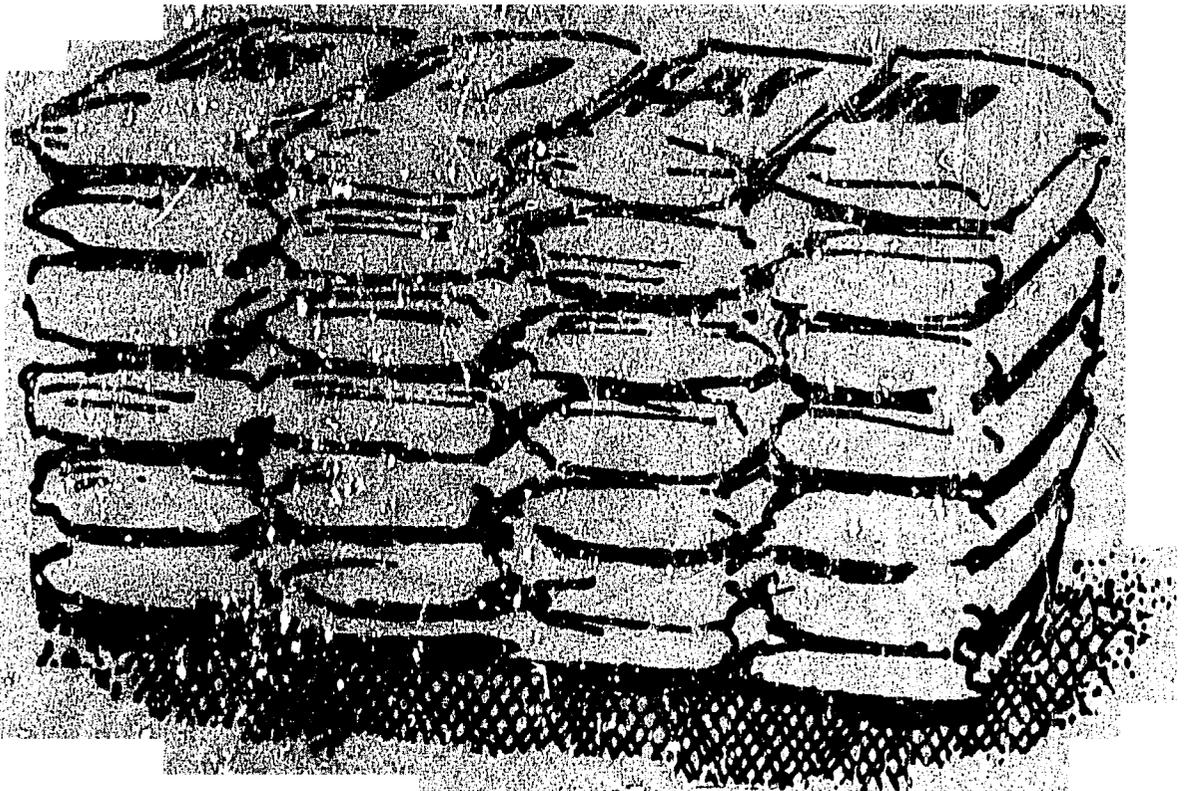
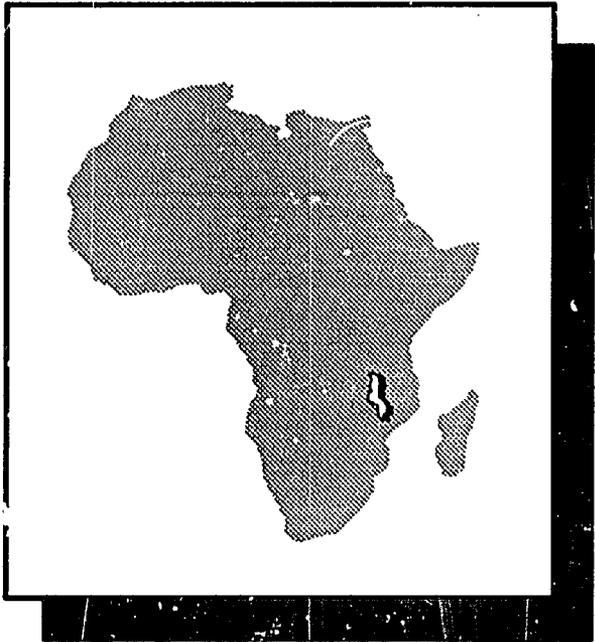




Fertilizer Situation and Markets in Malawi



 **IFDC**
International
Fertilizer
Development
Center



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Lewis B. Williams
and
John H. Allgood



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Abstract

Malawi is a long (some 840 km), narrow landlocked country situated in south central Africa. Long and expensive supply lines place Malawi at a decided disadvantage in importing, exporting, and distributing essential commodities and emphasize the need to be efficient and self-sufficient in agricultural production. Agriculture is the mainstay of Malawi's economy, accounting for 40% of the gross domestic product and 95% of export earnings. Maize, the most important planted food crop, is grown on two-thirds of the harvested area. The export crops--tobacco, sugar, and tea--account for only 6% of the area. The southern and central regions are heavily populated and are cultivated extensively. Additional agricultural production will come from increased productivity per unit of land. Research shows that maize yields can be increased by up to 27 kg of grain for each kilogram of applied nutrient.

Fertilizer marketing in Malawi is in the early stages of development. Fertilizer use increased at an average of 6% per annum during the past decade and totaled 43,000 tons in 1988. Malawi has two independent fertilizer marketing systems and thus two independent pricing systems. One marketing system serves the smallholder, and the other serves the large estates. The smallholder system is subsidized and serves approximately 1.2 million smallholder farmers, who cultivate 1.3 million ha or about 78% of the total area. The fertilizer subsidy in 1988/89 amounted to about 42% of the total fertilizer cost. The smallholder subsidy program leads to an extensive leakage of fertilizer sales to the estate sector. In the smallholder system, the Government performs all marketing functions. The private sector marketing system, which is nonsubsidized, serves the estates and operates on a free market basis. Estate farmers cultivate 22% of the cropped area. OPTICHEM, Blantyre, manufactures a wide range of fertilizer products and markets them directly or through agents to the private sector.

The outlook for the Malawi fertilizer sector is favorable. The Government has adopted a policy to expand agricultural production. An efficient fertilizer system that can make fertilizers timely available to farmers in a cost-effective manner is being seriously considered.

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Acronyms and Abbreviations

Miscellaneous

c. & f.	Cost & freight
FA	Field Assistant
f.o.b.	Free on board
f.o.r.	Free on rail
f.o.t.	Free on truck
GDP	Gross domestic product
MK	Malawi kwacha
pH	Soil acidity
T	Tambala
VCR	Value:cost ratio

Measurements

ha	Hectare
kg	Kilogram
km	Kilometer
mm	Millimeter
mt	Metric ton
ton	Metric ton
tpy	Tons per year

Chemicals and Fertilizers

AS	Ammonium sulfate
B	Boron
Ca	Calcium
CAN	Calcium ammonium nitrate
Cu	Copper
DAP	Diammonium phosphate
K	Potassium
Fe	Iron
K ₂ O	Potassium oxide
MAP	Monoammonium phosphate

MCP	Monocalcium phosphate
MOP	Muriate of potash (potassium chloride)
Mg	Magnesium
Mn	Manganese
Mo	Molybdenum
N	Nitrogen
P	Phosphorus
P ₂ O ₅	Available phosphate
PAPR	Partially acidulated phosphate rock
S	Sulfur
SSP	Single superphosphate
TSP	Triple superphosphate
Z	Zinc

Organizations

ADD	Agricultural Development Division
ADMARC	Agricultural Development and Marketing Corporation
ASA	Annual Survey of Agriculture
ATC	Agricultural Trading Company
FAO	Food and Agriculture Organization of the United Nations
FINCOM	Financial Corporation of Malawi
IFDC	International Fertilizer Development Center
MOA	Ministry of Agriculture
MTIT	Ministry of Trade, Industry, and Tourism
NRDP	National Rural Development Program
SCA	Smallholder Coffee Authority
SFRF	Smallholders Fertilizer Revolving Fund

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Fertilizer Situation and Markets in Malawi

Summary

Agriculture is the mainstay of Malawi's economy, accounting for 40% of the gross domestic product and 95% of export earnings. About 90% of the labor force is employed in agriculture.

Maize is the most important food crop planted in Malawi and accounts for two-thirds of the total harvested area. Tobacco, sugar, and tea—the major export crops—account for only about 6% of the harvested area. Most of the country's productive land is already under cultivation, and future gains in agricultural production will have to come from increased productivity per unit of land area. Fertilizer trials conducted by the Ministry of Agriculture have demonstrated that maize yields can be increased by up to 27 kg of grain for each kilogram of applied nutrient. Hence, more efficient use of fertilizers is the key to the future growth of Malawi's agricultural production.

During the past decade, fertilizer use expanded fairly consistently, increasing from 24,000 tons of nutrients in 1978 to 46,300 tons in 1988, a compound growth rate of 6.7% per year. In 1988 the N-P₂O₅-K₂O ratio was 1.0-0.35-0.15. The fertilizer product line used by Malawi's farmers varies by market segment. Approximately 1.2 million smallholder farmers collectively cultivate 1.3 million ha. Until recently smallholder farmers have used low-analysis products (calcium ammonium nitrate and 20-20-0) containing only nitrogen and phosphate. Estate sector farmers on approximately 22% of the cropped area rely on a broader range of fertilizer products; however, in 1988 complex fertilizer (6-18-15-9S) and urea accounted for about 50% and 23% of the market, respectively.

Fertilizers used in Malawi are imported as finished products or granulated locally using imported intermediate fertilizer materials. The Government, a private-sector firm, and some estates import fertilizers.

The two market segments in Malawi are served by two separate marketing channels: (1) the Government, through the Smallholders Fertilizer Revolving Fund, the Agricultural Development and Marketing Corporation, and the Agricultural Development Divisions, serves the smallholder sector, and (2) a private firm, OPTICHEM, supplies fertilizers to the estate sector. A few estates heretofore served by OPTICHEM are now importing fertilizer directly.

In marketing fertilizers to the smallholder sector, the Government performs all of the marketing functions, from determination of which products are to be sold and in what quantities, to procurement and subsequent physical distribution to the farm level. The Government also establishes retail prices at subsidized levels. The rate of subsidy in 1987/88 was about 24%, and it increased to about 42% in 1988/89.

The estate sector essentially operates on a free market system although the Government controls import licensing. Marketing decisions, including pricing, and performance of the marketing functions are handled by the private sector. The two-tier pricing system has contributed to a significant leakage of subsidized fertilizers to the estate sector.

The outlook for the Malawi fertilizer sector is favorable. The Government's policy toward development of the agriculture and fertilizer sectors is positive. A self-supporting fertilizer system that can adequately supply fertilizers to all sections of Malawi is being seriously considered. This should lead to improved performance of the marketing functions.

Introduction

Geography

The Republic of Malawi is landlocked in south central Africa. It is bordered by Tanzania to the north, Mozambique to the east and south, and Zambia to the west. A long, narrow country, Malawi is some 840 km from north to south and ranges in width from 80 km to 160 km; it falls primarily between longitude 33°-37° east of Greenwich and, south of the equator, between latitudes 9°-17°. The total area is only 118,484 km² of which 24,208 km² is inland water with Lake Malawi accounting for 23,310 km² [1].

Climate

Malawi is a plateau country of varying altitudes and has a wide range of climatic, soil, and vegetational conditions within its 94,276 km² of land area. There are three climatic seasons. The rainy season, which is the principal period of agricultural activity, occurs from November to April. About 90% of the country's annual rainfall, which normally ranges from 760 to 1,015 mm, occurs during this period.

History

During the colonial period, the concentration of population and markets developed in the southern portion of Malawi. Communication facilities developed south of Lake Malawi and ensured that the production of cash crops would take place principally in the southern and later in the central region. People in the northern region concentrated on subsistence farming and providing labor to the centers and mines of the south. Following a long struggle, independence was gained on July 6, 1964 [1].

Demography

Malawi's 1986 population was estimated at 7.3 million, yielding an average population den-

sity of 61.4 inhabitants per square kilometer of land. Hence, Malawi is one of the world's most densely populated countries. Females comprise about 52% of the population. With a projected population growth rate of about 3.4% per year, the population is forecast to reach 11.7 million by the year 2000. Malawi's relatively high population growth rate can be attributed to a high birth rate and to a heavy influx of refugees from Mozambique. At present the Mozambique refugee population in Malawi is estimated at over 700,000.

Approximately 88% of the population derives its livelihood from agriculture. The majority of people are classified as smallholder farmers, and collectively they account for about 80% of Malawi's agricultural production on 78% of the cultivated area. Geographically the southern region accounts for 48% of the total population; Blantyre and Zomba are the major cities. The central region has 40% of the total population. The capital city of Lilongwe is the major city. The northern region has only 12% of the total population and the principal city of Mzuzu. The area of potential agricultural expansion is in the north.

The Government of Malawi has placed a major emphasis on the development of country-wide education programs. As a result, the rate of adult literacy now exceeds 40%.

Economy

Malawi is one of but a few countries in sub-Saharan Africa where per capita food production increased during the 1970s. During this period the real growth in the gross domestic product (GDP) averaged 5.9% per year. This occurred despite a very limited mineral resource base and a small manufacturing sector, which contributed only about 13% to the GDP. By 1982 Malawi was a net exporter of maize, the staple crop.

Since mid-1980, the Malawian economy has suffered economic difficulties precipitated by a worsening trade position. The country has relied

increasingly on high-cost imports while at the same time suffering from a less competitive position in terms of agricultural exports, largely because external trade routes through Mozambique have been closed. This has resulted in use of prohibitively expensive transport routes through the Republic of South Africa or Tanzania to reach international markets.

The Government policy for agricultural development focuses on improving crop production at the smallholder farmer level while diversifying agriculture generally and maintaining self-sufficiency in food production. This approach was adopted to stabilize export earnings and potentially to reduce strains on the balance of payments by allowing continued import substitution, e.g., wheat imports. Self-sufficiency in food production is an important agricultural policy guideline for Malawi.

The Government policy supporting agricultural development, as stated in the Third Structural Adjustment Loan, indicates the importance of a more productive use of land and labor and includes developing credit facilities, establishing an estate management sector, and upgrading the extension service.

Agriculture is the mainstay of Malawi's economy, accounting for 40% of the GDP and 95% of export earnings. Of the 88% of the working population employed in agriculture, the majority is employed in the smallholder sector. The smallholder sector is largely involved in the production of maize, which typically accounts for 50%-60% of the cropped area, and other food crops. Some smallholder farmers are also engaged in the production of export crops, principally tobacco.

The estate crop sector, which accounts for about 22% of the cultivated land, has grown rapidly during the past two decades. It is now responsible for the majority of Malawi's tea and sugar production and, to a lesser extent, tobacco production. These three crops account for over 80% of the country's export earnings.

Land Use

About 50% of the total land area in Malawi is classified as forest and woodlands. Arable land and land planted to permanent crops, which are the areas that receive most of the applied fertilizer, occupy 25% of the land area. Permanent pastures and land currently not used for agricultural purposes account for the balance. About 1% of the agricultural land area in Malawi is irrigated; most is in the estate sector.

Historically, maize has been the largest crop area harvested, followed by groundnuts, sorghum, and dry beans. These four crops accounted for 82% of the harvested area in 1987. All are primarily produced for domestic use although groundnuts are increasingly being exported. The three major export crops (tobacco, sugar, and tea) accounted for only 6% of the harvested area in 1987. As Table 1 shows, the area cropped in maize has remained just about constant; however, the area

Table 1. Cropped Hectarage in Malawi, 1983-87

Crop	Year				
	1982/83	1984	1985	1986	1987
	(ha)				
Maize	1,169,402	1,182,601	1,144,853	1,193,275	1,182,415
Local		1,067,527	1,048,441	1,104,583	1,131,540
Composite		26,069	21,477	20,100	13,780
Hybrid		89,005	74,935	68,592	37,095
Rice	20,309	21,917	20,807	22,874	18,803
Groundnuts	146,314	144,935	135,966	176,293	209,938
Tobacco	27,587	44,999	46,939	38,045	39,872
Cotton	32,597	51,059	60,824	51,910	34,504
Cassava	59,351	81,497	80,262	72,904	63,174
Sorghum	22,649	21,302	32,725	32,059	30,626
Pulses	82,932	91,322	79,971	113,663	140,476
Millet	10,870	15,340	17,413	17,424	18,163
Cashew*	5,300	1,200	1,200	6,546	24,103
Coffee	2,000	2,000	2,800	2,000	2,000
Sweet potato	-	21,340	22,717	22,447	25,698
Tea	17,500	20,500	21,000	21,000	21,000
Sugarcane	14,457	14,056	13,829	14,000	14,000
Others	8,487	8,096	7,682	7,952	10,288
TOTAL	1,614,455	1,720,964	1,687,788	1,785,846	1,810,957

a. Data for cashew refer to the number of trees. Not included in total hectares.

Source: Ministry of Agriculture, Agricultural Development Divisions.

planted to hybrid maize has declined since 1984. Groundnut hectareage has been increasing since 1986.

Achieving and maintaining self-sufficiency in food production is a Government priority in Malawi and can be attained only through increased production per unit of land. According to the Ministry of Agriculture (MOA) data, most of the productive land is already under cultivation, and horizontal expansion for future development is basically limited to the northern part of the country.

The Fertilizer Market

Consumption

Fertilizer consumption in Malawi totaled 46,300 tons of plant nutrients in 1988 (Table 2). The N-P₂O₅-K₂O ratio is 1.0-0.35-0.15, reflecting the predominance of use of single-nutrient (N) and binary-nutrient (N and P) fertilizers. With the

exception of 1982-84, fertilizer use has increased fairly consistently. The compound growth rate in fertilizer nutrient use over the past decade has been 6.7% per year [2]. The trend in fertilizer nutrient use over the past decade is shown in Figure 1.

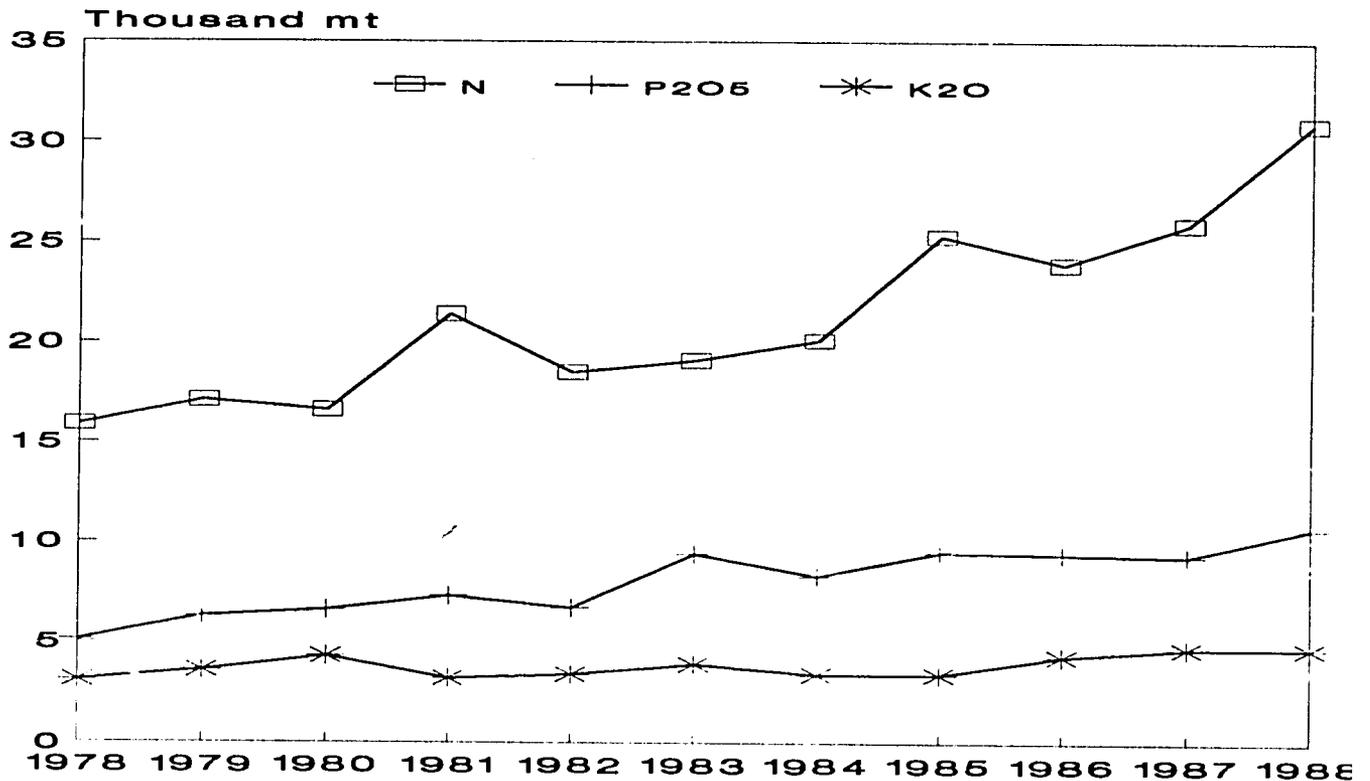
The volume of products that flow through the fertilizer marketing system has ranged from 86,600 tons in 1978 to about 119,500 tons in 1988 (Table 3 and Figure 2). Calcium ammonium nitrate (CAN) is the leading fertilizer marketed in Malawi, accounting for 27% of the market in 1988. Urea and complex fertilizer accounted for 22% and 19%, respectively, of the market.

The fertilizer market in Malawi comprises two distinct segments, the smallholder sector and the estate sector. Land ownership is the criterion that distinguishes the two sectors. Farmers who crop leased land are classified in the estate sector, and those who crop communal land are classified as smallholders [3].

Table 2. Fertilizer Consumption in Malawi

Nutrient	Year										
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
..... ('000 mt of nutrient).....											
Nitrogen											
Smallholder	9.2	9.5	10.3	13.1	11.8	12.4	13.4	16.0	14.9	17.5	21.7
Estate	6.7	7.6	6.3	8.3	6.7	6.7	6.7	9.3	9.0	8.4	9.2
Subtotal	15.9	17.1	16.6	21.4	18.5	19.1	20.1	25.3	23.9	25.9	30.9
Phosphate											
Smallholder	1.3	1.8	1.8	2.7	2.1	4.6	4.4	5.2	5.0	4.7	6.4
Estate	3.8	4.5	4.8	4.6	4.6	4.8	3.9	4.3	4.4	4.6	4.3
Subtotal	5.1	6.3	6.6	7.3	6.7	9.4	8.3	9.5	9.4	9.3	10.7
Potash											
Smallholder	0	0	0	0	0	0	0	0	0	0	0.1
Estate	3.1	3.6	4.3	3.2	3.4	3.9	3.4	3.4	4.3	4.7	4.6
Subtotal	3.1	3.6	4.3	3.2	3.4	3.9	3.4	3.4	4.3	4.7	4.7
Total smallholder	10.5	11.3	12.1	15.8	13.9	17.0	17.8	21.2	19.9	22.2	28.2
Total estate	13.6	15.7	15.4	16.1	14.7	15.4	14.0	17.0	17.7	17.7	18.1
GRAND TOTAL	24.1	27.0	27.5	31.9	28.6	32.4	31.8	38.2	37.6	39.9	46.3

Source: Ministry of Agriculture; OPTICHEM.



Source: Ministry of Agriculture and OPTICHEM.

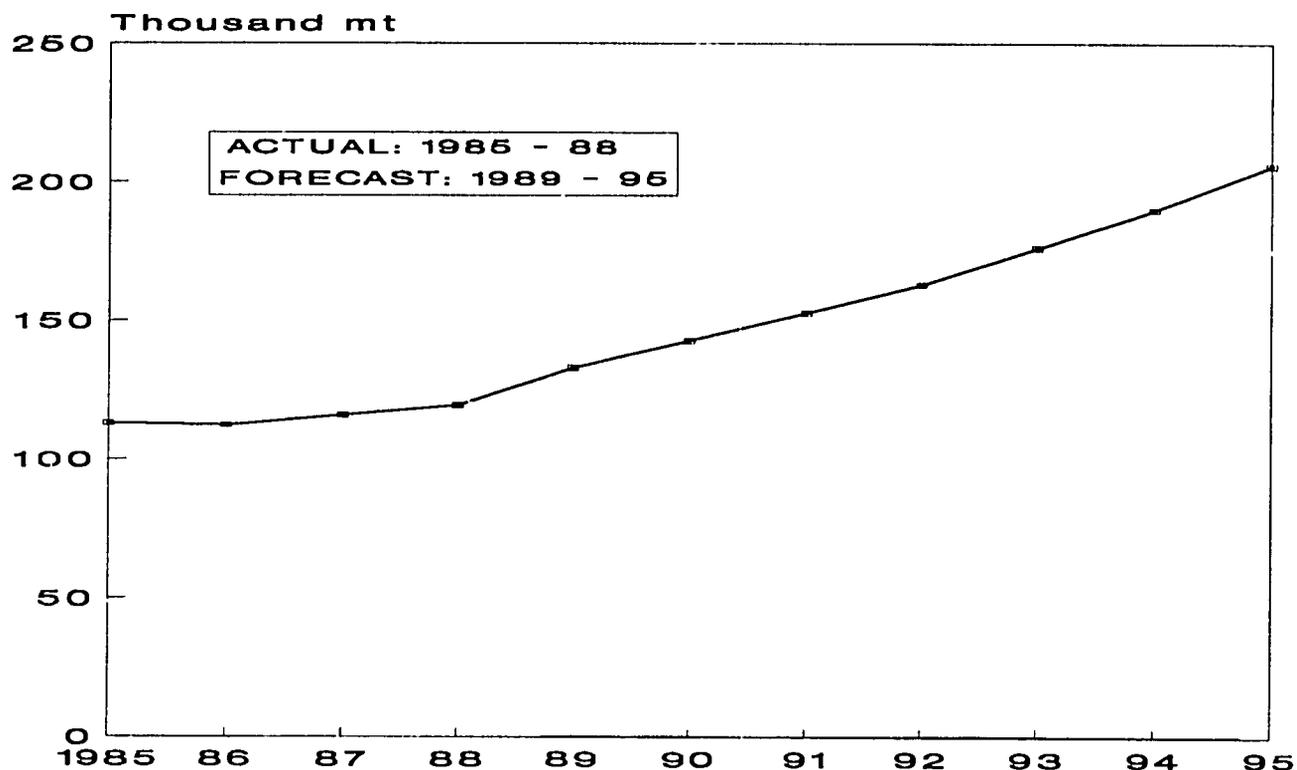
Figure 1. Fertilizer Nutrient Use in Malawi.

Table 3. Fertilizer Consumption (by product) in Malawi

	Year										
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
	(mt of product)										
Smallholder Sector											
20-20-0	6,374	8,971	9,170	13,469	10,619	22,928	21,813	26,107	25,485	21,924	20,273
AS	33,835	31,839	35,239	43,630	42,508	24,845	3,232	5,444	3,585	6,700	3,292
CAN	3,181	3,992	4,166	4,748	2,789	9,912	31,964	36,965	35,547	32,433	28,316
Urea	177	113	202	240	673	74	-	37	-	5,435	16,089
Other	999	873	364	2,361	-	4	-	501	331	1,047	5,816
Subtotal	44,556	45,788	49,141	64,448	56,589	57,763	57,009	69,054	64,948	67,539	73,786
Estate Sector											
6-18-15-9(S)	16,500	18,000	21,700	16,400	17,700	20,000	16,300	16,900	17,100	18,900	23,157
Other complex	9,800	13,100	3,900	3,500	2,900	3,100	2,900	3,600	3,200	1,700	-
CAN	5,700	5,900	8,600	5,100	7,500	1,700	5,100	5,500	5,600	5,700	4,369
AS	8,100	8,400	1,800	7,300	700	5,300	1,400	2,000	5,700	5,000	2,859
Urea	200	200	3,400	8,600	6,500	7,700	8,300	13,200	11,100	12,000	10,622
TSP	200	400	800	2,300	1,600	1,200	800	1,100	1,400	1,900	446
Potassium chloride	100	400	1,300	800	900	1,200	900	700	2,200	2,500	1,570
Other	1,400	1,600	1,400	700	1,100	500	600	900	900	700	2,657
Subtotal	42,000	48,000	42,900	44,700	38,900	40,700	36,300	43,900	47,200	48,400	45,680
GRAND TOTAL	86,556	93,788	92,041	109,148	95,489	98,463	93,309	112,954	112,148	115,939	119,466

a. Total complex fertilizer.

Source: OPTICHEM and Ministry of Agriculture.



Source: Ministry of Agriculture & OPTICHEM.

Figure 2. Fertilizer Product Consumption in Malawi.

Smallholder Sector—Total fertilizer use in the smallholder sector is officially reported at 73,786 tons of product or 28,200 tons of nutrient in 1988. However, actual use may be as much as 20%-30% lower because of sales to the estate sector. The reasons for the apparent leakage are (1) price differentials between the two sectors and (2) inadequate fertilizer availability in the estate sector. These factors are addressed later.

According to the fertilizer consumption statistics reported in Table 2, the smallholder sector has provided most of the recent growth in the market. Over the past decade, the compound growth rate in fertilizer use in the smallholder sector has been 10.4% per year.

The two most popular fertilizers used in the smallholder sector are CAN and 20-20-0. They accounted for about 38% and 28%, respectively, of

the market in 1988. Urea is growing in popularity, and use in the smallholder sector totaled 16,000 tons or 22% of the market in 1988. Smallholder farmers are not presently using nor have they ever used any sizable amount of potash.

Maize is by far the dominant crop planted by smallholders. In 1985 nearly 83% of the land area was planted to maize; local varieties accounted for 59% of the total area (Table 4). Maize accounted for 83.5% of all fertilizers used by smallholders in 1985. Tobacco, the only other smallholder crop that is fertilized to any significant level, accounted for 14.2% of fertilizer used in 1985 [4].

Estate Sector—Fertilizer use in the estate sector has been more or less stagnant during the 1980s in terms of both product and nutrient use

Table 4. Smallholder Sector Fertilizer Use by Crop, 1984/85

Crop	% of All Farmland	% of Crop Fertilized	% of Land Fertilized	% of Total Fertilizer Use
Maize				
Local	58.9	24.2	54.8	39.5
Composite	1.5	52.7	3.1	4.4
Hybrid	5.9	85.2	19.4	27.4
Mixture	16.6	19.0	12.1	12.2
Tobacco	3.0	77.7	9.1	14.2
Others	32.5	1.1	1.4	2.3

Source: ASA sample as reported by Nathan Associates, May 1987.

Note: Percentages in column 1 add up to more than 100% due to intercropping of some areas.

[5]. In 1988 the estate sector reportedly used about 46,000 tons of product or 18,100 tons of plant nutrients.

The estate sector, which is primarily concerned with tobacco, coffee, and sugarcane production, uses a somewhat broader product range than the smallholder sector [5]. In 1988 complex fertilizers accounted for the largest share of the estate sector market (50%) followed by urea (23%), CAN (10%), and ammonium sulfate (AS)(6%). On a nutrient basis, the fertilizer use ratio of N-P₂O₅-K₂O is about 2-1-1.

Seasonality of Fertilizer Use

The use of fertilizers in Malawi relates to a distinct rainfall pattern. The rainy season is the

season for soil preparation, the basal dose of fertilizer, and planting. The season starts in the south in late October/early November and proceeds to the central and northern sections in late November and December (Table 5). The rainy season continues through April (Figure 3). Fertilizer used for the basal or starter application is typically applied by farmers just prior to the start of the rains and planting season (Table 6). Nitrogen fertilizer used for topdressing or side-dressing is normally applied some 4-5 weeks after the basal dose. However, farmers typically procure their complete fertilizer requirements at one time.

Financial Incentive to Use Fertilizers

Most of the agronomic research trials in Malawi have been on the country's major crop, maize. Local maize is by far the most popular variety although fertilizer use on hybrid maize has historically offered a higher profit potential. The preference for local varieties is due to (1) the superior storage characteristics of local maize versus hybrid, (2) the fact that when hybrid maize is pounded it shatters more than does the local maize and thus results in greater losses, and (3) the fact that most farmers prefer the taste of local maize [6].

As indicated in Table 7, the value:cost ratio (VCR) (i.e., value of incremental output per kilogram of nutrient **divided by** value of incremental cost per kilogram of nutrient) from fertilizer use

Table 5. Rainfall for Bvumbwe, Lilongwe, and Mzuzu Stations by Months, 1987

Stations	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
(mm).....												
Bvumbwe ^a	270	247	203	83	21	24	17	11	11	28	104	229	1,248
Lilongwe ^b	208	197	131	39	7	1	0	1	3	7	66	180	840
Mzuzu ^c	210	200	214	227	46	41	37	18	20	29	83	201	1,344

a. Representative of southern region.

b. Representative of central region.

c. Representative of northern region.

Note: 25.3995 mm = 1 inch.

Source: Ministry of Agriculture.

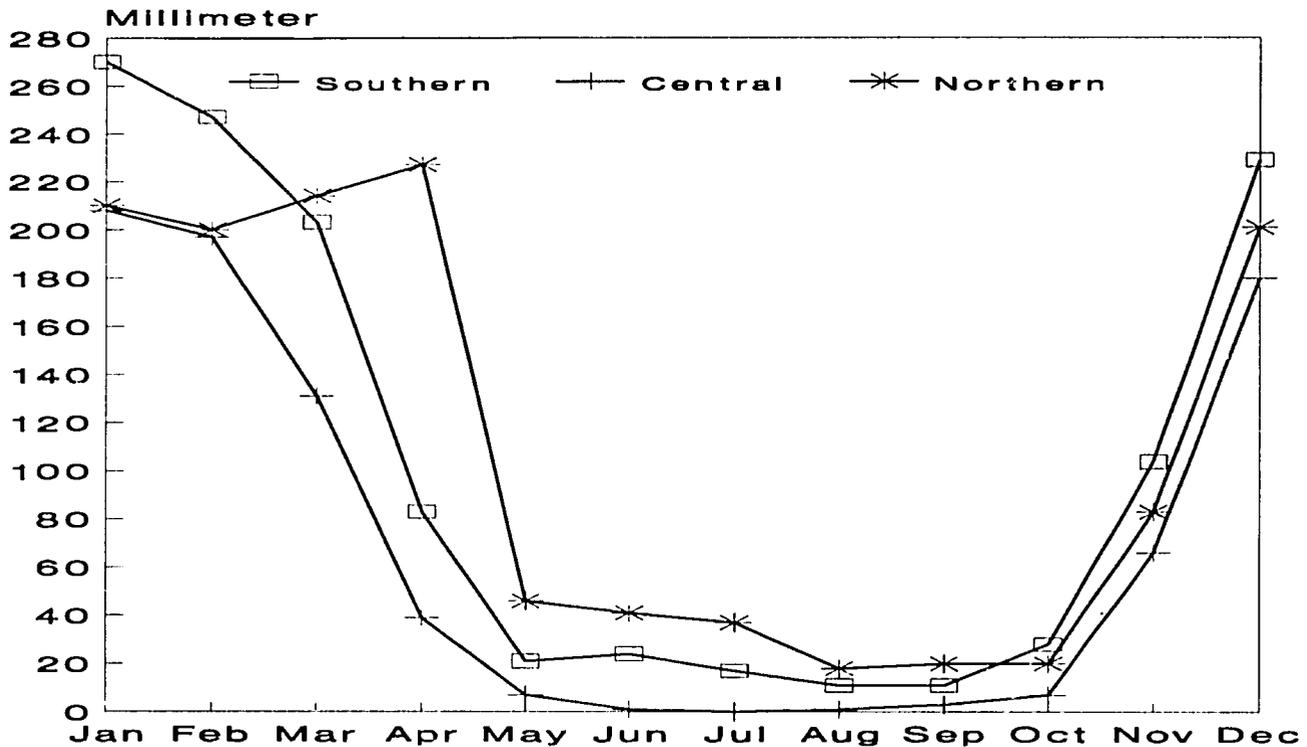


Figure 3. Rainfall Pattern In Malawi (Actual, by Month--1987).

Table 6. Mean Planting Raindate by Stations

Station	Region	Dates
Blantyre	Southern	November 17
Bvumbwe	Southern	November 17
Mzuzu	North	November 27
Lilongwe	Central	November 29

Source: Ministry of Agriculture, Smallholder Coffee Authority, Mzuzu.

on local maize has averaged slightly more than 2 over the past 10 years. However, because of the substantial increase in fertilizer prices during the mid-1980s, the VCR for fertilizer use has generally declined and was only 1.71 in 1987.

The VCRs for fertilizer use on hybrid maize, which is more responsive to fertilizer, have been significantly higher, averaging about 3.7 over the past decade (Table 8). Only in 1985/86 and 1986/87 did the VCR fall below 3.0 and then only marginally [7].

Fertilizer Marketing Systems

There are two parallel fertilizer marketing systems in Malawi [8]. Marketing to the smallholder sector is controlled by the Government. The system serving the smallholders is not a complete marketing system; it mixes social obligations with distribution. The Smallholders Fertilizer Revolving Fund (SFRF), Agricultural Development and Marketing Corporation (ADMARC), and Agricultural Development Divisions (ADDs) serve the smallholder sector with subsidized fertilizers. OPTICHEM supplies nonsubsidized fertilizers to the estate sector directly and also through the Agricultural Trading Company (ATC). ATC rebags OPTICHEM fertilizers in 5- and 10-kg bags for direct sale to smallholders at nonsubsidized prices or through Chipiku Stores. OPTICHEM also sells nonsubsidized fertilizers

Table 7. Value:Cost Ratios for Local Maize 1979-88 (Low-Analysis Fertilizer)

	Marginal Output ^a (kg)	Maize Price (/kg)	Value of Marginal Output (MK)	Fertilizer Price ^b (MK)	Marginal Cost/kg Nutrients ^c (MK)	Value: Cost Ratio ^d
1979/80	17.0	6.6	1.12	8.12	0.492	2.28
1980/81	17.0	6.6	1.12	9.52	0.576	1.94
1981/82	17.0	11.1	1.89	9.52	0.576	3.28
1982/83	17.0	11.1	1.89	12.80	0.775	2.43
1983/84	17.0	12.2	2.07	14.25	0.863	2.40
1984/85	17.0	12.2	2.07	16.50	1.000	2.07
1985/86	17.0	12.2	2.07	19.75	1.196	1.73
1986/87	17.0	12.2	2.07	20.50	1.205	1.71
1987/88	17.0	16.6	2.82	25.75	1.514	1.86
1988/89	17.0	24.0	4.08	28.75	1.691	2.41

a. Equates with the fertilizer response rate, i.e., the incremental yield of maize for the last additional unit of nutrients (N + P₂O₅) applied. For the time period indicated, it is shown as constant, i.e., in aggregate terms the response to fertilizer is not yet diminishing. Value derived from an average of results from the ASA 1982/83-1984/85.

b. Weighted price based on the use of basal and topdressings of 20-20-0 and CAN on hybrid maize (derived from ASA net recommended application rates) in a volume ratio of one part 20-20-0 to one part CAN per unit land area.

c. Marginal cost per kilogram of nutrients assuming weighted average nutrient content per kilogram of CAN and 20-20-0 of 16.5 kg/50 kg until 1986/87 and 17 kg/50 kg from 1986/1987 onwards.

d.
$$\frac{\text{Value of marginal output}}{\text{Marginal cost per kg nutrients}}$$

Source: Ms. Gill Lavers, Ministry of Agriculture.

containing potash (180 tons of 0-22-30 in 1987/88) to the Smallholder Tea Authority [8].

Beginning in 1988/89, organizations and individuals qualifying may obtain a license from the Ministry of Trade, Industry, and Tourism (MTIT) and import fertilizers directly. The SFRF and ADMARC will continue to handle donor and subsidized fertilizers for the smallholder sector. OPTICHEM will continue to supply private estates, ATC, and the Smallholder Tea Authority. Because of OPTICHEM's inability to meet demand on a timely basis and its high prices, a number of estates are importing fertilizer direct. Private estates reporting direct purchases include the Tea, Sugar, and Press Group.

Some key functions in the present fertilizer marketing system are diagrammed in product

Table 8. Value:Cost Ratios for Hybrid Maize, 1979-88 (Low-Analysis Fertilizer)

	Marginal Output ^a (kg)	Maize Price (/kg)	Value of Marginal Output (MK)	Fertilizer Price ^b (MK)	Marginal Cost/kg Nutrients ^c (MK)	Value: Cost Ratio ^d
1979/80	29.0	6.6	1.91	8.12	0.492	3.88
1980/81	29.0	6.6	1.91	9.52	0.576	3.31
1981/82	29.0	11.1	3.21	9.52	0.576	5.57
1982/83	29.0	11.1	3.21	12.80	0.775	4.14
1983/84	29.0	12.2	3.54	14.25	0.863	4.11
1984/85	29.0	12.2	3.54	16.50	1.000	3.54
1985/86	29.0	12.2	3.54	19.75	1.196	2.95
1986/87	29.0	12.2	3.54	20.50	1.205	2.93
1987/88	29.0	16.6	4.81	25.75	1.514	3.17
1988/89	29.0	24.0	6.96	28.75	1.691	4.11

a. Equates with the fertilizer response rate, i.e., the incremental yield of maize for the last additional unit of nutrients (N + P₂O₅) applied. For the time period indicated, it is shown as constant, i.e., in aggregate terms the response to fertilizer is not yet diminishing. Value derived from an average of results from the ASA 1982/83-1984/85.

b. Weighted price based on the use of basal and topdressings of 20-20-0 and CAN on hybrid maize (derived from ASA net recommended application rates) in a volume ratio of one part 20-20-0 to one part CAN per unit land area.

c. Marginal cost per kilogram of nutrients assuming weighted average nutrient content per kilogram of CAN and 20-20-0 of 16.5 kg/50 kg until 1986/87 and 17 kg/50 kg from 1986/87 onwards.

d.
$$\frac{\text{Value of marginal output}}{\text{Marginal cost per kg nutrients}}$$

Source: Ms. Gill Lavers, Ministry of Agriculture.

flow (Figure 4), title flow (Figure 5), cash flow (Figure 6), and technology transfer (Figure 7). Title flow, product flow, and cash flow all follow the same lines in OPTICHEM's operation. For SFRF and ADMARC, product title remains with SFRF until the fertilizers are sold to farmers. Fertilizers channeled through ADMARC are on a consignment basis. The technology transfer flow as shown in Figure 7 illustrates how information on fertilizer use and benefits is transferred in the fertilizer marketing system.

Demand Forecasting

The ADDs and the Ministry of Agriculture forecast fertilizer sales for the smallholder farmers in April of each year, approximately 18 months in advance of the use season. The forecasts are

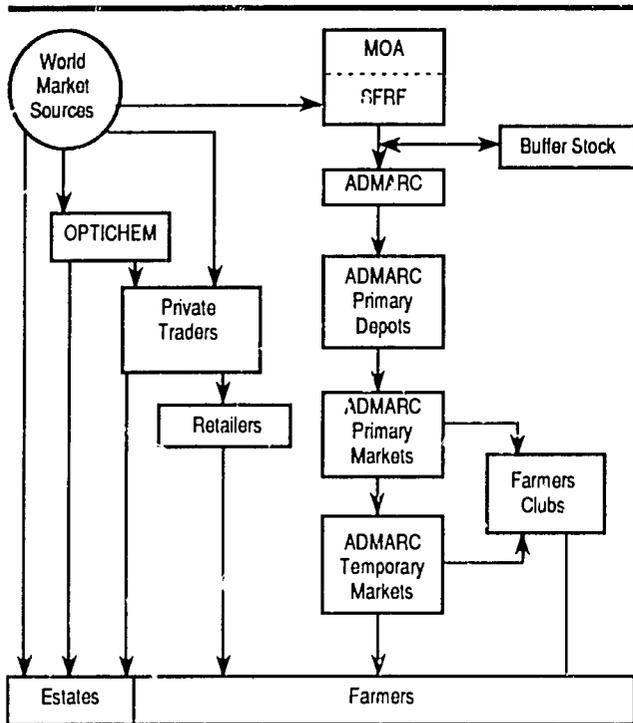


Figure 4. Product Flow in the Present Fertilizer Marketing Systems.

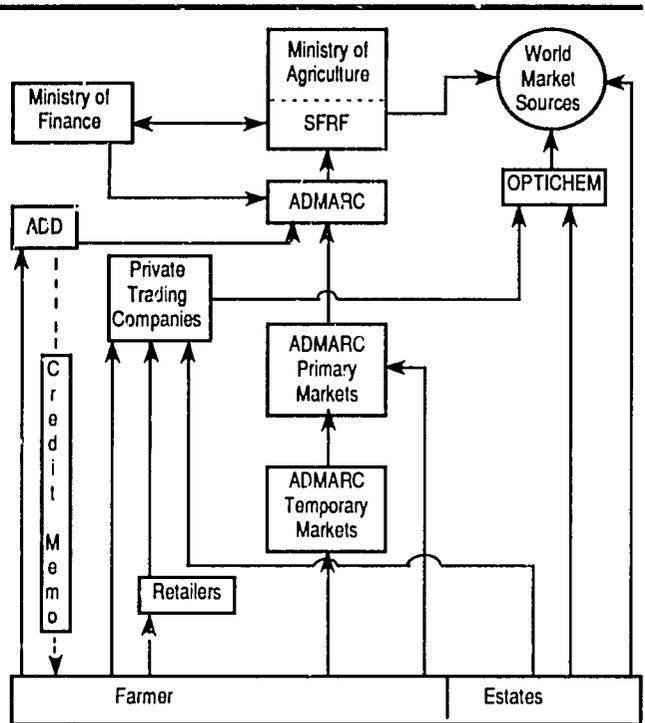


Figure 6. Cash Flow in the Present Fertilizer Marketing Systems.

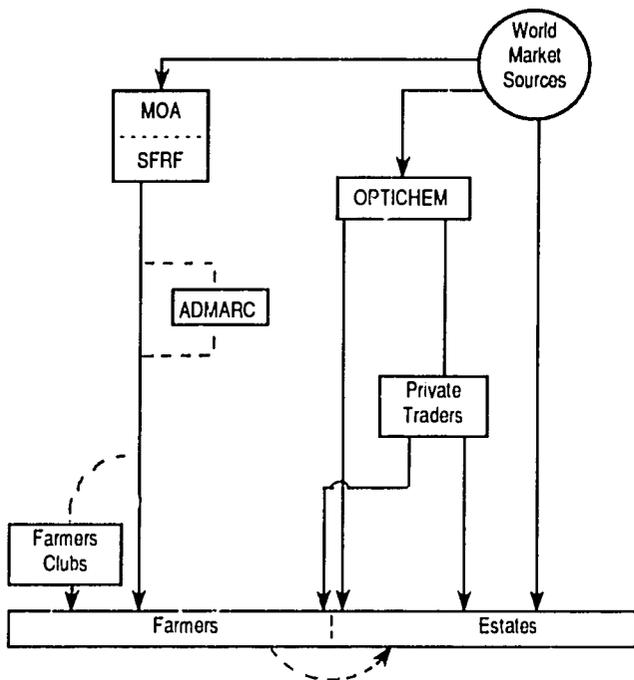


Figure 5. Title Flow in the Present Fertilizer Marketing System.

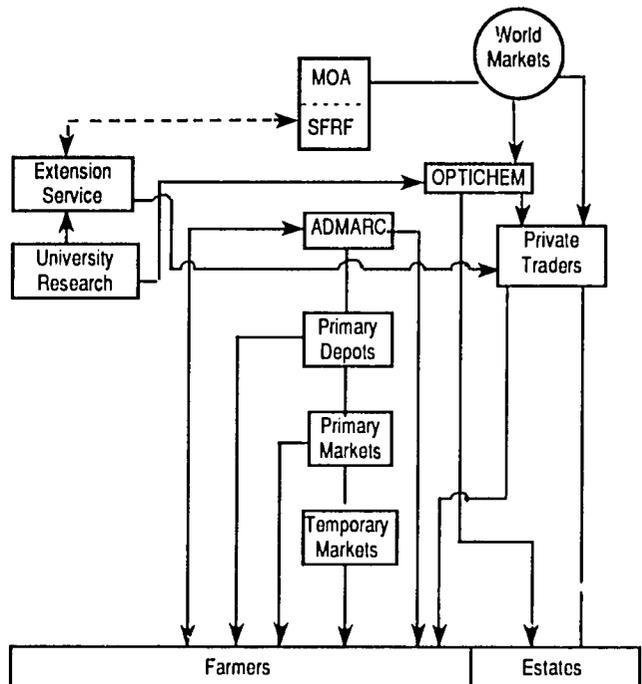


Figure 7. Technology Transfer Flow in the Present Fertilizer Marketing System.

reviewed in August, approximately 12 months in advance. The forecasts are then sent to the Fertilizer Section in the MOA in Lilongwe for review and approval. The MOA in turn sends the forecasts to SFRF.

Fertilizer Supply

All fertilizers used in Malawi are imported as finished products or granulated locally, using imported intermediate fertilizer products. SFRF, OPTICHEM, and some estates are involved in international procurement. Figure 8 illustrates the information flow that is required for the tendering and procurement of fertilizers.

SFRF is responsible for importing fertilizers for smallholders. SFRF has retained the Financial Corporation of Malawi (FINCOM) on an annual contract to handle the tendering process for (1)

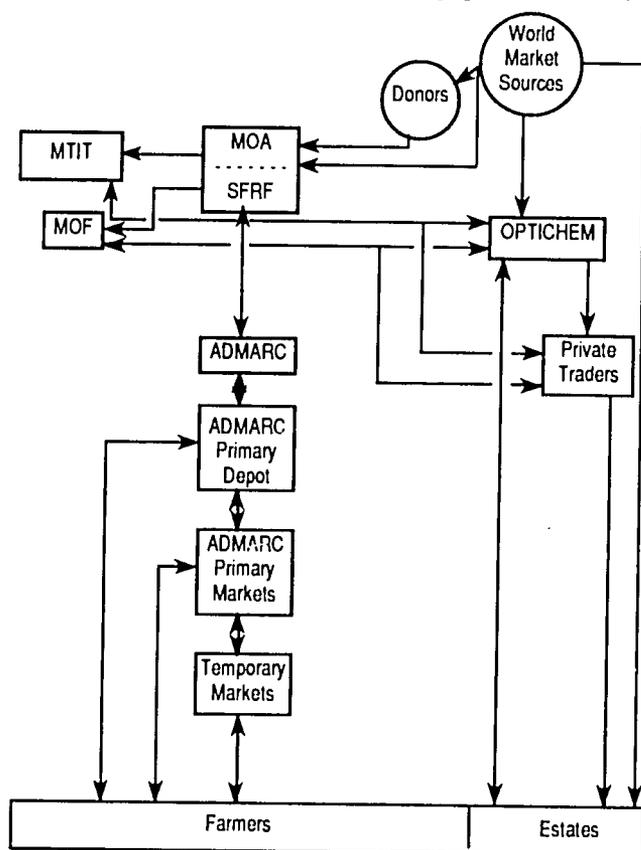


Figure 8. Information Flow for Purchasing in the Present Fertilizer Marketing System.

international fertilizer procurement and (2) external transport for movement of the product to Malawi. The tendering process is in accordance with World Bank procedures. The fee for this service was about MK 400 thousand in 1988/89. The tenders are on an f.o.r. or f.o.t. basis, South Africa or Tanzania. The quantities purchased by SFRF (64,079 tons in 1987/88) are of sufficient size to generate competitive bidding by suppliers.

The long pipeline time required to move product through the distribution system prevents Malawi from being able to take advantage of temporary declines in international spot market prices.

OPTICHEM is the principal supplier of fertilizer to the estate sector. It imports fertilizer for direct sale to customers or for further processing to meet the specific grade requirements of the estates. OPTICHEM tenders directly on the world market for product on an f.o.t. or f.o.r. basis, South Africa. The tendering process is on a selective basis; usually about 15 international firms are asked to supply competitive bids on OPTICHEM's tender.

Physical Distribution

Physical distribution of fertilizer is a significant component of a fertilizer marketing system. Presently in Malawi, long supply lines, high transportation costs, and excessive warehousing requirements are placing an extreme hardship on the system. A number of fertilizer studies have adequately highlighted the present international transportation problems [9,10].

During the 1970s, approximately 60% of Malawi's fertilizer imports were channeled through the Beira port. Because of civil unrest in Mozambique, in 1983 this port and route ceased to be available to Malawi. The Nacala port and route were the most economical because of their proximity to Malawi; however, they ceased to be available in 1985.

Presently Malawi has two ports and routes for use in importing fertilizer. From South Africa, the port in Durban is available. The route is through Zimbabwe/Harare/Tete to Blantyre or via Lusaka, Zambia, to Lilongwe and Mzuzu. Products manufactured in Johannesburg are shipped directly to Blantyre. The Northern Corridor uses the Dar-es-Salaam port via Mbeya to Mzuzu and Lilongwe. This route is used less than the South Africa route because of the sources of fertilizer supply, the poor transport infrastructure, and the concentration of fertilizer use in the southern and central regions. The routes, railroads, and international boundaries for fertilizer shipments are shown in Figure 9.

The port offering Malawi the most economic route is Nacala. The Malawi Railway Corporation staff speculate that this route will soon be reopened. To illustrate the importance of the most economical transportation route, the current transportation costs of a kilogram of urea-N delivered from the respective port to Blantyre are compared in Table 9.

Once fertilizers destined for the smallholder market arrive in Malawi, they pass through the regional depots. Transporters delivering fertilizer to ADMARC's main regional warehouses are paid by the transport agent according to weigh-bridge tally and physical count. Certified copies of the consignment instructions are passed by ADMARC to both SFRI and the transport agents and form the basis of payment for external transport.

ADMARC arranges for fertilizer transportation from its regional main depots to 16 subdepots. There are eight subdepots in the southern region, four in the central, and four in the northern region. From the subdepots, 80 primary markets are served [11]. The primary markets perform both wholesale and retail functions. The southern region has 32 primary markets, the central region 34, and the northern region 14. From the primary markets ADMARC serves 1,110 unit markets. The unit

markets currently supply 355 temporary selling and purchasing stores.

Farmers' clubs are now playing an important role in the distribution system, serving as delivery points for ADMARC sales in some areas and actually arranging for truckers to make direct deliveries to farmers. Farmer clubs have an average of about 30 members [12].

The planned distribution of fertilizers by region for 1988/89 is shown in Table 10. The locations of ADMARC's main depots are shown in Figure 9.

OPTICHEM receives imported fertilizers and fertilizer materials at its Blantyre warehouse having a storage capacity of 12,000 tons. At its factory, 10 different compound fertilizers are manufactured (Table 11). The compound fertilizers are sold ex-factory, Blantyre or are shipped to OPTICHEM's Lilongwe warehouse (storage capacity of 6,000 tons), from which sales to farmers in the estate sector are made.

Three modes of transportation are used in fertilizer distribution—rail, water, and road. Road transport bears the greatest burden in fertilizer movement. In 1988 an estimated 36,277 tons of fertilizer was shipped by rail wagons, 10,168 tons by water, and 73,000 tons by road. The limited number of rail wagons and barges prevents a significantly higher tonnage from being shipped by these two modes of transportation.

Closed Markets

The physical distribution network varies by district with respect to serving the domestic market. In 1988 ADMARC closed 190 selling points throughout the country in an effort to reduce costs [8]. In the Lilongwe ADD district, ADMARC outlets are located on 15-km centers, meaning that farmers must travel no more than about 7.5 km to purchase fertilizers. Seasonal markets are retail points where fertilizers are sold to farmers during the planting season only. In areas where seasonal

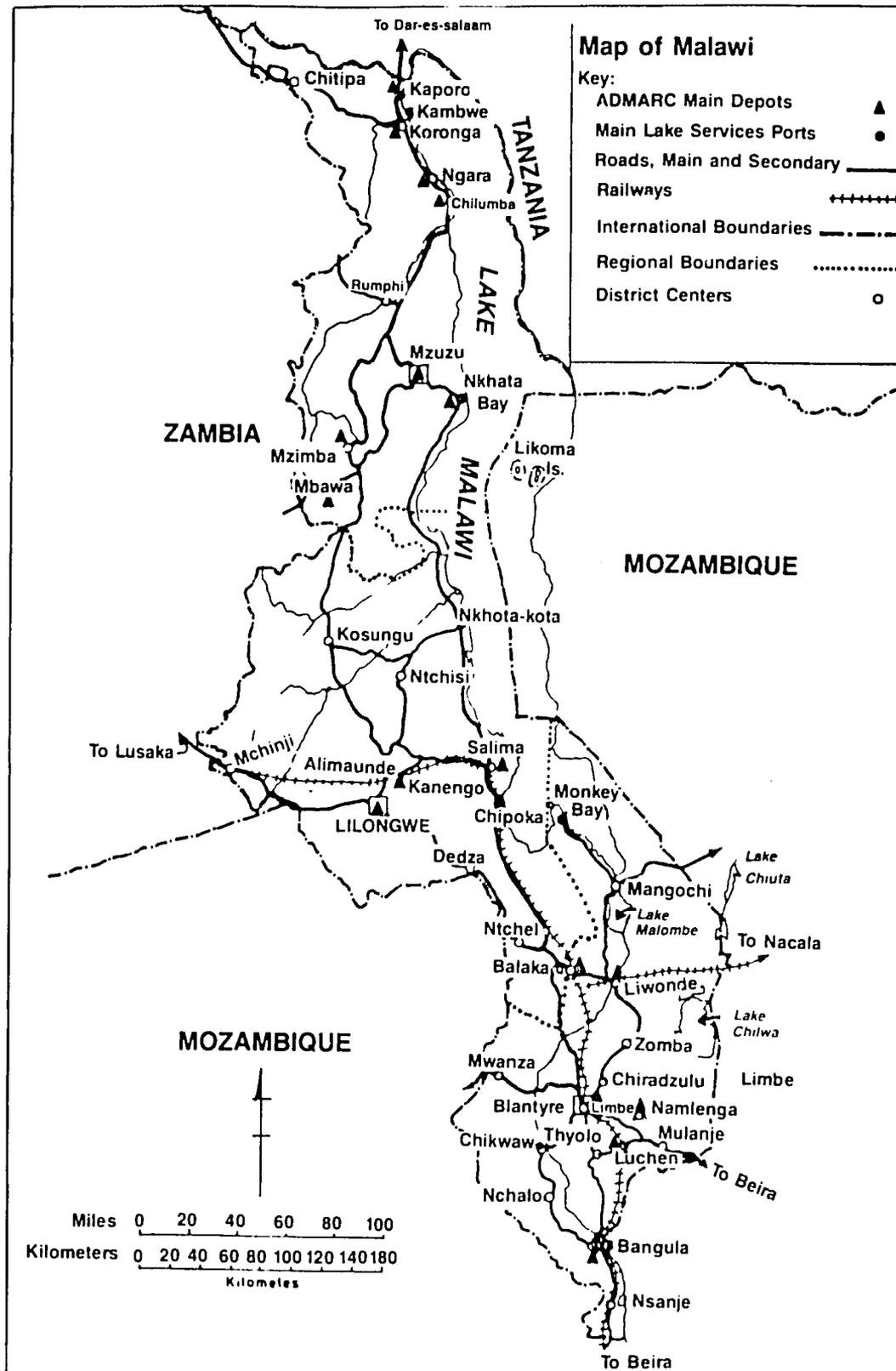


Figure 9. A Map of Malawi Showing ADMARC Main Depots, Roads, Railroads, and Boundaries.

Table 9. Comparison of Port Distances and Freight Cost^a

Port	Distance to Lilongwe (km)	MK/mt	Transport Cost for 1 kg of N Delivered Lilongwe ^b (MK)
Dar-es-Salaam via Mbeya	2,000	396	0.86
Durban	2,660	296	0.64
Beira	650	-	-
Nacala	810	87	0.189

a. According to conversation with International Transport Brokers, the Nacala route when opened will be adjusted at approximately 90% of the Durban/Tete route.

b. Nitrogen from urea.

Source: Study of Alternative Institutional Arrangements For the Smallholder Revolving Fund, 1987. Deloitte, Haskins, and Sells.

Table 10. Distribution of Fertilizer by Regions, 1988/89

	Type of Fertilizer	Revised Allocation (tons)
South	20-20-0	2,800
	CAN	8,250
	AS	1,489
	Urea	6,000
	DAP	1,000
	TOTAL	19,539
Central	20-20-0	13,450
	CAN	14,000
	AS	1,061
	Urea	15,500
	DAP	6,000
	TOTAL	50,011
North	20-20-0	5,250
	CAN	4,250
	AS	450
	Urea	3,500
	DAP	2,000
	TOTAL	15,450
GRAND TOTAL		85,000

Source: Derived from "1988/89 Allocation of Fertilizer to ADD markets," SFRF.

Table 11. OPTICHEM Fertilizer Selling Prices 1987/88 Versus 1988/89 at Blantyre^a

	Price Per Ton		% Increase	1989 Per Bag ^b (MK)
	1988	1989		
	----- (MK) -----			
Compound "A"	686.60	926.80	34.9	46.34
Compound "B"	695.80	940.20	35.1	47.01
Compound "C"	702.00	942.60	34.3	47.13
Compound "D"	712.80	964.40	35.3	48.22
Compound "S"	638.20	784.00	22.8	39.20
Compound 3-2-0-22-30	513.00	877.00	43.1	43.85
Compound "J"	715.00	946.80	32.4	47.34
15-5-20	-	854.20	-	42.71
Single supers	519.60	774.20	49.0	38.71
Double supers	685.00	915.00	33.6	45.75
Ammonium sulfate	510.20	674.80	32.2	33.74
CAN	565.60	831.40	47.0	41.57
Urea	604.20	850.60	40.7	42.53
MOP (STD)	617.20	818.80	32.7	40.94
MOP (granular)	-	856.60	-	42.83
Potassium nitrate	1,079.80	1,224.60	13.4	61.23
DAP	751.00	1,021.40	36.0	51.07
Nitrate of soda	723.40	1,040.20	43.6	52.01
Super "B"	-	1,051.40	-	52.57
Super "C"	-	1,090.60	-	54.53
Super "D"	-	1,075.20	-	53.76
Potassium sulfate	-	1,095.40	-	54.77
Borate	-	1,686.60	-	84.33
MAP	-	1,076.20	-	53.81
MCP	-	2,073.60	-	103.68
Dolomitic lime	-	66.00	-	3.30
Magnesium sulfate	-	1,610.00 (21/9/88)	-	80.50
Zinc sulfate	-	2,300.00 (18/10/88)	-	100.00

Dwangwa Sugar Corporation

TSP	850.57
MOP	733.00

a. OPTICHEM has a warehouse at Lilongwe, and farmers in Lilongwe pay an ex-factory Blantyre price plus MK 47 per mt for freight to Lilongwe.

b. 50-kg bags.

Source: OPTICHEM official price list.

markets have closed, farmers may be required to travel excessive distances, even up to 60-70 km or more to purchase fertilizers. In the central region, a number of seasonal markets have been closed; however, the total of 1987 sales for these markets was only 104 tons.

Losses

Losses in the physical distribution of fertilizers in the ADMARC system totaled 1,200 tons in 1987/88 or slightly over 1% of total throughput in the system [8]. In view of the long supply lines and frequent handling of fertilizers through warehouses, this is not considered an excessive loss rate.

Storage Capacity

ADMARC has three main regional warehouses in operation—Limbe, Mzuzu, and Lilongwe. An additional warehouse is under construction at Mzuzu to serve the northern section of Malawi. The warehouses are multipurpose and have a capacity in excess of the 76,000 tons of fertilizer sold by ADMARC in 1987/88.

Additional warehouses are currently being built for the buffer stock of fertilizers. Their locations and capacities are Blantyre (17,500 tons), Lilongwe (46,700 tons), and Mzuzu (18,000 tons), i.e., a total storage capacity of 82,200 tons.

In addition to the main regional warehouses, most ADMARC outlets have permanent structures for fertilizer storage. Temporary storage space is required during the main fertilizer season and involves stacking fertilizers on dunnage and using tarpaulins for cover [8].

Fertilizer and Crop Prices

The fertilizer pricing policy in Malawi is based on a two-tier system—one for smallholder farmers and the other for estates. Fertilizers destined for the smallholder sector are priced on a pan-territorial basis and are subsidized by the

Malawi Government. The rate of subsidy in 1987/88 was about 24% and will increase to approximately 42% in 1988/89. Retail price levels are set one time per year by the National Pricing Committee based upon the MOA's (Planning Division) detailed analysis of fertilizer costs, crop production costs, and fertilizer-crop price relationships. Prices are published in the national newspaper and circulated to ADD, ADMARC, and SFRF officials each September [7].

Fertilizer prices paid by smallholders have increased significantly during the 1980s (Table 12). The reasons for the increase, which in the case of ammonium sulfate is nearly fivefold, are as follows:

1. A series of currency devaluations.
2. Inflation.
3. Increasing external transport costs caused by the closing of the Mozambique import routes.
4. Malawi's attempts to gradually eliminate the subsidy on fertilizers.
5. An increase in international market prices for fertilizer.
6. A desire to influence demand for one product relative to another for agronomic or economic reasons.

Table 12. Smallholder Fertilizer Prices

	AS	CAN	20-20-0	Urea	DAP	23-21-0+4S
 (MK/50-kg bag)					
1976/77	5.50	7.75	8.50			
1977/78	5.50	7.75	8.50			
1978/79	5.50	7.75	8.50			
1979/80	5.50	7.75	8.50			
1980/81	6.50	10.54	8.50			
1981/82	9.00	10.54	8.50			
1982/83	10.50	13.00	12.60			
1983/84	12.00	14.00	14.50			
1984/85	13.50	15.50	17.50			
1985/86	17.50	19.00	20.50			
1986/87	18.00	19.50	21.00	26.00	24.00	
1987/88	23.00	24.50	27.00	27.00	31.50	
1988/89	27.00	27.50	30.00	30.00	34.50	31.50

Source: Unpublished documents, Ministry of Agriculture.

Retail price increases in 1988/89 averaged 12.2% for the five main products marketed to smallholders. The smallest increase (9.5%) was for diammonium phosphate (DAP), a high-analysis fertilizer that has only recently been introduced in Malawi. Meanwhile, in an effort to discourage the use of AS (21% N) in favor of higher analysis products such as CAN (28% N) and urea (46% N), the price of AS increased by 17.3%.

Fertilizers marketed by OPTICHEM are primarily destined for the estate market and as such are sold on a cost-plus basis. OPTICHEM's 1988/89 product price list, which includes a variety of grades tailored to meet the specific needs of customers, is presented in Table 11. The smallholder fertilizer prices are shown in Table 12. In comparison with smallholder fertilizer prices for comparable products, OPTICHEM's prices are from 25% to 51% higher (Table 13). OPTICHEM's prices to estates were MK 47.20/ton higher in Lilongwe than in Blantyre. The price differential reflects the freight rate from Blantyre to Lilongwe. OPTICHEM's prices in 1988/89 are approximately 35% higher than they were in 1987/88.

Table 13. 1988/89 Fertilizer Prices for Different Products as Priced by ADMARC and OPTICHEM

Source/Product	AS	CAN	Urea	20-20-0	DAP
 (MK per 50 kg)				
I ADMARC	27.00	27.50	30.00	30.00	34.50
II OPTICHEM	33.74	41.57	42.53	-	51.07
II as a % of I	125%	151%	142%	-	148%

Source: ADMARC and OPTICHEM price list.

The price of fertilizer relative to the price of maize also increased during the early to mid-1980s. As indicated in Table 14, 8.39 kg of maize was required to purchase 1 kg of nutrient from CAN in 1980; this increased to 9.07 kg of maize per kilogram of nutrient in 1985 and to 10.54 kg of maize in 1988. This undesirable trend was reversed in 1989 in an effort to stimulate fertilizer use on maize when it required 8.17 kg of maize to buy 1 kg of nutrient in the form of CAN. Urea is the cheapest N source, requiring 5.4 kg of maize to purchase 1 kg of N. For compound fertilizers, DAP is the most economical nutrient source, requiring 4.5 kg of maize to purchase 1 kg of nutrient in 1988/89.

Product Decision

Smallholder farmers use a narrow range of fertilizer products while estate farmers use a somewhat broader range of complex fertilizers tailored to meet their crop and soil requirements. The products selected are based upon traditional practices and recommendations of the Ministry of Agriculture and various crop authorities. A few estates perform their own soil and tissue analyses to determine nutrient requirements.

Malawi farmers have traditionally used low-analysis products such as AS, CAN, and 20-20-0. Recently the SFRF and Ministry of Agriculture have promoted increased use of high-analysis fertilizers (i.e., urea and DAP) where agronomically suitable. None of the products marketed by ADMARC contain potassium.

Because of the long overland transport dis-

25-kg, and 50-kg bags. The products in 15-kg, 25-kg, and 50-kg bags are imported in woven polypropylene bags with a polyethylene inner liner. Fertilizer sold in smaller bag sizes (i.e., 5 kg and 10 kg) are packaged locally by OPTICHEM, ADMARC, and ATC. It appears that the 25-kg bag size is the most popular followed by the 50-kg bag, which is popular among estate farmers and farmers' club members.

Marketing Costs

The cost of marketing fertilizers includes all costs incurred in the flow of fertilizer from the point of production to the point of sale to the farmer. In Malawi such costs are understandably high because of the country's landlocked position. In 1987/88, the total reported cost of fertilizer marketing to smallholder farmers ranged from MK 370/ton to about MK 390/ton. For CAN and urea, marketing costs exceed the f.o.r. Durban value by 50% and 30%, respectively [8].

Table 15. Fertilizer Marketing Costs, 1987/88

Cost Classification	20:20:0	CAN	Urea	DAP	% of Total
(MK/mt).....				Cost for Urea
Import costs:					
f.o.r. Durban cost	343.40	251.86	296.96	435.95	43.54
External transport	253.00	253.00	253.00	253.00	37.09
Import levy	36.93	46.65	36.60	41.28	5.37
Tender commission	5.95	5.05	5.50	6.89	0.81
Insurance	3.40	3.40	3.40	3.40	0.50
Subtotal, landed cost, Malawi	642.69	559.96	595.46	740.52	87.30
Domestic marketing cost:					
Rebagging	2.00	2.00	18.10	18.10	2.65
ADMARC fee-transportation	38.21	38.21	38.21	38.21	5.60
ADMARC fee-storage and selling	15.60	15.60	15.60	15.60	2.29
SFRF overhead ^a	8.76	8.76	8.76	8.76	1.28
Loss (1%)	6.43	5.60	5.95	7.41	0.87
Subtotal, domestic marketing cost	71.00	70.17	86.62	88.08	12.70
Total cost, ex-retailer	713.69	630.13	682.08	828.60	100.00
Selling price	540.00	490.00	540.00	630.00	
Loss (subsidy)/ton	173.69	140.13	142.08	198.60	
% of subsidy	24.34	22.24	20.83	23.97	

a. SFRF overhead estimate does not include an allowance for working capital costs associated with fertilizer purchases.

Source: Based upon information provided by SFRF and ADMARC.

External Costs—As indicated in Tables 15 and 16, the cost of external transport is the largest cost item in fertilizer marketing [8]. In 1988/89 the cost of external transport is MK 296/ton or about 28% of the total ex-retailer cost of fertilizer. For comparative purposes, in 1987/88 external transport costs totaled MK 253/ton or 37% of the ex-retailer cost of fertilizer. External marketing costs include two other cost items, the tendering commission paid to FINCOM and insurance. The fertilizer import levy of 5% to 10%, which was effective in 1987/88, has been discontinued.

Domestic Costs—Domestic marketing costs in Malawi include (1) an assumed value for interest on working capital, (2) internal transport and storage costs paid to ADMARC, (3) rebagging costs, (4) SFRF overhead, and (5) losses at 1% of the c. & f. Malawi value. The domestic marketing costs were estimated at MK 90/ton in 1987/88, excluding an allowance for the cost of working capital. However, in 1988/89 it is estimated that the domestic marketing cost will be MK 238/ton to MK 287/ton depending upon the product. This significant increase is due to three key factors. One, it is assumed that interest on working capital is a cost to the system at 16% per year and the funds will be on loan for an 11-month period. This cost item alone is expected to account for 50% of the domestic marketing cost. The second major cost increase will be to cover ADMARC's services for marketing fertilizers. ADMARC plans to invoice SFRF for the full cost of fertilizer marketing in 1988/89, estimated at MK 47/ton. Finally, SFRF overheads, due to increased costs of the buffer stock, are expected to

Table 16. Estimated Fertilizer Marketing Costs in Malawi, 1988/89

Cost Classification	23:23:0	CAN	Urea	DAP	% of Total Cost for Urea
	------(MK/ton)-----				
Import costs:					
f.o.r. Durban cost	583.22	402.54	467.93	590.50	45.02
External transport	296.00	296.00	296.00	296.00	28.48
Import levy*	0.00	0.00	0.00	0.00	0.00
Tender commission	8.79	6.99	7.64	8.87	0.73
Insurance	2.83	2.25	2.42	2.85	0.24
Subtotal, landed cost, Malawi	890.84	707.78	774.03	898.22	74.46
Domestic marketing cost:					
Interest on working capital ^b	142.53	113.24	123.84	143.72	11.91
Rebagging ^c	2.00	2.00	18.10	18.10	1.74
ADMARC fee- transportation	45.00	45.00	45.00	45.00	4.33
ADMARC fee-storage & selling ^d	46.59	46.59	46.59	46.59	4.48
SFRF overhead ^e	24.15	24.15	24.15	24.15	2.32
Loss (1%)	8.91	7.08	7.74	8.98	0.74
Subtotal, domestic marketing cost	269.19	238.07	265.43	286.54	25.54
Total cost, ex-retailer	1,160.03	945.85	1,039.46	1,184.76	100.00
Selling price	630.00	550.00	600.00	690.00	
Loss (subsidy)/ton	530.03	395.85	439.46	494.76	
% of subsidy	45.69	41.85	42.28	41.76	

a. Import levy on fertilizer was discontinued in April, 1988.

b. Interest on working capital is calculated @ 16 % per annum of landed cost of fertilizer. This cost is not currently recognized because some fertilizers are provided by donors and the balance is provided through Government funding.

c. Based on estimated 1988/89 rebagging costs by SFRF.

d. Based on ADMARC's projected costs for marketing fertilizers in 1988/89.

The projection is based on the full recovery of all fertilizer-related costs.

e. See detailed costing of SFRF costs.

increase to MK 24/ton in 1988/89 versus only MK 9/ton in 1987/88 [8].

Credit

It has been estimated that 55% of the fertilizer sales to smallholders is on credit and the balance for cash [13,14]. Various informal credit sources are available to smallholders for purchase of fertilizers, including relatives, friends, local traders, traditional money lenders, and the Smallholder Tea Authority. However, the most important source is the formal credit system available through the ADDs. For access to credit through the ADDs, membership in a farmers' club is required; the club applies for seasonal credit on behalf of its members. The application process is relatively simple, no collateral is required, and the waiting period for the loan to clear averages about 1-2 weeks. The credit terms for fertilizer loans are 12% per year, and the payment is due within 1 year of the date of the

loan. Repayment on the loans is generally well over 90%. Although the ADDs coordinate the credit system, repayment is made to ADMARC, which in turn transfers the funds to SFRF.

The credit package available to farmers' club members through the ADDs is supervised credit and includes technical advice regarding fertilizer recommendations and cropping practices. The system not only enables farmers to procure fertilizers and other agricultural inputs but also helps to ensure that the inputs are used effectively.

Because of the ADD credit scheme, farmers' clubs have grown in popularity. The number of clubs has increased by 12% since 1983 and in 1986/87 totaled 8,045 (Table 17). The membership size varies by club but averages about 30 farmers per club. Club membership is restricted to credit-worthy farmers, as determined by each club. Most farmers' clubs require annual dues of MK 1 to MK 5. The club membership meets monthly and in many cases in permanent structures built and owned by the membership.

Table 17. Number of Farmers Having Access to Seasonal Credit Through the ADDs

Year	No. of Clubs	Membership	Loan Value (MK)
1983/84	7,191	180,256	11,583
1984/85	8,148	211,770	15,975
1985/86	8,259	207,996	19,066
1986/87	8,045	206,409	18,289

Source: Ministry of Agriculture.

Buffer Stock

Effective with the 1988/89 crop year, Malawi instituted a buffer stock plan for fertilizers. Supported by funding from the European Economic Community, the plan involves the establishment of a 70,000-ton buffer stock at three central locations in Malawi—Mzuzu, Lilongwe, and Blantyre. The primary rationale for establishment of the buffer stock was to (1) maintain a strategic reserve of fertilizer in the event of supply route disruptions and (2) improve the negotiating flexibility of SFRF in procurement of fertilizers in the international market [15]. Other benefits are likely to accrue to SFRF as a result of the buffer stock, not the least of which is a more even movement of product throughout the year rather than primarily over a four-month period as is the current practice. The buffer stock will, however, be expensive inasmuch as the working capital tied up for a year has to be accounted for and covered in the fertilizer cost [16]. In the beginning, funds generated through the sale of the buffer stock inventory will be used to purchase the next year's supply.

The warehouse facilities for storage of the buffer stock are in place in Lilongwe and planned for the other sites. Their capacities are as follows:

Location	Capacity (ton)
Mzuzu	18,000
Lilongwe	46,700
Blantyre	17,500
TOTAL	82,200

The capital costs associated with the above facilities will be borne by the European Economic Community. The handling of the buffer stock will be on a revolving basis following a first-in first-out product flow schedule.

Implementation of the buffer stock plan will be in two phases. Phase I will be completed in early 1989 and involves importing 40,000 tons of fertilizer. The products to be included in the Phase I plan are 23-23-0-4S, urea, and CAN. Phase II of the plan involves importation of 30,000 tons of fertilizers. No delivery schedule for Phase II has yet been developed.

Research and Linkages

Agricultural research in Malawi is under the auspices of the Department of Agricultural Research in the Ministry of Agriculture. There are currently 11 operating research stations. The following is a list of the stations by location and their principal areas of research.

1. Chitedze agricultural station, Lilongwe—cereals and groundnuts.
2. Tobacco Research Authority, Lilongwe—tobacco all types.
3. Bvumbwe Research Station, Limbe—citrus, coffee, maize.
4. Kasinthula Research Station, Ngabu—irrigated rice and maize.
5. Makoka Research Station, Zomba—cotton.
6. Mwimba Research Station, Kasungu—tobacco.
7. Chitala Research Station, Salima—cotton, citrus.
8. Lifuwu Research Station, Salima—rice, vegetables.
9. Lunyangwa Research Station, Mzuzu—high altitude trials, maize.
10. Mbawa Research Station, Mzimba—maize, variety trials.
11. Baka Research Station, Karonga—rice and maize.

The strongest research programs are on tobacco and cereals. The Chitedze station and to a

lesser degree Bvumbwe are expanding their research base, and both stations are carrying out capital improvement programs.

Research at the Smallholder Tea Authority indicates that added potassium is essential for high yields of quality tea. The Authority purchases compound fertilizers containing potash from OPTICHEM rather than purchasing 20-20-0, 23-21-0, or 23-23-0 from ADMARC for their smallholder farmers.

Coffee production in Malawi is confined to the higher elevations of the northern region, which receives an adequate seasonal rainfall. Principal coffee-producing areas are the Viphya plateau 1,500-1,800 m, the Nyika plateau 1,800-2,400 m, and the southeast Mzimba area 1,200-1,600 m [17]. The Smallholder Coffee Authority (SCA) at Mzuzu, through its approximately 65 extension staff, advises over 10,000 farmers on coffee production. The SCA makes the appropriate fertilizers timely available to farmers from some 30 input stores. Due to the soils in the northern region and coffee requirements, fertilizers are usually medium to high in potassium, e.g., 15-5-20.

Research findings are disseminated to the extension service. The extension service has the responsibility of motivating farmers to adopt improved technologies. The acceptance of improved technology by smallholder farmers appears to be low because yield instability elevates risk.

The Tobacco Research Authority has found that potash fertilizers are necessary for the production of quality tobacco. The present recommendation calls for the "S" mixture 6-18-6 for tobacco beds and "C" compound 6-18-15 for fields [18].

At the Chitedze station, potassium research although more limited than research on nitrogen and phosphorous indicates that potassium deficiencies are occurring on intensively cropped soils with high yields. In the high-rainfall areas, the

soils are acid and can be found in the range of pH 4.5 to 5.0. Calcium and magnesium are often found to be low.

Sulfur deficiencies have been identified in most of the soils in Malawi. Compound fertilizers with 4% sulfur are adequate to correct this imbalance. Boron has been found to be deficient especially for crops with high boron requirements. Molybdenum has been found to be low but normally can be corrected with a liming program to bring the soil pH to a desired level. Zinc has been found to be deficient in only a few places in Malawi [19].

The Food and Agriculture Organization (FAO) has completed an assessment of the soils of Malawi based on 100 pairs of maize-soil sample results [20]. The following is their summary:

"The soils of Malawi are mostly coarse textured with low pH, low cation exchange capacity, and medium organic matter contents. Relatively high P, low to medium N and K, and low Ca and Mg contents are typical of most Malawi soils. Of the six micronutrients included in this study, the analytical data for Fe and Zn show usually 'normal' values, but at some locations shortages of Zn are likely. The contents of B and Cu are low; those of Mo are lower than in most other countries while the Mn contents are among the highest."

Extension Service

Organization—For administrative purposes, the Ministry of Agriculture under its National Rural Development Program (NRDP) has eight ADDs. Each ADD is headed by a Program Manager. The eight ADDs as shown in Figure 10 are Ngabu, Blantyre, Liwonde, Lilongwe, Salima, Kasungu, Mzuzu, and Karonga. Each ADD is divided into projects. The number of projects

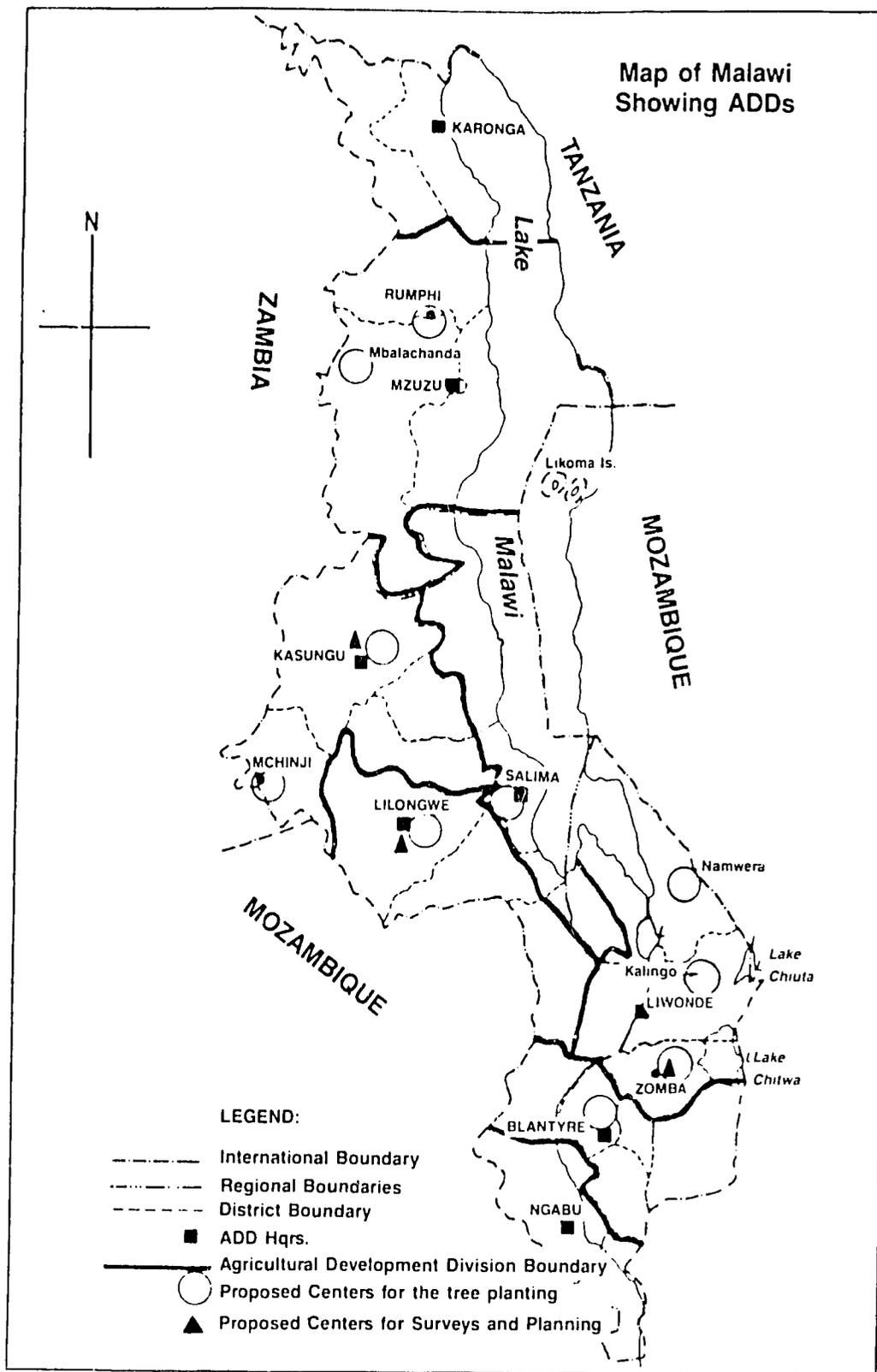


Figure 10. A Map of Malawi Showing Location of Agricultural Development Divisions (ADDs).

varies from ADD to ADD depending on the size. The project is divided into extension planning areas and is supervised by field officers and field assistants (FA) who have ongoing contacts with farmers. To facilitate extension so as to reach as many farmers as possible, the use of farmers' clubs is common practice. The following shows the extension strength by ADD field assistants in Malawi in 1988.

Location	FA ^a	Others	Total
Ngabu	253	299	552
Blantyre	210	238	448
Liwonde	215	200	415
Salima	120	75	195
Lilongwe	194	656	850
Karonga	182	205	467
Mzuzu	215	206	421
Karonga	161	280	441

a. Denotes field assistant.

Transfer of Technology—Information regarding improved agricultural practices comes from the various research stations in the country. This is passed to the farmers through the ADDs who organize farmer meetings, demonstrations, and farmers' clubs. Training centers are used for longer courses.

Extension and Research Linkage—The extension staff forms a bridge between research and the farmer insofar as new techniques and new products are concerned and in providing a feedback to research. Field trials are often carried out on farmers' fields in consultation with the extension staff and the ADD. Extension workers have faced a small problem in introducing new high-analysis fertilizers in that it has been difficult to convince farmers of the potential economic advantage of using high-analysis fertilizers.

Fertilizer Raw Materials

The availability of indigenous raw materials for fertilizer production in Malawi is limited to phosphate minerals [21]. Malawi does not have any known deposits of potash nor does it possess deposits of hydrocarbon materials required for economic production of nitrogenous fertilizers.

Apatite is the principal phosphate mineral in the world. Apatite mineralization has been recorded at various locations in southern Malawi. The Tundulu carbonite complex located about 3 km from Lake Chilwa offers the best potential for exploitation; however, the deposits have not yet been fully explored.

In the western part of the Tundulu complex, apatite deposits on Nathace Hill were examined in 1956 to assess their suitability as a phosphate source for a fertilizer factory in Zimbabwe. The results of pitting by the Geological Survey Department indicated that reserves to a depth of 30 meters exceed 800,000 tons of apatite rock containing over 20% P_2O_5 and an additional 1,000,000 tons of apatite-sovite and apatite rich bastnaesite-carbonite with a P_2O_5 content of 10%. An estimated 500,000 tons of feldspathic apatite-sovite with a 5% P_2O_5 content is also available.

Other occurrences of phosphate-bearing minerals in Malawi include those known as the Chilwa Island and the Mlindi complexes. The Chilwa Island deposit comprises Malawi's largest carbonatite and breccia ring complexes and consists of ring dikes of apatite-solvite, with a maximum of 50% apatite and veinlets of massive apatite up to a few centimeters in thickness. The Mlindi deposits, about 10 km south of Neno, include apatite occurring in biotite-pyroxenite. Samples indicate that the average grade is below 14% P_2O_5 [21]. Field trials are presently underway at the Chitedze Agricultural Station to determine the effectiveness of Tundulu phosphate rock. Trials include finely ground phosphate rock for

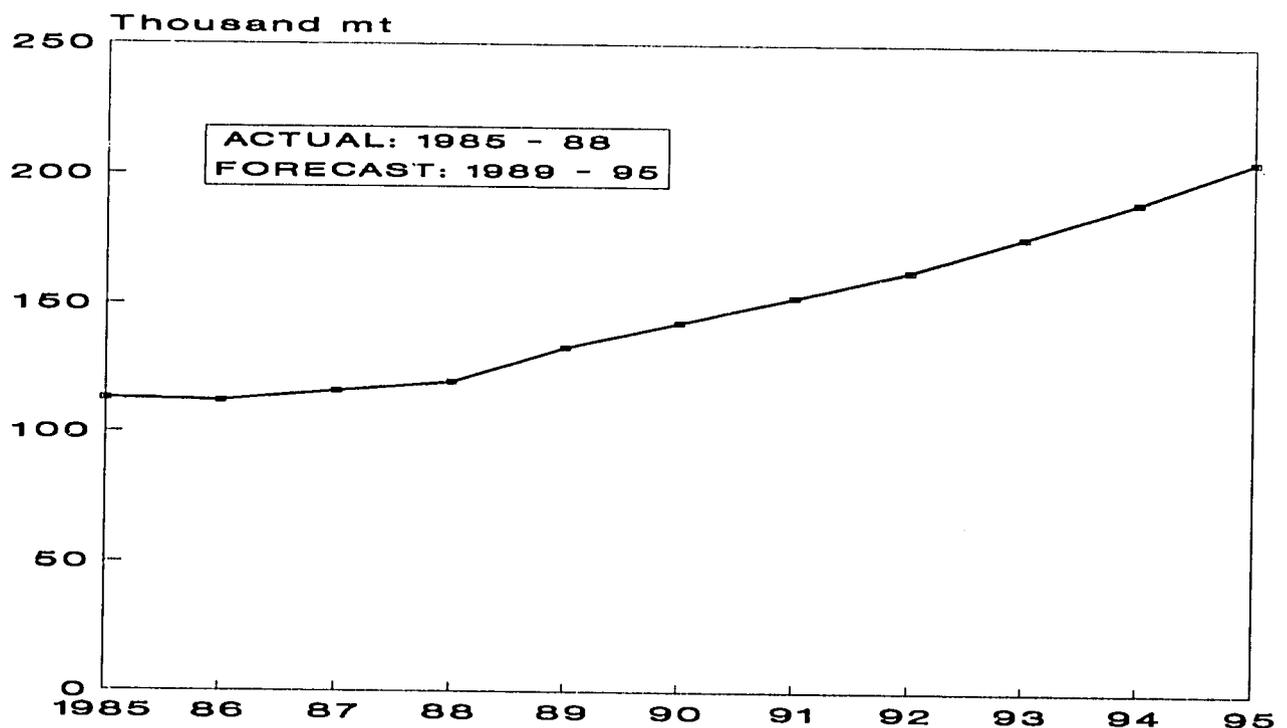
direct application and 50% partially acidulated phosphate rock (PAPR). The PAPR is produced by reacting with phosphate rock 50% of the sulfuric acid normally required to produce single superphosphate (SSP). If the Tundulu phosphate rock proves to be agronomically and economically attractive as a source of P_2O_5 , it could be possible to save large amounts of foreign exchange.

Future Fertilizer Consumption

The Malawi fertilizer market has significant potential for growth, particularly in the small-holder sector. Converting potential demand to actual consumption will be dependent upon a

number of factors including (1) the performance of the marketing system in ensuring the timely availability of the appropriate types of fertilizers for sale in locations convenient to farmers and at a reasonable price; (2) a favorable fertilizer:crop price relationship; (3) effective promotional efforts, primarily consisting of educational programs (on-farm demonstration, farmer meetings, etc.); and (4) a credit system that is adequately funded and provides reasonable credit conditions. The Government policy toward agriculture and development of the fertilizer sector will also be a major factor in determining future levels of fertilizer use in Malawi. All indications are that the Government fully supports the efficient development of the Malawi fertilizer market [8].

With more emphasis on fertilizer marketing and increased food production, it is expected that fertilizer use in Malawi will increase by an average of 7.8% per year during the next 7 years and



Source: Ministry of Agriculture & OPTICHEM.

Figure 11. Malawi Fertilizer Total Product Use Forecast.

total 206,000 tons of product in 1995 (Figure 11). The smallholder sector will account for 52% of the market and the estate sector for the balance.

On a product basis, it is expected that increased emphasis will be placed upon high-analysis products, which generally provide the lowest cost sources of nutrient delivered to the farm level. Urea, complex fertilizers, and DAP should account for 41%, 22%, and 16%, respectively of the market in 1995 (Table 18) [8].

On a nutrient basis, consumption is expected to total 61,780 tons of N, 23,345 tons of P_2O_5 , and 8,700 tons of K_2O in 1995 (Figure 12). To attain these levels will require average annual increases of 9%-10% in nutrient consumption. The projected 1995 N- P_2O_5 - K_2O ratio of 1.0-0.38-0.14 is very similar to the present nutrient use relationship [8].

Table 18. Malawi: Fertilizer Demand Forecast, 1989-95

Product	Actual 1987/88	Projected 1988/89	Forecast					
			1989/90	1990/91	1991/92	1992/93	1993/94	1994/95
----- (mt of product) -----								
Smallholder sales:								
DAP	5,816	8,100	11,500	13,800	18,000	20,000	23,000	25,000
Urea	16,089	13,273	17,500	23,000	31,000	38,000	45,000	55,000
AS	3,292	3,206	3,300	3,500	3,600	3,800	4,000	4,500
CAN	28,316	22,299	20,500	18,500	16,000	14,000	13,000	10,000
23:23:0	20,273	15,965	13,500	12,800	8,500	7,500	6,000	5,000
Complex	0	0	500	1,000	2,000	3,500	5,000	7,500
TOTAL	73,786	62,843	66,800	72,600	79,100	86,800	96,000	107,900
Estate sales:								
DAP	0	960	1,000	3,500	4,000	5,000	6,000	7,000
Urea	10,622	17,624	19,000	21,000	23,000	25,000	27,500	30,000
AS	2,859	5,423	6,000	6,200	6,500	7,000	7,000	7,000
CAN	4,369	13,418	15,000	15,000	15,000	14,000	13,000	11,000
23:23:0	0	5,322	5,000	4,000	2,500	2,500	2,500	2,500
MOP	1,570	2,750	3,000	3,000	3,000	3,000	3,000	3,000
Complex	23,157	22,660	25,000	27,500	30,000	33,000	35,000	38,500
TSP	446	1,995	2,000	0	0	0	0	0
Other	2,657							
TOTAL	45,680	70,152	76,000	80,200	84,000	89,500	94,000	99,000
GRAND TOTAL	119,466	132,994	142,800	152,800	163,100	176,300	190,000	206,000

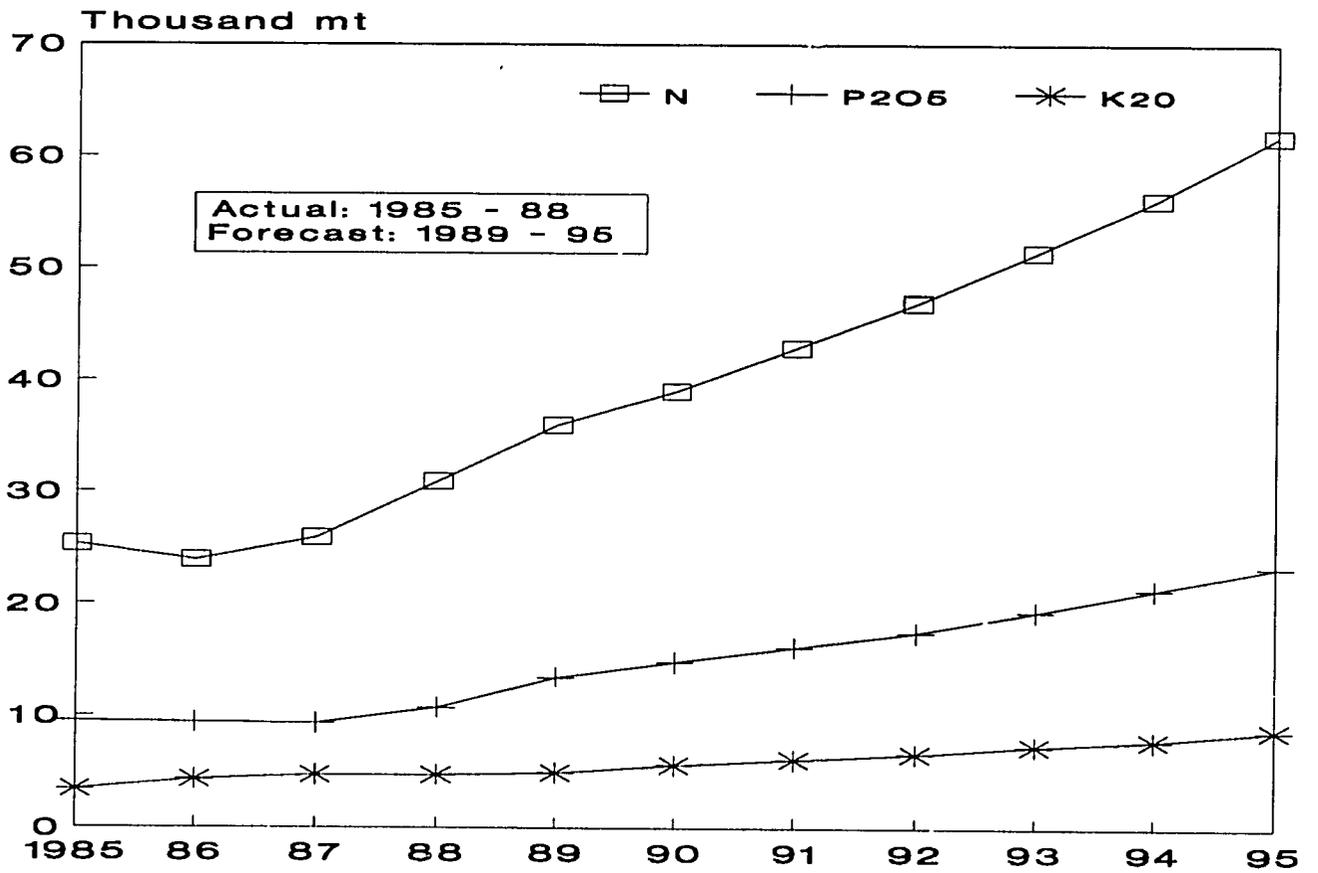


Figure 12. Malawi Fertilizer Nutrient Use Forecast.

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