 (2,416,490Qt) applied to each crop (%)	(B) Fertilizer used on each crop (1995/96) (quintals)	(C) Incremental Yield by using 100kg DAP (Qt/Ha)	(D)=(B)*(C) Incremental yld as a result of fertilizer use (quintals)
Teff	46.3	1,118,835	3.87	4,329,891
Wheat	21.7	524,378	4.86	2,548,479
Maize	10.7	258,564	7.03	1,817,708
Barley	7.5	181,237	5.10	924,307
Millet	2.9	70,078	3.68	257,888
Sorghum	1.8	43,014	3.40	146,246
Total	90.0	2,196,106		10,024,519

Note: Total fertilizer supply for the 95/96 crop year = 406,565 tons. The amount unutilized in 1995/96 crop year = 164,916 tons (54330 tons for AISCO, 91689 tons for Amalgamate Eth. Ltd. and 18897 ton for Ambassel Trading Co.). Therefore, the amount utilized in 1995/96 = 241,649 tons. The total marketed quantity of cereals in 1995/96 = 21.65 Million quintals (i.e., 26.2 % of the total cereal produced). The total quantity of cereals produced in the 1995/96 meher season = 82.7 Million quintals.

A = percentage proportion of fertilizer applied on each crop obtained from CSA Agricultural Sample Survey Statistical Bulletin # 152.

B = Incremental yield as a result of using 100 kg of DAP/ha obtained from KUAWAB/DSA" Fertilizer Marketing Survey; USAID/Ethiopia, October 1995.

C = The incremental yield resulting from use of fertilizer.

fertilizer applied in some areas of Arssi. By contrast, the average response rate of teff is rarely over 5 quintals per quintal of DAP in any of the regions examined. In general, yield response to fertilizer application is highest for wheat and maize, and lowest for teff. However, this is offset to some extent by the high value of teff relative to wheat and maize.

- ***Importance of crop value rather than just crop prices in determining fertilizer use:*** The VCR highlights that the profitability of fertilizer use depends on the additional *value* of crop output generated from its application, not just the price of the crop. Crop value is related not only to the output price, but also the additional amount produced from fertilizer application. While it is commonly felt that incentives to use cash inputs on grain crops may be depressed by low grain prices, low prices do not necessarily mean that producers are worse off. If low grain prices occur as a result of favorable production, and farmers are able to produce more (for own consumption or for sale) than ordinarily, then farmers' may have greater incentives to use fertilizer in low price/good harvest conditions and may also be in a better position to finance input purchases in the next season.

The value of crop output also affects the economics of fertilizer use by rural households that sell little or no cereals. For these net grain-purchasing households, which account for almost half of Ethiopia's rural population, the response rate of fertilizer and the acquisition price of cereal crops influence whether the household should spend its scarce money on buying fertilizer to produce more grain that would otherwise need to be purchased. The ability of net cereal-buying farm households to afford fertilizer is negatively affected as grain prices rise. The higher the price of grain, the more of their scarce income must be spent on procuring grain for household consumption, leaving less money to purchase inputs for the next crop. These households are generally adversely affected by higher prices of staple food.

- ***Implications of Deregulating Fertilizer Prices:*** Until January 1997, fertilizer prices were subsidized by 20% to 39% depending on the location. The total cost of distributing fertilizer to production regions averaged 257 birr per quintal according to Government records, while the selling price in 1995/96 was 200 birr per quintal. In addition, a pan-territorial pricing policy on fertilizer tended to reduce the price even further in the more remote areas (relative to market conditions) and offset the general price subsidy somewhat in the areas where transport costs were relatively low. The implications of deregulating fertilizer prices for 1997 are assessed for 51 location and crop combinations (Table 2). The landed import cost of DAP at Assab are added to transport costs to each wholesale distribution location (using private freight rates obtained from Ministry of Transport and Communications). A further transport cost of 37.5 birr per ton is added to account for transport costs from these wholesale locations to the retail points. To these costs are added 1996 average CIF, bank charges, handling costs, inspection expenses, etc. to obtain the deregulated fertilizer price referred to as Scenario 1 in Table 2.

  Scenario 1 represents a situation in which deregulation is accompanied by no cost savings in fertilizer distribution. This gave an average weighted price of DAP fertilizer of 261.15 birr per quintal (column c, Table 2).[5]

  Under Scenario 1, the removal of fertilizer price subsidies and pan-territorial pricing would result in a 21 to 39 percent increase in the price that farmers pay for fertilizer, compared to subsidized 1996 prices. Farmers in areas with very high transport costs such as Gondar, Harar and Mekelle are likely to pay at least 35% more in nominal terms than they did in 1996.[6] Under this scenario, the VCR of DAP fertilizer use is above 2.0 (the generally accepted break-even point for fertilizer profitability) in only 20 of 51 crop/location combinations presented in Table 2. By contrast, using subsidized 1996 fertilizer prices, the VCR exceeded 2.0 in 41 of 51 cases. Based on Scenario 1 deregulated fertilizer prices, the VCR estimates exceeded 2.0 in 5 of 13 cases for maize, 12 of 25 cases for teff, and 6 of 8 cases for wheat. These results indicate that, other factors held constant, the demand for fertilizer will decline in some areas following the removal of subsidy in 1997.

  The cost to the Government of the fertilizer subsidy in 1995/96 was approximately 149 million birr (US$24 million). If the elimination of the subsidy results in a 20% reduction in fertilizer use, the value of the output foregone would be approximately 170 million (based on information in Table 1). If the elimination of the subsidy resulted in only a 10% reduction in fertilizer use, then the value of the output foregone would only be approximately 91 million. On-going analysis is attempting to estimate the expected demand for fertilizer at unsubsidized price levels.

Table 2. Profitability of Fertilizer Use, Various Regions, with and without subsidy

Region	(A) Most fertilized. crop in the area	(B) Avr. incremental yield (qt per qt DAP applied)	(C) average producer price, January-June 1996 (Birr per qt)	(D)=(B)*(C) incremental value of one qt DAP applied (birr)	(E) subsidized price DAP (birr/qt)	(F) unsubsidized price DAP (birr/qt)	(G)=(D)/(E) VCR with subsidy	(H)=(D)/(F) VCR without subsidy
S. Tigray								
Ambalagie	Mixed Wheat	2.68	215	576.2	2000	2568.7	2.88	2.24
Chercher	Mixed Teff	3.5	224	784	2000	2568.7	3.92	3.05
W. Tigray								
Lilay Keraro	Mixed Teff	3.1	224	694.4	2000	2568.7	3.47	2.70
E.Gojjam								
Guzamen	Red Teff	4.09	110	449.9	2000	2568.7	2.25	1.75
Mechakel	Red Teff	0.91	110	100.1	2000	2568.7	0.50	0.39
Shebel Bernta	Red Teff	4.37	110	480.7	2000	2568.7	2.40	1.87
N. Shoa								
Kaya Gabriel	Mixed Wheat	3.42	141	482.22	2000	2568.7	2.41	1.88
S.Gondar								
Dera	Millet	5.05	125	631.25	2000	2568.7	3.16	2.46
Iste	Red Teff	3.39	147	498.33	2000	2568.7	2.49	1.94
Kemkem	Red Teff	3.2	147	470.4	2000	2568.7	2.35	1.83
Simada	Red Teff	2	147	294	2000	2568.7	1.47	1.14
W. Gojjam								
Bahir Dar	Millet	3.83	80	306.4	2000	2568.7	1.53	1.19
Dembecha	Mixed Teff	3.14	114	357.96	2000	2568.7	1.79	1.39
Jabi Tahnan	maize	5.95	70	416.5	2000	2568.7	2.08	1.62
Quarit	Mixed Teff	2.3	132	303.6	2000	2568.7	1.52	1.18
Yilma & Densa	barley	3.6	115	414	2000	2568.7	2.07	1.61
Arsi								
Bale Gesgar	Mixed wheat	10.72	101	1082.72	2000	2568.7	5.41	4.22
Diksis	Mixed Wheat	5.81	106	615.86	2000	2568.7	3.08	2.40
Hitosa	Mixed wheat	10.25	106	1086.5	2000	2568.7	5.43	4.23
Limu Bilbilo	Mixed wheat	3.79	106	401.74	2000	2568.7	2.01	1.56
Tena	Mixed wheat	5.45	106	577.7	2000	2568.7	2.89	2.25
E. Shoa								
Ad'a	Mixed Teff	4.32	202	872.64	2000	2568.7	4.36	3.40
Dugda	Red Teff	3.8	153	581.4	2000	2568.7	2.91	2.26
Liben Zequala	Mixed Teff	4.12	202	832.24	2000	2568.7	4.16	3.24
Shashemene	maize	7.85	66	518.1	2000	2568.7	2.59	2.02
E. Wollega								
Gida Kiramu	Mixed Teff	1.45	152	220.4	2000	2568.7	1.10	0.86
Jima Rarie	Mixed Teff	4.03	152	612.56	2000	2568.7	3.06	2.38
Sibu Sire	Maize	6.87	56	824	2000	2568.7	4.12	3.21
Jimma								
Dedo	Maize	3.21	52	166.92	2000	2568.7	0.83	0.65
Limu Kosa	Maize	6.51	52	338.52	2000	2568.7	1.69	1.32
Mana	Maize	7.97	52	414.44	2000	2568.7	2.07	1.61
Seka Chokorssa	Mixed Teff	3.85	145	558.25	2000	2568.7	2.79	2.17
N.W. Shoa								
Kuyu	Mixed Teff	5.35	155	829.25	2000	2568.7	4.15	3.23
Sululta	Mixed Teff	4.86	155	753.3	2000	2568.7	3.77	2.93
W. Shewa								
Ambo Zuria	Mixed Teff	2.86	155	443.3	2000	2568.7	2.22	1.73
Cheliya	Mixed Teff	2.7	155	418.5	2000	2568.7	2.09	1.63
Dendi	Mixed Teff	2.97	155	460.35	2000	2568.7	2.30	1.79

Welmera	Mixed Teff	1.94	155	300.7	2000	2568.7	1.50	1.17
Wenchi	Mixed Teff	3.64	155	564.2	2000	2568.7	2.82	2.20
S. People								
Guraghe								
Dalocha	Maize	11.54	64	738.56	2000	2568.7	3.69	2.88
Gumera	Barley	9.33	77	718.41	2000	2568.7	3.59	2.80
Izha & Welene	Barley	7.33	77	564.41	2000	2568.7	2.82	2.20
Hadiya								
Lemo	Mixed Wheat	6.89	105	723.45	2000	2568.7	3.62	2.82
Soro (Timbaro)	Mixed Teff	5.7	139	792.3	2000	2568.7	3.96	3.08
Kembata								
Alaba	Maize	7.67	64	490.88	2000	2568.7	2.45	1.91
Kacha Bira	Mixed Teff	5.56	139	772.84	2000	2568.7	3.86	3.01
North Omo								
Damote Gale	Maize	5.81	64	371.84	2000	2568.7	1.86	1.45
Kindo Koyisha	Maize	9.93	64	635.52	2000	2568.7	3.18	2.47
Sidama								
Aleta Wondo	Maize	7.15	66	471.9	2000	2568.7	2.36	1.84
Dale	Maize	9.32	66	615.12	2000	2568.7	3.08	2.39
shebedino	Maize	6.95	66	458.7	2000	2568.7	2.29	1.79

Notes: 1. Output prices are average prices for January - June 1996 obtained from Grain Market Research Project MIS Unit; Incremental yield from fertilizer use from KUAWAB/DSA Fertilizer Marketing Survey, 1995; 1996 fertilizer price from National Fertilizer Industry Agency (NFIA).

- However, there appear to be important opportunities to reduce the cost of fertilizer delivery to the farm gate. These are discussed in detail in the main report. Scenario 2 assumes that increased competition and private sector initiatives will reduce input delivery costs by about $35 per ton or 22.2 birr per quintal, according to the following (figures in US$ per ton): adjusting the month of purchase ($10); more competitive bidding ($2); economies of scale in purchase ($5); bulk purchase instead of bag purchase ($4); use of chartered vessels ($5); use of larger vessels ($4); improving port and clearing services ($2); more competitive wholesale, retail, and transport services ($3). However, the gains through advance purchase imply extra costs in the form of interest and storage. These costs are estimated at 3.43 birr per quintal. Hence, the net savings are estimated at 18.80 birr per quintal (22.23-3.43) under Scenario 2.

  Assuming that such cost reductions in fertilizer distribution can occur, the average weighted price of DAP fertilizer for 1997 would then be estimated at 242 birr per quintal, an 8% cost reduction compared to the unsubsidized price in Scenario 1. In this case (Scenario 2), the VCR for fertilizer use exceeds 2.0 in 28 of 51 cases. After accounting for the increased crop output that would result from increased use of fertilizer estimated under Scenario 2, the gain to the economy (due to an assumed 8% cost reduction in input marketing) would be roughly 313 million birr each year (US$49 million).

- A major conclusion from the results of Scenario 2 is that even with assumed cost savings of 8% in fertilizer distribution to the farm gate, this is expected to improve the profitability of fertilizer use only moderately. The expected profitability of fertilizer use is estimated to remain below that obtained in 1996 largely because of the extent to which fertilizer was subsidized under the former system. It thus follows that unless the deregulation is accompanied by other measures such as improvement in the performance of the grain market and/or improvement in the agronomic efficiency of fertilizer use in the long run, the decline in profitability reduce fertilizer demand in some areas.

- ***Implications of Increasing the Agronomic Response of Fertilizer Use:*** The output response to fertilizer application is low in many areas because of inappropriate cultivation practices, sub-optimal nutrient use and lack of complementary inputs such as improved seed, chemicals, and animal traction.. Also, fertilizer has for the most part been applied without improved seeds and chemicals; hence yields are low. As mentioned above, the Government's agricultural extension efforts in recent years have shown the potential for substantially raising cereal yields on peasant' farms with on-shelf technology.[7] Under the assumption of a 20% increase in yield response to fertilizer use, the VCR for fertilizer use exceeds 2.0 in 35 of 51 cases (holding other factors constant at levels in Scenario 1) and in 40 of 51 cases under Scenario 2. The mean VCR estimates, under the assumption of a 20% increase in yield response, increases 18.2 percent (from 2.14 under existing response rates, to 2.53 with a 20% improvement in response rates). There is also the potential for greater use of fertilizer on high-valued crops such as cotton, coffee, and oilseeds which could further contribute to productivity growth in Ethiopian agriculture.

- However, the profitability of the National Agricultural Extension Program technology package needs to be clarified. While average yields under the program are two- to three-fold higher than non-participating farms, these advantages could be potentially offset by additional labor demands, timing of labor for improved cultivation practices, and additional cash input costs. If solid research shows that the NAEP-type technology package provides peasant farmers with higher returns to land and labor than existing technical practices in most regions, then this would indicate the high payoffs to diffusion of this new technical package through sustainable coordination of credit, input, and output markets to meet the needs of smallholder farmers.

- ***Importance of Grain Market Performance in Influencing Fertilizer Use***: Data presented in this note emphasize that efforts to reduce grain marketing costs should be viewed as a critical component in the overall strategy to stimulate fertilizer demand and crop productivity in Ethiopia. Improving the efficiency and reducing costs in the grain marketing system represent one important means for conferring higher output prices to farmers. Evidence indicates that grain market liberalization, initiated in Ethiopia in 1990, has raised output prices for Ethiopian farmers in major surplus-producing areas (Asfaw and Jayne 1997; Dercon 1995). For example, Asfaw and Jayne estimate that grain market liberalization has raised equilibrium maize prices in Shashemene and Bako, two important maize producing areas, by 29 birr/quintal and 21 birr/quintal, respectively. Moreover, in January 1997, some regional governments announced their intention to eliminate or reduce taxation of grain movement at regional grain checkpoints. These taxes had increased grain marketing costs between 4 to 15 birr per quintal on major grain trading routes in 1996 (i.e., about 20% to 33% of observed price spreads between major wholesale markets in the country). Under the assumption that the elimination of these taxes and further efficiency gains in grain marketing were capable of increasing cereal output prices by 10 birr per quintal, the VCR of fertilizer use (holding other factors constant at Scenario 1 values) rises above 2.0 in 32 of 51 cases. The average VCR rises to 2.69, given the unsubsidized fertilizer price specified in Scenario 1 and largely offsets the adverse effect of fertilizer subsidy elimination on fertilizer profitability.

  A major conclusion of this report is that the performance of the grain marketing system in Ethiopia strongly influences the profitability of fertilizer use by farmers. This conclusion underscores the importance of viewing productivity growth from a "systems perspective," in which the profitability of investments made at one level of the system (e.g., farm production) are liable to depend on the kinds of investments (or lack thereof) made at other stages of the agricultural system.

- ***Synergistic Effects of Improved Output Markets, Input Delivery Systems and Agronomic Response to Fertilizer:*** If higher producer prices (as above) were accompanied by lower input costs (Scenario 2) and 20% higher agronomic response rates, the VCR for fertilizer use would exceed 2.0 in 42 of 51 cases. This emphasizes that substantial increases in fertilizer profitability can be accelerated most rapidly through concerted efforts at increasing agronomic response rates, improved crop marketing and efficient procurement and distribution of fertilizer.

A major unknown in the immediate future is how the deregulation of fertilizer prices will affect the demand for fertilizer in the coming years. The results above indicate that the answer to this question will depend largely on what other steps are taken to improve the functioning of input delivery systems, output markets, credit provision, and to improve crop management practices.

Notes

1. This Note is a synthesis of a Working Paper by the Grain Market Research Project: Mulat Demeke, Ali Said, and T.S. Jayne, 1997. "Relationships Between Fertilizer Use and Grain Sector Performance," Working Paper #5, Grain Market Research Project, Ministry of Economic Development and Cooperation, Addis Ababa. Readers interested in details as to method, model specification, and results are referred to this paper.

2. Food production growth can conceivably occur through expansion of cropped area, but much of the highland regions suitable for cropping are already fully utilized given the carrying capacity of the land.

3. Over 300,000 peasant farmers took part in the Government's New Agricultural Extension Program (NAEP) in 1995/96, patterned after the Sasakawa Global-2000 Program. The centerpiece of these programs are farmers' half-hectare extension plots, utilizing improved seeds, improved management practices, and fertilizer types and rates as recommended by the Ministry of Agriculture. Results from the SG-2000 Program have shown that yields for maize, wheat and teff can be increased to 55, 31 and 18 quintals per hectare respectively.

4. A full accounting of costs associated with this fertilizer use would include the additional labor and other complementary input costs incurred from the fertilizer use.

5.The difference between this derived cost of 261 birr per quintal and the Government estimate of 256 birr per qunital is due to the more realistic provision for transport costs in estimating the deregulated price.

6. With general price inflation at roughly 4%, the real annual price increase of DAP in 1997 in these areas is likely to reach roughly 33%.

7. Even in the case of fertilizer, only one type, DAP, is used by the vast majority of farmers. According to the new recommendation, DAP and urea should be applied in equal proportion in order to the greatest yield response.

Selected References

Asfaw Negassa and Jayne, T.S. (1997). "The Response of Ethiopian Cereal Markets to Liberalization," Grain Market Research ProjectWorking Paper #3, Ministry of Economic Development and Cooperation, Addis Ababa.

Dercon, Stephan (1995). "Food Markets, Liberalization, and Peace in Ethiopia: An Econometric Analysis," Center for Study of African Economies," Oxford.

The Grain Market Research Project (formerly known as Food Security Research Project) is a joint collaboration between the Ministry of Economic Development and Cooperation, USAID/Ethiopia, and Michigan State University. Please direct all inquiries to the In-Country Coordinator, Grain Market Research Project, Ministry of Economic Development and Cooperation, P.O. Box 1037, Addis Ababa, Ethiopia; Tel. 12-89-73; Fax 55-01-18; Internet: GMRP@TELECOM.NET.ET