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Service Provision and Its Impact on Agricultural and Rural Development in Zimbabwe: A Case Study of Gazaland District

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Converting Potential into Effective Demand for and Use of Fertilizers: A Study of Small Farmers in Gazaland District of Zimbabwe

Vasant P. Gandhi and Gunvant M. Desai

Given the critical importance of soil fertility in increasing food production, researchers and policymakers widely recognize the importance of fertilizers in accelerating the growth of food production in Sub-Saharan Africa. Mellor, Delgado, and Blackie (1987) give fertilizers the first functional priority for accelerating food production in Sub-Saharan Africa. They suggest that even with the existing technology, a 15 percent annual growth rate in fertilizer consumption is possible and would be of great significance for Sub-Saharan Africa. The Food and Agriculture Organization of the United Nations (1981) studied the feasible growth of agriculture toward the year 2000 and concluded that 60 percent of the additional food production that developing countries will need to meet their growing demand will have to come from increases in yield. Between 1965 and 1976, fertilizers produced 55 percent of the increase in yields in developing countries; a clear relationship exists between increasing the use of fertilizers and achieving above-average agricultural production. For all of Africa, the consumption of fertilizer could reach between 4.1 and 5.7 million tons by the year 2000. If attained, this level would represent a huge growth from the 0.16 million tons of fertilizer used in Sub-Saharan Africa during the early 1960s and the 0.95 million tons used in the early 1980s. The Food and Agriculture Organization's estimates represent a 6-7 percent growth rate for all of Africa between the mid-1970s and 2000, and this rate would be much higher for Sub-Saharan Africa, whose consumption was lower than that of the continent as a whole in the mid-1970s.

In another study, the Food and Agriculture Organization (1986) projected a scenario in which Africa's production of crops and livestock would expand at an annual rate of almost 3 percent from 1979-81 to the year 2010. The bulk of this growth would come from increased yields, which would require a substantial increase in fertilizer use. This scenario of improved performance assumes a sixfold increase in the

total use of fertilizer in Sub-Saharan Africa, which would lead to a level of 44 kilograms per hectare. In comparison, the average level of consumption in Sub-Saharan Africa was only 7 kilograms per hectare in 1979-83.

FERTILIZER USE IN ZIMBABWE

Zimbabwe's government clearly recognizes the importance of agriculture in the economy and of fertilizers in agriculture. In Sub-Saharan Africa, Zimbabwe uses more fertilizer per hectare than any other large country (58 kilograms per hectare in the early 1980s) and is the only large-scale producer of fertilizers, producing more than 70 percent of the fertilizer it uses. It is richly endowed with mineral resources, including chromium, cobalt, copper, iron, gold, nickel, silver, and zinc, which contribute to its major exports of basic manufactured metals including ferro-alloys, copper, and nickel.

The agricultural sector, which produces both food and cash crops, is an important source of food, export earnings, and some industrial raw materials. Only 6 percent of the total area of the country is currently cultivated (arabie). Agriculture employs 59 percent of the work force and contributes 18 percent of the gross domestic product. Agriculture in Zimbabwe is dualistic: 15 million hectares are operated by 4,800 white farmers and companies using capital-intensive technology, whereas 16 million hectares are operated by 780,000 African families. Maize, followed by wheat and millet, is the most important crop, judging by the amount of land devoted to it. Tobacco is the largest agricultural export, contributing 20 percent of all export earnings, followed by cotton and sugarcane (8 and 4 percent, respectively). Zimbabwe has also been a net exporter of cereals in most years.

Using data from 1979-81, the Food and Agriculture Organization (1986) estimates that 48 percent of the 153,000 tons of fertilizer consumed annually in Zimbabwe is used on food crops and the rest is used on nonfood and export crops (including sugarcane). Though the cropping patterns, mechanization, the pressures of being landlocked, and government efforts encouraged the rise in fertilizer consumption between 1979 and 1981, political turmoil, external transportation bottlenecks, and weather constrained this growth.

The economic sanctions imposed on Zimbabwe by the United Nations from the mid-1960s to the late 1970s posed a serious problem

for the economy. Although fertilizer imports declined, the domestic production of fertilizer increased sharply and compensated for the decline (see Figure 6.1). The consumption of fertilizer grew quite rapidly with the introduction of hybrid maize in the late 1960s and early 1970s but stalled with the drought of 1972. Consumption fell sharply after 1975, probably in reaction to two major events. First, an intense political struggle and civil war broke out in Zimbabwe in 1975 and continued until 1979, when a new government was formed and independence declared. Second, Mozambique became independent in 1975, but rebels repeatedly sabotaged the major rail linking Zimbabwe with the port of Beira in Mozambique. This was a serious problem for Zimbabwe, which is landlocked, and probably affected both exports and imports. The difficulty was partly solved by using rail links through South Africa.

When Zimbabwe became independent, the United Nations lifted its trade sanctions and the consumption of fertilizer rose 60,000 tons in 1979-80. This sharp rise was also aided by good weather. Consumption subsequently fell, in part because of a succession of droughts between 1981 and 1984. Increasing foreign exchange difficulties, the outmigration of many white European farmers, and the limited use of fertilizers in black African farming areas also contributed to the decline. The new government has, however, recently made considerable efforts to encourage the use of fertilizers in the historically neglected African small-farm sector. These efforts appear to be yielding significant results.

Some doubts are occasionally raised, based on past experience, about the existence of a significant potential for fertilizer use in Sub-Saharan Africa (see Lele, Christiansen, and Kadiresan 1989; Mudahar 1981). In Zimbabwe, however, the level of fertilizer consumption is relatively high and comparable to the average for all developing countries. This indicates that potential for use exists in Zimbabwe and, judging from the recent patterns of growth, in other parts of Sub-Saharan Africa as well (Desai and Gandhi 1988). Unlike other countries in Sub-Saharan Africa, however, Zimbabwe has converted its potential into effective demand and consumption. Examining this conversion and the critical processes and activities governing it may provide useful lessons on how other parts of Sub-Saharan Africa can raise their use of fertilizers.

In Zimbabwe, in the past, the process of raising fertilizer consumption was achieved substantially through large private commercial farms. Although raising fertilizer consumption and food

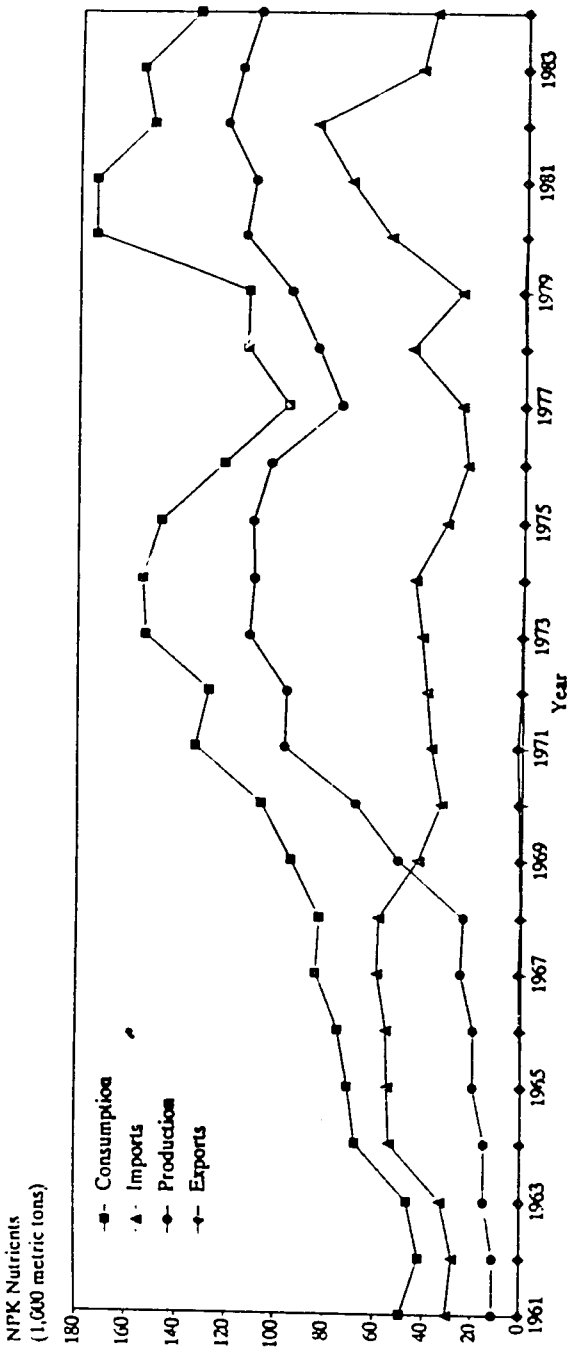


Figure 6.1—Production of fertilizers in Zimbabwe, 1961-83

Source: Food and Agriculture Organization of the United Nations, *Fertilizer Yearbook*, various issues (Rome: FAO, various years).

production through more of such farms could be an option in Sub-Saharan Africa, its political and socioeconomic feasibility is limited for various reasons. This is because supporting such farms has high capital costs and low employment potential, tends to create large inequalities, and is often politically unacceptable. In recent years, however, Zimbabwe has mobilized the small-farm sector and significantly increased its consumption of fertilizer (Rohrbach 1988). Some elements of Zimbabwe's process of mobilizing the small-farm sector may be applicable to other countries in Sub-Saharan Africa.

The nature of government administration, policies, and efforts in Zimbabwe as well as features of the study area of Gazaland District are discussed in greater detail in Chapters 3 and 4 of this volume. Zimbabwe's postindependence agricultural policies have sought to raise the income level of rural areas by promoting economic growth in both farming and nonfarming sectors. The services provided for agricultural production include extension, credit, agricultural implements, seeds, fertilizers, and markets. The government helps in the provision of these services to communal farms and resettlement areas. Historically, communal farming areas have received fewer services than commercial farming areas, but this is changing. Communal farmers are now eligible also to receive low-interest loans from the Agricultural Finance Corporation for various agricultural activities. They repay these loans after the harvest, when they sell their produce to the depots of marketing boards. Marketing boards have established several depots to help communal farmers participate in the market economy.

THE STUDY REGION AND SURVEY

This study is based on a survey planned for about 330 farm households in Zimbabwe's Gazaland District that was conducted in 1987-88 by the International Food Policy Research Institute in collaboration with Zimbabwe's Department of Physical Planning, Ministry of Local Government, Rural and Urban Development. The district is located around the major town of Chipinge in Manicaland Province of eastern Zimbabwe, about 500 kilometers from Harare. A survey of fertilizer use and the behavior of farmers who use fertilizer was conducted in coniunction with a larger survey of household characteristics, agricultural production, and the provision of, and access to, rural infrastructure and services in the study region. The sample was fairly broad-based and included both large commercial farming and

small communal farming households.

Gazaland District has areas of all five of the agroecological (natural) regions present in Zimbabwe. About 40 percent of the study region falls under natural regions 1 and 2, which have high agronomic potential, whereas about half falls under natural region 5, which has relatively poor agronomic potential. Agriculture is the main source of income and sustenance.

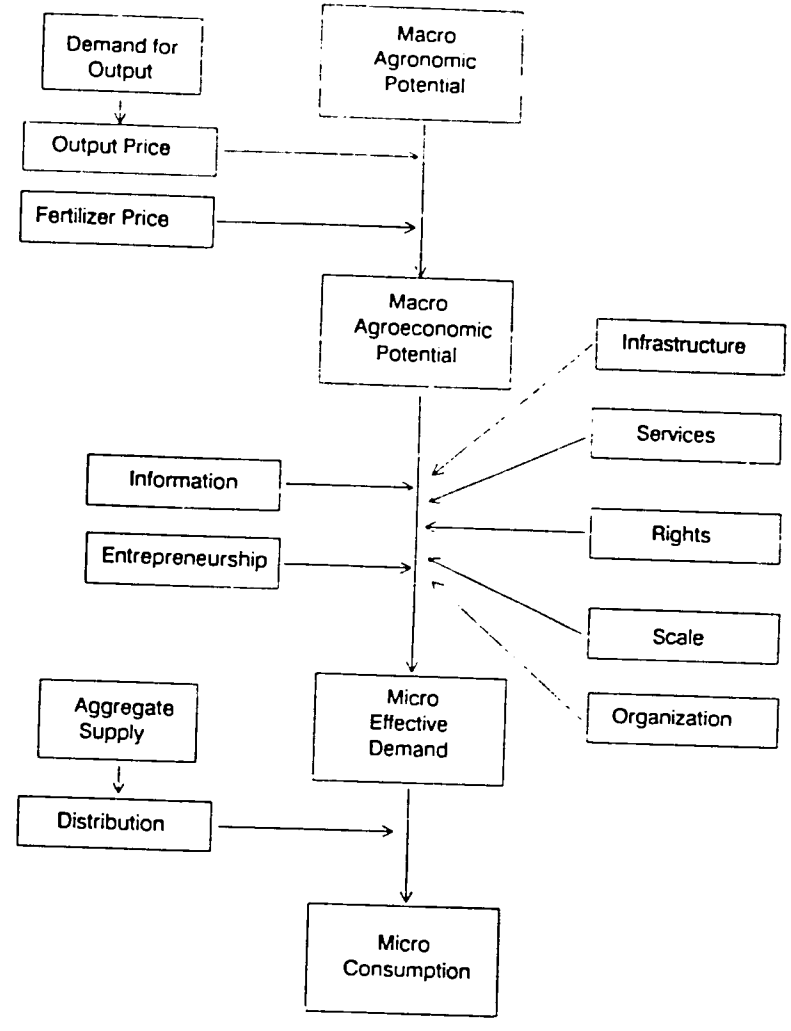
The region can also be classified into four administrative areas: communal farming, large-scale commercial farming, small-scale commercial farming, and resettlement. Communal farming areas and small-scale commercial farming areas have higher population densities than large-scale commercial farming areas and resettlement areas. Of the total population of 203,000 people, 61 percent live in communal farming areas, 32 percent in large-scale commercial farming areas, 6 percent in small-scale commercial farming areas, and less than 1 percent (0.04 percent) in resettlement areas. The characteristics of sample villages and households are given in Chapter 5.

THE FRAMEWORK OF ANALYSIS

Using a purely neoclassical framework to study the growth of fertilizer use has serious limitations in most developing countries, since consumption of fertilizer is in almost perpetual disequilibrium in these countries (Desai and Stone 1987). Prices often do not play a dominant role in the behavior of aggregate fertilizer consumption in many developing countries because their markets as well as many other nonprice factors are relatively undeveloped and strongly constrain the responsiveness of the agricultural sector to prices. Markets and nonprice factors, which develop over time, play a much larger role than prices in influencing the level of fertilizer consumption. Even within Sub-Saharan Africa the level of fertilizer use varies across countries because of a large number of nonprice factors and government policies (Desai and Gandhi 1988). Desai and Stone (1987) have proposed an alternative framework for understanding the complexities of growth in fertilizer use in developing countries.

In a given country, the overall limits to fertilizer use are set by the total agronomic potential, that is, the maximum level to which fertilizer can be used to increase production given the existing technology and agroecological conditions (see Figure 6.2). The macro agronomic potential may be different from the micro agronomic potential because

Figure 6.2—Elements determining a country's agronomic potential



Source: Based on description in Gunvant M. Desai and Bruce Stone, Fertilizer Market Development and National Policy in China and India: A Comparative Perspective (paper prepared for the IFA-FADINAP Southeast Asia and Pacific Regional Conference, Kuala Lumpur, Malaysia, 22-25 July 1987).

all the land that could be cultivated may not be cultivated at present and the available technology may not be used as extensively as possible. To be economically viable and implemented for agriculture, agronomic potential must be translated into agroeconomic potential. This depends on the demand for output reflected in the price (either the market or administered price) that can be obtained for the output in the market and the price of the available fertilizer.

At the macro level, agroeconomic potential represents an economic opportunity for farmers. The extent to which agroeconomic potential translates itself into effective demand depends on user behavior as well as a large number of facilitating factors. It also depends on competing economic opportunities. The transformation of macro-level agroeconomic potential into the generation of effective demand at the micro level may be called the conversion of the potential into effective demand for fertilizers. This conversion is a principal focus of this study.

As shown in Figure 6.2, conversion is a complex process involving a large number of factors. These include, first, information and entrepreneurship (since conversion is a response to an economic opportunity). Another major factor is infrastructure. The provision of infrastructure alone may allow some entrepreneurs to take advantage of an economic opportunity and thereby effect a conversion. Usually, however, most entrepreneurs require the development and provision of services that, among other things, help them fully use the infrastructure created.

Besides these, conversion is influenced by factors that affect the economic behavior of the entrepreneur or farmer. One such aspect is the rights of the farmer. The scale of operation (holding size) can have a considerable impact on the extent to which the farmer is willing or able to adopt a particular technology. To some extent, the problem of small-scale operations can be solved by establishing an organization to help distribute the fixed costs and ease the access to services and markets.

Aggregate supply of fertilizers is also very important. Micro-level effective demand, once generated, can be converted into actual consumption only when the aggregate supply of fertilizers is adequate. The distribution system must convert macro-level aggregate supply into micro-level supply. Only then can the micro-level effective demand for fertilizers be extensively converted to actual consumption. Distribution systems are crucial, since agriculture is extensive in nature, and they are particularly important for small farmers.

EMPIRICAL ANALYSIS AND RESULTS

The fertilizer survey was designed to address issues of fertilizer demand and use; the information on household production, employment, and expenditure was collected by a separate survey. The two surveys used separate questionnaires but covered the same households in the same year (1987-88) and used the same household number coding. The data from these two surveys were scrutinized separately and entered into the computer. The data bases were first analyzed separately and then together.

This paper focuses mainly on information related to fertilizer use. Most of the households who responded to the fertilizer survey were the smallholder communal farmers. This is the major group in the study region, and their responses are significant within the wider context of agricultural development in Sub-Saharan Africa.

This study raises specific questions. What are the features of the agronomic potential for fertilizer use in the area? What are the characteristics of the processes that help convert this potential into actual consumption in a given setting? How do these processes operate? What do they require? What constraints are the most binding? How can the environment be made more conducive to increasing the use of fertilizer? General questions were also asked. What is the environment for fertilizer use in Zimbabwe? How can that environment be made more conducive to the rapid growth of fertilizer use? What features of farmer behavior are important for fertilizer use in rural Zimbabwe?

One important feature of the environment is the sharp differences that separate the white from the black farming population. These differences include the agroecology of the areas they farm, the access to infrastructure facilities and services, and the inputs and resources available to them. Because of the characteristics of the data collected, this study concentrates mainly on the population of black smallholder communal farmers.

One key dependent variable is the use or nonuse of fertilizers, that is, the factor that separates farmers who use fertilizers from farmers who do not. If fertilizers are not available, and effective demand has been created, then supply could be withholding actual consumption. If supply is not the major problem, then the difficulty may be related to the creation of effective demand. If the farmers are convinced that using fertilizers is profitable and desirable, agroeconomic potential exists and, therefore, the central problem may lie with the processes that convert potential into effective

demand. In this case, the search would be to find the key elements in the process of conversion.

How did farmers who use fertilizers become users? What are the descriptive elements that are important in the process, and what are some of the characteristics of users? How do they use fertilizers, and what are the profiles of use in the area? The profile would include information on crops, seasons, farms, and demand. One component of the growth in fertilizer consumption is intensified use. Once farmers begin to use fertilizers, they may increase their use by applying it on more plots, more crops, and at a higher rate. To what extent is this happening in Gazaland District, and what factors are hindering, or helping, the process?

The surveys planned to cover a representative sample of about 330 households from Gazaland District of Zimbabwe. A village was randomly selected from 10 zones of the district, and about 33 households were randomly selected from each village. For the fertilizer survey, 241 questionnaires were recovered. Since 2 yielded no data, the net sample came to 239 households. Of the available sample of 239 households, only about one-third were found to use fertilizers and two-thirds did not.

The questionnaire contained different questions for users and nonusers and five questions for both. The common questions were analyzed for differences between users and nonusers, and the significance of those differences was frequently checked through a Chi-square test, with a null hypothesis that there was no difference. Statistically significant differences between users and nonusers emerged for many of the statistics considered for both groups. These are discussed in the paragraphs that follow in the context of the issues being investigated.

An important dependent variable for farmers who use fertilizers could be the level of use. Precise data are available only for the quantity of fertilizer purchased during the year. Patterns of amount purchased can be studied from the point of view of different features of the framework, and meaningful relationships can be tested and noted. Besides these, several important qualitative and indicative responses exist, such as major source of information, crops grown, reasons for delaying use, reasons for discontinuing use, and so on, that describe the farmer's behavior. Particular focus is placed on these responses. The analysis reported here also uses data from the production survey for some aspects. This, as well as the availability of responses, causes some variation in the number of observations used.

FEATURES OF AGRONOMIC AND AGROECONOMIC POTENTIAL

Farm Size

Data are available on the number of plots that each farmer cultivates and the crops grown on them by month, although neither the fertilizer survey nor the production survey could obtain data on the size of the farm or the area that a farmer devotes to each crop. Information is also available on the total amount of area that farmers plant with crops each month. In the absence of data on landholding, the maximum area that farmers plant in the year provides some idea of the effective size of farms. Of the 267 farms for which information is available, more than half (141) appear to have a farm size of less than 5 hectares. This indicates that the effective farm size may be relatively small, and therefore a large number of farmers may experience pressures for intensification and use of yield-increasing inputs. About 20 percent of the farms are, however, more than 50 hectares.

Crops Grown

Data from the production survey indicate, on the basis of household frequencies, that the major crops grown are local maize, hybrid maize, sorghum, millet, beans, cowpeas, groundnuts, and cotton (the fertilizer survey found that wheat follows maize as the most important crop grown by farmers who use fertilizers, but the production survey did not poll wheat separately).

Within maize-growing households, 45 percent grow only hybrid maize, 5 percent grow only local maize, and 30 percent grow both. This indicates large-scale adoption of hybrid maize. This also indicates that the diffusion of fertilizers in lagging far behind the diffusion of hybrid maize. Since many households in this region of Sub-Saharan Africa have problems directly consuming hybrid maize for food, the widespread diffusion of hybrid maize suggests that possibilities exist in this area for processing hybrid maize into a form that can be used for food or that it is possible to exchange hybrid for local maize on the market.

The profile of growing local and hybrid maize by sample households varies from village to village. In Rusitu village, all households grow only hybrid maize, and in Batanai, Chaminuka, Tuzuka, and Zamchiya villages, too, most households grow mainly hybrid maize, although a few grow it with local maize. In Murimbira

and Tafuka villages, however, all households grow both hybrid and local maize. In Rufaro village, an equal number of households grow local maize as grow a combination of local and hybrid maize. Most households of Chipinge and all of Middle Sabi do not grow maize at all. These are commercial farming households who cultivate mainly nonfood crops: tea, coffee, and cotton. The differences among villages must be examined further using location-specific information.

The monthly production surveys indicate that the largest percentage of households reporting that they have crops in the field occurs in the month of January (see Figure 6.3). January coincides with the summer and rainy season and is the peak cropping month in the area. In January, 68 percent of the households have planted hybrid maize, followed by sorghum (38 percent), cotton (27 percent), local maize (22 percent), groundnuts (11 percent), millet (5 percent), and beans (1 percent). The main cropping season starts in October-November and ends in May-June, although an unusual dip occurs in the percentage of households that have crops growing in February and March. This may occur because different households or areas have different sowing times or because some households plant two separate crops during the season. Beans and wheat are grown mainly in the winter season from March-April to September-October.

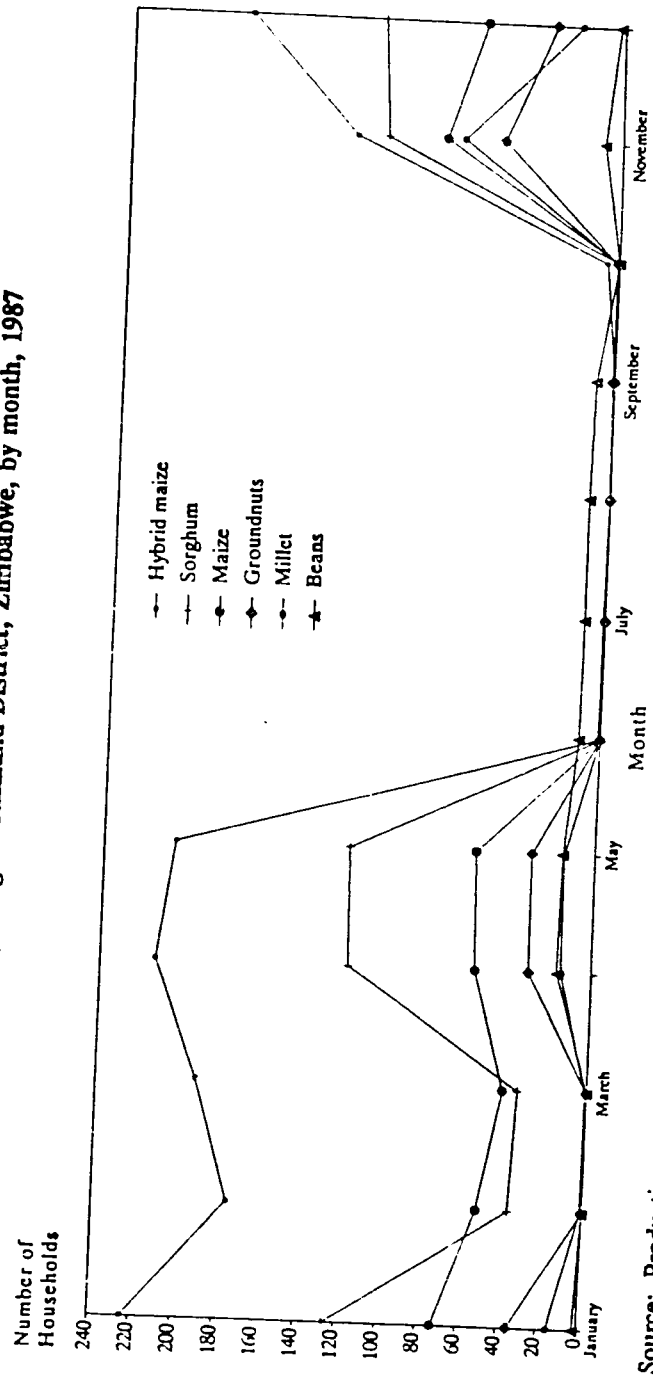
The following cropping patterns are based on the fertilizer survey, which collected this data only for farmers who use fertilizer. Of the 76 farmers who use fertilizer, 95 percent grow maize (in the fertilizer survey information, maize includes both hybrid and local maize), 34 percent grow wheat, 28 percent grow beans, 21 percent grow cotton, and 16 percent grow napier grass. Other crops grown are rapoko, sunflower, sorghum, millet, and vegetables. Coffee and tea are grown only in Chipinge, and Chipinge grows only these two crops.

Fertilized or Unfertilized Crops

Farmers who use fertilizers use them most frequently on maize (87 percent), followed by wheat (31 percent), beans (24 percent), cotton (19 percent), and napier fodder (21 percent). Based on household frequency, maize is by far the major crop fertilized.

Farmers who do not use fertilizers now, but have used them in the past, applied them only on maize. These farmers live in Murimbira, Tuzuka, and Zamchiya villages; two of these villages also have farmers who use fertilizers now. Since maize is among the crops that current users fertilize most frequently, former users probably stopped using fertilizers not because they were ineffective, but for other reasons.

Figure 6.3—Frequency of crop reporting in Gazaland District, Zimbabwe, by month, 1987



Source: Production survey conducted by the International Food Policy Research Institute and Zimbabwe Department of Physical Planning, Ministry of Local Government, Rural and Urban Development, 1987.

Current users apply fertilizers on a large variety of crops, which indicates that crop coverage may have increased over time and the application may have begun with maize and then spilled over to other crops.

Of the farmers who use fertilizers, 92 percent of those who grow maize use fertilizers on it and 100 percent of those who grow wheat, napier, coffee, tea, and millet use fertilizers on them. A high percentage of farmers also use fertilizers on cotton and beans. A low percentage of farmers use fertilizers on groundnuts and sunflower, and none use them on the local crop, rapoko, but the number of farmers growing these crops is small. Combining data from the production and fertilizer surveys yields the percentage of fertilizer users and nonusers who grow each of the crops covered in the production survey (see Table 6.1). All of the farmers who use fertilizer and 86 percent of those who do not use it grow hybrid maize, although only 24 percent of the users and 61 percent of the nonusers grow local maize. Among nonusers, 80 and 50 percent grow sorghum and millet, respectively; the percentages are very small for users. The diffusion of hybrid maize has gone much beyond that of fertilizer use, but the fertilizer nonusers more frequently grow other crops such as local maize, sorghum, and millet.

Thus, based on farmer reporting frequencies, a substantial proportion of the agroeconomic potential for fertilizer use in the district appears to be in maize, especially hybrid maize, followed by wheat, beans, and cotton. Since agroeconomic potential assumes that agronomic potential and remunerative price ratios exist, the response coefficients as well as the price ratios for these crops must be favorable.

The issue of agronomic potential could be probed further by exploring why farmers do not use fertilizers on other plots and crops. Of the 48 users who responded to this question, 60 percent stated that cash or credit constraints were the reason and another 15 percent reported that fertilizers were not available. Since lack of agronomic potential was not the major reason they did not extend fertilizer use to other crops and plots, the principal problems appear to be in the conversion processes.

Farmers who grow and fertilize maize, wheat, cotton, and beans frequently extend their use of fertilizer to more plots (67, 89, 81, and 80 percent extend their use, respectively; see Table 6.2). These crops appear to have good agroeconomic potential and could serve as lead crops in the adoption and increased use of fertilizer. Farmers who grow napier grass, however, rarely expand their use of fertilizer to other

Table 6.1—Crops grown by users and nonusers of fertilizers in Gazaland District, Zimbabwe, 1987-88

Crop	Users	Nonusers	All Households
		(percent)	
Hybrid maize	100	86	91
Local maize	24	61	48
Groundnuts	40	25	30
Sunflower	26	36	33
Cotton	44	18	27
Rice	...	...	...
Beans	29	3	11
Soybeans	...	...	..
Cowpeas	...	...	...
Sorghum	21	80	60
Millet	8	50	35
Pumpkins	5	1	3
Sweet potatoes	19	1	7

Source: Fertilizer survey and production survey conducted by the International Food Policy Research Institute and Zimbabwe Department of Physical Planning, Ministry of Local Government, Rural and Urban Development, 1987-88.

Note: Only includes households covered in the fertilizer survey, which identified users and nonusers; data on crops grown are from the production survey, which sought to cover all households (users as well as nonusers). Wheat was not identified separately in this survey.

plots, indicating that this may not be very effective as a demonstration crop for fertilizer use. Maize leads the extension of fertilizers not only to more plots, but to other crops as well (see Table 6.3). The crops to which fertilizer use was extended include maize, 38 percent, followed by wheat, beans, cotton, and all others except tea. This indicates that the use of fertilizer is becoming more diversified.

Table 6.2—Frequency of expansion of fertilizer use to more plots in Gazaland District, Zimbabwe, by crop fertilized, 1987-88

Crop	Expanding Use	Not Expanding Use	Total	Percent of All Plots
	(number of farmers)			
Maize	48	24	72	42.3
Groundnuts	6	0	6	3.5
Sunflower	1	1	2	1.2
Sorghum	2	0	2	1.2
Cotton	13	3	16	9.4
Wheat	23	3	26	15.3
Tomatoes	1	0	1	0.6
Napier fodder	8	9	17	10.0
Coffee	3	1	4	2.3
Tea	1	1	2	1.2
Millet	2	0	2	1.2
Beans	16	4	20	11.8
Total number	124	46	170	...
Total percent	72.9	27.1	...	100.0

Source: Based on available responses to the fertilizer survey conducted by the International Food Policy Research Institute and Zimbabwe Department of Physical Planning, Ministry of Local Government, Rural and Urban Development, 1987-88.

Cropped Area Fertilized

Of the farmers who use fertilizers and reported cropping data by plot, a majority (77 percent, or 44 farmers) grow crops on two or more plots, but most of them fertilize only one of these plots (75 percent; see Table 6.4). Thus, even farmers who use fertilizers do not fertilize the entire area cultivated. The reasons for this could include differences in the perceived response or profitability of different plots or crops, the availability of fertilizers, and constraints such as the lack of credit to convert the potential into reality. Scope may exist for increasing the use of fertilizers among current users through increase of area fertilized.

Table 6.3—Frequency of expansion of fertilizer use to more crops in Gazaland District, Zimbabwe, by crop fertilized, 1987-88

Crop	Expanding Use	Not Expanding Use	Total	Percent of All Plots
	(number of farmers)			
Maize	50	13	63	41.4
Groundnuts	6	0	6	3.9
Sunflower	1	0	1	0.7
Sorghum	2	0	2	1.3
Cotton	16	0	16	10.5
Wheat	26	0	26	17.1
Tomatoes	1	0	1	0.7
Napier fodder	6	5	11	7.2
Coffee	2	1	3	2.0
Tea	0	1	1	0.7
Millet	2	0	2	1.3
Beans	20	0	20	13.2
Total number	132	20	152	...
Total percent	86.8	13.2	...	100.0

Source: Based on available responses to the fertilizer survey conducted by the International Food Policy Research Institute and Zimbabwe Department of Physical Planning, Ministry of Local Government, Rural and Urban Development, 1987-88.

Other farmers who use fertilizers report cropping data by the amount of area cropped and fertilized (36 farmers). The cropped as well as the fertilized areas range from 0.2 to 4.0 hectares; 56 percent crop 1 or more hectares, but 50 percent fertilize 1 or more hectares. Thus, contrary to the observations for farmers who report cropping data by plot, most of the farmers in this subsample use fertilizers on most of the land they crop. However, 86 percent of the farmers reporting data on area cropped come from the village of Chaminuka, which suggests that this characteristic is particular to that village.

Table 6.4—Percentage of fertilizer users planting and fertilizing crops in Gazaland District, Zimbabwe, by number of plots, 1987-88

Number of Plots	Cropping	Fertilizing
	(percentage of households)	
1	22.7	75.0
2	45.5	22.7
3	22.7	2.3
4	9.1	0.0
Total	100.0	100.0

Source: Based on the 44 households reporting data on the number of plots cropped and fertilized in the fertilizer survey conducted by the International Food Policy Research Institute and Zimbabwe Department of Physical Planning, Ministry of Local Government, Rural and Urban Development, 1987-88.

Findings on the past expansion of area fertilized indicate that 68 percent of the farmers who use fertilizers now apply them on more plots, and 79 percent apply them on more crops than when they began to use fertilizers. Thus, the experience of using fertilizers appears to be positive, although the pattern varies somewhat by village. The village of Chaminuka has the highest percentage of farmers citing more application, although most other villages also have a fairly high percentage of farmers applying more fertilizer.

Perceptions of Agronomic and Agroeconomic Potential

All the farmers who use fertilizers cite improved harvests as the major factor determining the effectiveness of fertilizers. This great emphasis on the agronomic potential (that is, increased yields) of fertilizers indicates that perceived response of crops to fertilizers is clearly a crucial factor in the adoption of fertilizer use. Farmers are likely to use fertilizers only when they substantially increase crop yields on their own farms (see Table 6.5).

Table 6.5—Factors considered important by users and nonusers for determining or realizing the effectiveness of fertilizers in Gazaland District, Zimbabwe, 1987-88

Factor	Nonuser	User	Total
Do not know			
Number	13	0	13
Percent of this factor	100.0	0.0	100.0
Percent of all factors	8.3	0.0	8.3
Percent of all factors for the type of household	16.7	0.0	...
Better harvest			
Number	29	78	107
Percent of this factor	27.1	72.9	100.0
Percent of all factors	18.6	50.0	68.6
Percent of all factors for the type of household	37.2	100.0	...
Greener crops			
Number	1	0	1
Percent of this factor	100.0	0.0	100.0
Percent of all factors	0.6	0.0	0.6
Percent of all factors for the type of household	1.3	0.0	...
Knowledge of application			
Number	28	0	28
Percent of this factor	100.0	0.0	100.0
Percent of all factors	17.9	0.0	17.9
Percent of all factors for the type of household	35.9	0.0	...
Knowledge of application with rainfall or irrigation			
Number	5	0	5
Percent of this factor	100.0	0.0	100.0
Percent of all factors	3.2	0.0	3.2
Percent of all factors for the type of household	6.4	0.0	...

(continued)

Table 6.5—Continued

Factor	Nonuser	User	Total
Better harvest with irrigation			
Number	2	0	2
Percent of this factor	100.0	0.0	100.0
Percent of all factors	1.3	0.0	1.3
Percent of all factors for the type of household	2.6	0.0	...
Total			
Number	78	78	156
Percent	50.0	50.0	100.0
Chi-square	71.43925		
D.F.	5		
Level of significance	0.0000		

Source: Fertilizer survey conducted by the International Food Policy Research Institute and Zimbabwe Department of Physical Planning, Ministry of Local Government, Rural and Urban Development, 1987-88.

Farmers who do not use fertilizers, but know about them, are more divided on the question of which factor is the most crucial to determining the effectiveness of use: 37 percent perceive the crucial factor to be improved harvests, but 36 percent indicate knowledge of correct application. Information seems to play a substantial role in the adoption of fertilizer use. Thus extension services are very important. Some 8 percent of all farmers who answered this question do not know clearly why fertilizers are important to use.

One factor indicating the importance that farmers place on higher yields is the use of organic manures. A little more than 57 percent of farmers use organic manures (including 4 percent who use manure on vegetable plots). Surprisingly, 94 percent of farmers who use fertilizers also use organic manures, compared with only 37 percent of farmers who do not use fertilizers. The use of organic manures seems to be related to and seems to complement rather than substitute for the use

of fertilizers. This indicates possible limitations in the availability and use of organic manures for enhancing soil fertility. Their use is infrequent in some villages and universal in others. The reasons for this could be variation in the availability of organic manures as well as the potential for their use.

Nonusers gave various reasons for not using or for discontinuing their use of fertilizers. These included their perception that the land is still fertile, cash or credit constraints, unavailability of fertilizers in the market, and problems of application due to drought.

Fertilizer users were asked to name the three crops on which the use of fertilizers is the most profitable; of the farmers planting food crops, 95 percent reported maize, 36 percent reported wheat, 36 percent reported tomatoes, and 11 percent reported beans as among the most profitable crops to fertilize. Of the farmers planting commercial crops, only 10 and 4 percent reported cotton and tobacco, respectively, as the most profitable commercial crops to fertilize. The farmers' responses do depend on their personal experience with the crops they grow but there could be some exchange of information. Subject to this limitation, the findings indicate that food crops may hold more agroeconomic potential for fertilizer use than nonfood crops in the perception of the farmers. Maize leads other crops by a large margin, although this pattern varies significantly from village to village.

Stability of Use and Risk: Incidence of Discontinuation

By and large, farmers who begin to use fertilizers keep using them (see Table 6.6). Of the 84 current users, 65 percent never even cut back their use, 73 percent kept using at least some fertilizers once they began, and 27 percent completely stopped using them at some time or another. Thus the use of fertilizers seems to be relatively stable once farmers begin to use them. The principal reason cited for temporarily discontinuing the use of fertilizers is drought (30 percent of users), followed by lack of availability and cash or credit constraints (22 percent each). Thus, constraints rather than disappointment with fertilizer's agronomic or agroeconomic potential cause farmers to discontinue their use of fertilizers. There is variation in the discontinuation at the regional and village levels. Discontinuation of use is more frequent in the villages of Rusitu and Tuzuka, both of which are located in better natural regions than most villages. In Rusitu farmers say they stopped using fertilizers because their use is only recommended for napier grass and fertilizers are not available; in Tuzuka farmers cite drought and cash or credit constraints.

Table 6.6—Reasons given by users and nonusers for stopping the use of fertilizers in the past, Gazaland District, Zimbabwe, 1987-88

Factor	Nonuser	User	Total
Cash or credit constraints			
Number	25	6	31
Percent of this factor	80.6	19.4	100.0
Percent of all factors	40.3	9.7	50.0
Percent of all factors for the type of household	71.4	22.2	...
Expense			
Number	2	0	2
Percent of this factor	100.0	0.0	100.0
Percent of all factors	3.2	0.0	3.2
Percent of all factors for the type of household	5.7	0.0	...
Not available			
Number	0	6	6
Percent of this factor	0.0	100.0	100.0
Percent of all factors	0.0	9.7	9.7
Percent of all factors for the type of household	0.0	22.2	...
Drought problems			
Number	0	8	8
Percent of this factor	0.0	100.0	100.0
Percent of all factors	0.0	12.9	12.9
Percent of all factors for the type of household	0.0	29.6	...
Others			
Number	0	1	1
Percent of this factor	0.0	100.0	100.0
Percent of all factors	0.0	1.6	1.6
Percent of all factors for the type of household	0.0	3.7	...

(continued)

Table 6.6—Continued

Factor	Nonuser	User	Total
Lack of irrigation			
Number	1	0	1
Percent of this factor	100.0	0.0	100.0
Percent of all factors	1.6	0.0	1.6
Percent of all factors for the type of household	2.9	0.0	...
Using manure			
Number	2	0	2
Percent of this factor	100.0	0.0	100.0
Percent of all factors	3.2	0.0	3.2
Percent of all factors for the type of household	5.7	0.0	...
Land still fertile			
Number	5	0	5
Percent of this factor	100.0	0.0	100.0
Percent of all factors	8.1	0.0	8.1
Percent of all factors for the type of household	14.3	0.0	...
Recommended for napier only			
Number	0	6	6
Percent of this factor	0.0	100.0	100.0
Percent of all factors	0.0	9.7	9.7
Percent of all factors for the type of household	0.0	22.2	...
Total			
Number	35	27	62
Percent	56.5	43.5	100.0
Chi-square	42.31746		
D.F.	8		
Level of significance	0.0000		

Source: Based on available responses in the fertilizer survey conducted by the International Food Policy Research Institute and Zimbabwe Department of Physical Planning, Ministry of Local Government, Rural and Urban Development, 1987-88.

Note: Credit constraints were inferred from the stated reason for the money problem.

The farmers who report having discontinued their fertilizer use in the past either temporarily or permanently tend to be those who fertilize napier grass, sunflower, and maize. Farmers who grow napier grass could be discontinuing fertilizer use because they depend on the subsidized fertilizers available through the Agricultural and Rural Development Authority's (ARDA) dairy development project. The low rate of discontinuation among farmers who grow maize may indicate the high agroeconomic potential of maize.

Of the 148 farmers who do not use fertilizers, 88 had heard about fertilizers, and of these, 35 had used them at some time in the past. The reasons they give for discontinuing their use of fertilizers include cash or credit constraints (71 percent) and the perception that the land is still fertile (14 percent). This indicates that the major problem with getting farmers to start and keep using fertilizers may not be the agronomic potential of the crop grown, but the processes related to converting potential into effective demand.

Among both current users and nonusers who discontinued their use of fertilizers at some point, 50 percent did so because of cash or credit constraints. These constraints are much more prevalent among nonusers (71 percent) than among users, who also cited drought (30 percent) and lack of availability of fertilizers (22 percent). Therefore, drought and lack of availability of fertilizers are important factors influencing stability of use of fertilizers, whereas cash and credit are important in the initiation of fertilizer use by farmers.

Other Factors Influencing the Conversion of Agroeconomic Potential

The price of fertilizers should be an important factor determining fertilizer use, but farmers rarely mention fertilizer price or its being expensive as an important factor keeping them from using or from expanding their use of fertilizers. This is true of both current users and nonusers. Thus, many other factors could be more binding and crucial, and small changes in fertilizer price probably have limited effect on fertilizer use, particularly when important nonprice factors are simultaneously addressed.

Neither users nor nonusers mention the lack of irrigation as a major factor for limiting fertilizer use or for determining the effectiveness of fertilizers. Thus, irrigation may not be a prerequisite for fertilizer use, and fertilizers may be effective in large parts of the survey area even without irrigation.

INFORMATION, EXTENSION, AND ENTREPRENEURSHIP

More than 25 percent of the total sample and 43 percent of the nonusers report that they have never heard of fertilizers. Clearly, without knowledge, these farmers cannot be expected to respond to other factors related to the demand for fertilizers. This highlights the problem of information. Even among farmers who have heard about fertilizers, 12 percent heard about them only in the current year. There is, however, a regional dimension to this problem, which is particularly severe in the villages of Batanai and Rufaro.

Length of Time of Knowledge

Among the farmers who have heard of fertilizers, those who use them seem to have heard about them earlier than those who do not. The majority of users heard about fertilizers more than 10 years ago, whereas the majority of nonusers heard about them within the past 10 years. A majority of both groups, however, heard about fertilizers more than five years ago, and one-fifth heard about them only in the past one or two years. Thus, the time farmers have known about fertilizers plays a limited role in adoption. Some groups of farmers may adopt fertilizers after knowing about them for only a short period of time, if the conditions are favorable.

Source of Information

Data collected by the household survey on fertilizers indicates that extension workers and other farmers are the major source of information on fertilizers (see Table 6.7). Of the total sample, 57 percent heard about fertilizers from extension workers and 35 percent heard about them from other farmers. However, 71 percent of the users heard about them from extension workers compared with only 44 percent of the nonusers. On the other hand, 54 percent of the nonusers heard about them from other farmers compared with only 16 percent of users. Almost 84 percent of the users first heard about fertilizers from official agencies (extension agents and agents of ARDA) compared with 45 percent of the nonusers. The differences may be due to supply factors, such as the access to and availability of information through official agencies, as well as demand factors, such as whether and where farmers normally look for such information. However, 44 percent of the nonusers who have heard about fertilizers first heard about them from extension agents. Of the farmers who were contacted

Table 6.7—Initial source of information for users and nonusers who know about fertilizers in Gazaland District, Zimbabwe, 1987-88

Initial Source of Information	Nonuser	User	Total
Extension agent			
Number	37	57	94
Percent of this factor	39.4	60.6	100.0
Percent of all factors	22.6	34.8	57.4
Percent of all factors for the type of household	44.0	71.3	...
Other farmers			
Number	45	13	58
Percent of this factor	77.6	22.4	100.0
Percent of all factors	27.4	7.9	35.3
Percent of all factors for the type of household	53.6	16.3	...
Anyone else			
Number	1	0	1
Percent of this factor	100.0	0.0	100.0
Percent of all factors	0.6	0.0	0.6
Percent of all factors for the type of household	1.2	0.0	...
Agent of the Agricultural and Rural Development Authority			
Number	1	10	11
Percent of this factor	9.1	90.9	100.0
Percent of all factors	0.6	6.1	6.7
Percent of all factors for the type of household	1.2	12.5	...

(continued)

Table 6.7—Continued

Initial Source of Information	Nonuser	User	Total
Total			
Number	84	80	164
Percent	51.2	48.8	100.0
Chi-square	30.19453		
D.F.	3		
Level of significance	0.0000		

Source: Fertilizer survey conducted by the International Food Policy Research Institute and Zimbabwe Department of Physical Planning, Ministry of Local Government, Rural and Urban Development, 1987-88.

by extension agencies, 60 percent use fertilizers and 40 percent do not; of the farmers who were contacted by other farmers, only 25 percent use fertilizers and 75 percent do not. This underscores the great importance of information and extension work; official extension agencies have an important role to play in converting the potential for fertilizer use into effective demand in Gazaland District.

The source of information differs by village. ARDA agents are the only source of information in Rusitu, perhaps because a dairy development project is located in that village. Most farmers in Batanai and Rufaro report not knowing about fertilizers, while farmers in Murimbira, Tufuka, and Zamchiya generally learned about them from other farmers. These villages may be poorly covered by extension agencies, which coincides with the high proportion of farmers in these villages who do not use fertilizers and the relative instability of use among those who do. In the village of Chaminuka, however, most farmers heard about fertilizers from extension agents, which coincides with that village's high percentage of users and greater stability of use. All villages except Rusitu belong to the same natural region, and differences in the source of information, fertilizer use, and stability of use may, therefore, reflect the great importance of conversion

processes, including information and extension, in increasing the use of fertilizer.

When the farmers were asked whom they would consult on fertilizer use, 90 percent of the users and 54 percent of the nonusers said that they would consult an extension agent (including an agent of ARDA) on matters related to fertilizer use. Other farmers are a surprisingly unimportant source of information: only 10 percent of both the users and nonusers would consult other farmers. This shows the substantial importance of a vertical flow of information through extension for introducing new technology, such as fertilizer use, compared with a horizontal flow across farmers.

The Content of Information

The content of the information conveyed by extension agents may determine how farmers respond in using fertilizers. Seven percent of farmers report difficulty in determining when to apply top dressing, and 9 percent report difficulty in sustaining fertilizer response, possibly because of lack of appropriate and balanced application. The content of the information being used in extension appears to be adequate in general, except for the gaps mentioned, and the major problem keeping extension from being effective may be that it simply does not reach enough farmers.

Maize growers are the only farmers who report difficulty in determining when to apply top dressing and in maintaining a crop response. Coffee and tea growers, however, have difficulty applying fertilizers accurately or evenly. Extension agents need to address the specific problems that affect the use of fertilizers on specific crops.

INFRASTRUCTURE AND SERVICES

Roads and Bus Transportation

Roads and bus transportation facilities are crucial in bringing about the necessary access to fertilizers from points of supply, but farmers in the study region do not mention availability of fertilizers as a major problem. Farmers who use fertilizers are willing and able to travel an average distance of about 30 kilometers to obtain fertilizers. The presence of good roads and bus transportation in Gazaland District clearly plays an important role in the conversion process.

Credit

Cash or credit constraints appear to be very important for converting potential into effective demand. Half of both the users and nonusers cite cash or credit constraints as a problem. Among the nonusers, both those who have tried fertilizers and those who have never used them, 71 percent cite cash or credit constraints as their reason for not using fertilizers. Among users, cash or credit constraints is one of the three most important reasons for temporarily discontinuing their use in the past. Further, among the 18 users who reported reasons for delaying their use after hearing about fertilizers, 72 percent report doing so because of cash or credit constraints.

AGGREGATE SUPPLY AND DISTRIBUTION

Although lack of availability does not seem to be a major constraint to fertilizer use, 22 percent of the farmers who use fertilizers cite lack of availability as a reason they temporarily discontinued them in the past. Nonusers do not, however, mention lack of availability as an important reason for not using fertilizers. Over 40 percent of nonusers report not knowing about them. Thus, the major constraints to increasing the use of fertilizers in the study region may be within the process of converting potential into effective demand rather than to the availability of fertilizers.

Farmers cooperatives seem to be a very important source of supply: 47 percent of the users purchase fertilizers from farmers cooperatives, and another 24 percent obtain them from ARDA. Farmers must travel a long distance by bus to reach the district headquarters of Chipinge, where the district's one cooperative outlet is located: 52 percent of the farmers obtain fertilizers from Chipinge, and 42 percent obtain them from Mutema. The distance traveled to obtain fertilizers varies from village to village. For Chaminuka, Murimbira, Rusitu, and Tuzuka, farmers travel average distances of between 12 and 70 kilometers, but these averages conceal a great deal of variation, even within villages. Most of the white commercial farmers from Chipinge travel as far as 500 kilometers by truck to obtain fertilizers directly from the factories located near the capital city of Harare. This indicates that the need for infrastructure and services may be very different for different farmers. Large farmers may be able to obtain fertilizers from great distances if the roads are good. But small farmers

clearly need a good distribution system that makes fertilizers available near their villages or farms.

CONCLUSIONS AND IMPLICATIONS

Only about one-third of the sample households, which are principally composed of small farmers, use fertilizers. Thus, assuming that potential exists, the process of converting potential into effective demand and use may still have a long way to go, even in parts of relatively high-use countries of Sub-Saharan Africa such as Zimbabwe. The diffusion of fertilizer use appears to be lagging far behind the diffusion of hybrid maize. Of the two-thirds of the households who do not use fertilizers, almost half do not report knowing about fertilizers and therefore cannot be expected to respond to other factors, such as prices, that determine demand. This indicates the great importance of information and extension in raising fertilizer use. Most of the farmers who use fertilizers do not use them on the entire area cultivated. Since they began using fertilizers, however, most farmers have expanded their use to more plots as well as more crops. Thus, farmers seem to have positive experiences with using fertilizers, and use could probably be expanded among farmers who already use them. Most users keep using fertilizers once they begin, which again indicates positive experience. Users who temporarily discontinued their use of fertilizers in the past did so mainly because of problems caused by drought, cash or credit constraints, or availability. Farmers who stopped using fertilizers did so mainly because of cash or credit constraints. Thus the agronomic potential of fertilizer use does not appear to be substantially questionable in much of the region, but important constraints lie in converting this potential to effective demand and use by small farmers.

Agronomic potential (implying improved harvests) is considered to be the major reason by all users as well as a large number of nonusers for the usefulness (or effectiveness) of applying fertilizers. As reflected in the crops fertilized, a significant part of the potential for fertilizer use lies with maize (particularly hybrid maize), followed with a large margin by wheat, beans, tomatoes, and cotton. Farmers consider fertilizer use to be most profitable on maize, wheat, and tomatoes. Food crops lead nonfood crops by a large margin in the frequency of reporting.

Lack of information seems to be a major problem, since 43 percent of nonusers report not knowing about fertilizers. This highlights the great importance of extension services, since extension workers are considered the most important source of information for farmers on fertilizer use. A large number of nonusers also heard about fertilizers from extension workers, but many heard about them from other farmers. In the future, however, both users and nonusers would prefer to consult an extension worker rather than other farmers, which suggests that vertical communication has a major role to play in the diffusion of fertilizers. A large number of farmers indicate cash or credit constraints as a barrier to beginning and continuing to use fertilizers. Thus, availability f credit services could play a significant role in the conversion of potential into effective demand.

Infrastructure and services are important for the conversion process, but the need for them varies with the scale of operation. Large farmers can obtain fertilizers from as far away as 500 kilometers if good roads are available, but small farmers clearly need distribution agencies and transportation services. These significantly influence the adoption as well as the expansion of fertilizer use in the study area.

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Market Towns and Service Linkages in Southern Africa: A Case Study of Chipata, Zambia, Salima, Malawi, and Chipinge, Zimbabwe

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This paper is based on a study of market towns and service linkages in southern Africa that was undertaken by the International Food Policy Research Institute. That study sought to understand the nature and composition of the relationship that exists between the growth of market towns and the growth of their agricultural rural hinterlands. This relationship, the study hypothesized, would be expressed in the service sector activities of market towns, and these activities would be more numerous and diversified and have greater employment potential in towns whose agricultural rural hinterlands were prosperous and dynamic than in those whose hinterlands were not.

This chapter identifies the nature of these relationships using information gathered on the service sector activities of three market towns in the southern African countries of Zambia, Malawi, and Zimbabwe. This was a pilot study, and separating the effects of the growth of towns from those of the growth of agriculture in rural hinterlands was beyond its scope. Despite this limitation, some interesting interrelationships were uncovered, and their characteristics are noted in this chapter.

FARM AND NONFARM LINKAGES AND MARKET TOWNS

The extensive literature on farm and nonfarm linkages in rural Sub-Saharan Africa treats some aspects of town-centered relationships.[1] In that literature, a rural region is defined as being dominated by a large

[1] For a good review of the literature on farm and nonfarm linkages in Sub-Saharan Africa, see Haggblade, Hazell, and Brown (1987). For the theoretical enunciation and empirical details of production linkages and consumer demand linkages, see Bell, Hazell, and Slade (1982); Hazell and Ramasamy (Forthcoming); Hazell and Roell (1983); Johnston and Kilby (1975); Mellor (1976); and Mellor and Lele (1973).