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MADAGASCAR FERTILIZER SECTOR STUDY

FINAL REPORT

VOLUME I

EXECUTIVE SUMMARY AND RECOMMENDATIONS

JANUARY 1990

UNITED STATES OF AMERICA

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Dear Mr Thomas

RE: A.I.D CONTRACT NO. 623-0101-C-00-9015-00
MADAGASCAR FERTILIZER STUDY

We are pleased to submit the final Executive Summary and Recommendations of the Madagascar's Fertilizer study. This document summarizes the study findings and presents our recomemndations regarding the fundamental issues within Madagascar's fertilizer sector.

Yours sincerely

Price Waterhouse

A list of partners is available from the above address

INTRODUCTION

This report presents the findings of a fertilizer sector review undertaken for USAID/Madagascar, by Price Waterhouse. Two primary factors influenced the commissioning of this study:

(i) Madagascar's extremely low fertilizer usage.

(ii) The ongoing liberalization of Madagascar's fertilizer marketing systems.

The review was undertaken during the period May to August 1989. The study team of seven comprised of specialists in economics, agronomy, fertilizer marketing, finance and transport logistics.

This report in three volumes presents the consultants' findings and recommendations. Volume I presents the study's executive summary and recommendations. The references on the right of the executive summary refer it to the text in Volume II. Volume II is the main report which reviews and analyses in detail, the various aspects of Madagascar's fertilizer sector. Volume III contains the annexes to the study.

The objectives of the study are set out in the Terms of Reference (Volume II, Appendix I). They call for an assessment of the role and importance of fertilizer in Madagascar's agricultural sector; the identification of parties involved and their roles; and the identification of constraints to more efficient and increased fertilizer use. Particular attention has been given to defining the role of the private sector in the fertilizer marketing system and the successes or failures encountered in promoting fertilizer use. An area examined in detail is commercial vis-a-vis aid-in-kind fertilizer supplies and their impact on fertilizer use.

Acronyms are used extensively in this report. They are listed and explained in Appendix II.

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1 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

1.1 INTRODUCTION

Madagascar is a country in transition. In the last few years, the country has experienced major policy changes. In some cases, such as the reform of rice marketing, these changes have not yet led to desired results or effects. Although aid has been provided to support the reform process, this does not seem to have alleviated all side-effects of adjustment. This fact could be critical to the political sustainability of the reform process. 9.1

During the current transition period, strategies are needed that will lead to the attainment of long-term goals while taking care of short-term needs.

1.2 THE FERTILIZER SUB-SECTOR: RECENT DEVELOPMENTS

Past and present reforms in the fertilizer sub-sector have focused on fertilizer supply rather than on demand. The Government has embarked on a policy of rapid disengagement from fertilizer supply. An attempt has been made to liberalize fertilizer prices, increase commercial imports, and privatise distribution. 9.4

Reforms in the marketing of produce have not yet had the hoped-for result. Fertilizer prices have increased before output prices (particularly for rice) and farmers' resources (know-how, disposable income, credit, etc) could sustain them. Fertilizer use has fallen actually well below the previous low level of about 30,000 MT per year.

1.3 PRIORITIES AND CONSTRAINTS OF REFORM

The fertilizer sector cannot be reviewed in a vacuum. The fertilizer issue is in this study perceived within the much broader context of: Madagascar's agricultural sector, the socio-economy, and the political structure. These areas are inter-linked and therefore need to be taken into consideration collectively. 9.2

REFERENCE

In the immediate term, Madagascar's priority is to boost agricultural production. This will fuel the country's economic recovery, reduce food imports, improve conditions in the rural sector, and sustain the reform process. 9.2.2

Any measures that will further depress fertilizer use should be avoided. In particular, fertilizer prices cannot be raised without output prices (and other factors) to support them.

So long as explicit or implicit price controls are in place, commercial fertilizer importation is hampered, as costs cannot be fully passed on to the consumer. Indeed commercial fertilizer importation in Madagascar at present simply does not exist except for the production of export crops. The country's low consumption limits imports to small quantities which are costly to produce. Cost-effectiveness is therefore not achieved either for the country or for the farmers. The institutional capacity to support commercial imports is also very limited.

Produce marketing requires reform before fertiizer marketing. This reform process should lead to increased demand for fertilizers provided that banking, credit and regulatory systems are also reformed.

1.4 THE FERTILIZER SUB-SECTOR: DIRECTION OF REFORM

The present situation in Madagascar calls for a policy to stimulate fertilizer demand. 9.3

Increased fertilizer use would not only benefit the country's economy and its farmers, but also the environment. Mining of the soil would be reduced, land productivity would be increased, and pressure to open up marginal lands to cultivation reduced. An enlightened fertilizer policy could speed up the country's recovery and improve the fortunes of most of the population. It could also make better use of external assistance.

12

REFERENCE

The country is clearly able to use more fertilizer than the present tiny amount as indicated by the higher amounts used in the past. Opportunities for increased use to boost agricultural production and reduce food imports are both vast and economically viable.

Efforts to stimulate demand should encompass a range of measures such as research, extension, varieties, credit, etc. Economic analysis of costs and benefits at world market prices indicates that it is cheaper for the country to import fertilizer than to import rice. But present financial cost and price ratios make fertilizer use only marginally profitable to the farmer. The financial cost and price ratios are worsened by an official policy to keep down the price of rice.

Until crop prices increase to allow profitable use of fertilizer, there is a case for maintaining fertilizer prices at a level that supports continuation of fertilizer use. This short- to medium-term option should be phased out as soon as conditions permit. Therefore, fertilizer prices should be subsidized in the short-term to improve the benefit cost ratio of fertilizer use particularly on food crops such as rice, which the country has to import. Subsidies should be progressively reduced, as producer prices allow, and eventually prices should be fully liberalized. A realistic liberalization process is unlikely to take less than five years. 9.2.3

Prices should ensure adequate margins for the distribution chain. Increased fertilizer consumption and better margins will form the basis for a fertilizer market, and create the condition necessary to develop a proper marketing system. The policy of Government disengagement from fertilizer importation should be continued. Mechanisms should be devised and put in place to promote commercial importation, possibly by applying a subsidy on the landed cost. All handling operations should be carried out by the private sector.

REFERENCE

Aid fertilizer supplies should continue to be distributed by the private sector. However, the present the role of the Government in apportioning supplies should be replaced by competitive, tendering by private firms.

With regard to distribution, Government disengagement should continue, with the private sector taking over where profitable. However, some areas will remain where distributors will not, for the time being, operate. A plan should be prepared for the devolution of Government selling points and systems designed to supply such areas.

1.5 REFORM OF FERTILIZER SUPPLY 9.4

The order of priority in a reform of fertilizer supply should be:

- expansion of selling points and retail outlets
- secondary distribution
- imports

Fertilizer policy will need to be consistent with adjustments in the rest of the economy and with constraints to desired goals, such as:

- the limited amount of fertilizer used
- foreign exchange constraints
- the banking system and the limited availability of credit
- the very limited number of companies with capability to import.

1.6 THE EXTENT OF PRICE SUPPORT 9.4.1

Given the limited resources available to the Government, the donors could play a determinant role in supporting this short-term policy. Indeed, the Norwegian Government is already actively supporting low fertilizer prices.

REFERENCE

1.7 THE ROLE OF THE DONORS

9.9

There is considerable donor support in Madagascar for fertilizer supply. Lately the main beneficiaries of this aid have not been the users, but some distributors who have tended not to repay the Government for supplies received.

Fertilizer aid can constitute a vehicle to boost the economy by directly supporting crop production and the rural sector. If, for the short-term, the aid is used to keep fertilizer prices balanced, then it can be used as a vehicle to stimulate demand.

Thus an increase in fertilizer aid by donors is strongly recommended. The aid could initially take the form of physical fertilizer to be progressively changed to aid financing of fertilizer imports by the commercial operators.

The first requirement will be to standardize fertilizer aid. Aid-in-Kind or fertilizer imports shoul have the same conditions attached. If possible, all aid should be in grant form. Access to the aid should similarly be standardized.

The donors' involvement should be planned and coordinated. Their aid should be made conditional to the design and adoption of an efficient system of apportioning the fertilizer to distributors, and of a strictly enforced system of payment of countervalue funds to the Government.

1.8 SUMMARY OF POLICY RECOMMENDATIONS

Fertilizer demand should be stimulated. To minimize the financial burden on the Government, donors should step up their fertilizer aid. The selling price of the aid fertilizer should be such as to allow suitable margins for the distributors as well as affordable prices to the farmers.

Producer prices and fertilizer retail prices should be professionally monitored to enable a progressive phasing out of the subsidy as soon as conditions permit.

REFERENCE

1) The demand for fertilizer must be boosted as a prerequisite to increasing fertilizer use.

2) Aid fertilizer should be priced at a level that will ensure adequate profitability to farmers.

3) Systems should be designed to minimize Government's involvement in administering fertilizer supplies.

4) Supplies of fertilizer aid need to be increased.

5) Counterpart funds payable to Government should be used as a subsidy to ensure adequate margins for the supply network.

6) The ultimate goal is to align fertilizer prices with world market prices as soon as producer prices for food crops permit.

1.9 REALISTIC PUBLIC AND PRIVATE SECTOR ROLES IN FERTILIZER SUPPLY — 9.6

Remaining Ministry of Agriculture (MPARA) involvement in fertilizer supply should be phased out, to be replaced by specific private sector initiatives as part of a MPARA sectoral development plan.

Retail Level — 9.6.2

Fertilizer should be marketed wherever there is actual or potential demand. In the short-term the serving of remote areas where current profit margins are not attractive to distributors should be contracted out by MPARA to the private sector. In the longer term, as distribution expands, this arrangement should be phased-out.

Distribution Level

At the distribution level, private sector domination should continue. The Government should have no influence on distributors' supplies and prices.

REFERENCE

Import Level

The import level represents a paradox. Competing importers cannot survive on a total national consumption level of around 25,000 MT per year. At present only firms which can absorb their overheads by handling other agricultural inputs and products, can afford to handle imports of small quantities of fertilizer. But at the same time more competition is necessary if increased fertilizer use is to be achieved.

Private sector involvement is at its weakest at the import level, due to financial and political constraints. Only two companies (excluding marketing boards) have been importing. They have done so mainly on non-commercial terms, using aid credits which allow generous payment delays.

1.10 AN APPROPRIATE COMMERCIAL MARKETING SYSTEM 9.7

Commercial importation should continue to be freely allowed. This approach is recommended because of the private sector's varying capability of handling the various functions. On the basis of cost-effectiveness, the import function will be the last to be sustainable by the private sector because it is only after economies of scale have been achieved that it will make sense to have a full commercial import system.

Increased grant aid supplies are needed coupled with short-term subsidization of fertilizer prices to allow attractive margins for supplying firms. Only with such initial support can existing firms handle imports profitably. Fertilizer prices can therefore be gradually adjusted towards world market levels.

1.11 IMPROVED LOGISTICS OF FERTILIZER SUPPLY 9.8

Consultative mechanisms should be established for programming ship traffic to Toamasina port to avoid simultaneous arrivals of large shipments of fertilizer and other commodities. Both donors and importers should participate in such mechanisms.

REFERENCE

There is a need for special railway sidings to some fertilizer storage facilities in the Central Highlands. These would enhance railway participation in fertilizer transport.

Importers in better management of import logistics should be trained, perhaps through Chambers of Commerce or similar groupings in Madagascar in concert with SEPT. This will enable importers to improve their freight clearing activities and achieve higher port evacuation rates. This training should include coordination and appropriate advance negotiating positions (e.g. for demurrage) vis-a-vis SEPT.

SGS inspections should be eliminated for purely commercial fertilizer imports when pricing becomes highly competitive amongst several importers.

The Central Bank should eliminate/simplify its procedures for approving requisitions ("FSI") and for confirming documentary credits.

Fertilizer importers should be encouraged to negotiate with the railways for favorable terms and conditions on the Manakara/Fianarantsoa line which currently needs more traffic to remain viable.

1.12 IMPROVING THE FERTILIZER SUPPLY SYSTEM 9.10

An issue that needs to be addressed is that of the relative attractiveness of distributing fertilizer aid rather than importing commercial supplies.

Credit is a constraint to commercial fertilizer importation. Improved credit lines need to be available, subject to prospective importers demonstrating adequate financial capability.

Donors should rather give their fertilizer aid in cash, reserved for fertilizer use, than as Aid-in-Kind supplies. The cash would partly be used to improve the commercial credit lines of the banking system.

REFERENCE

This should help to reduce the problem of poor payments of countervalue funds. Clear regulations are laid down for the payment of aid fertilizer. If they are followed, the problem of buyers failing to pay Government should be eliminated.

MPARA should shed its role as the administrator of countervalue funds. This responsibility should become that of a Ministry with the necessary instruments to ensure payment, such as the Ministry of Finance, or preferably that of the banks themselves.

The Aid-in-Kind supplies used to maintain affordable fertilizer prices should be sold to distributors at a price that allows them suitable profits. 9.11

1.13 TECHNICAL RECOMMENDATIONS 9.12

Although the study could not go into technical issues, the following was noted:

- Madagascar's very low fertilizer usage leads to the depletion of nutrients in the soil, especially in intensively cultivated areas. A well designed and expeditiously implemented soil management program is necessry if agricultural production is to remain sustainable

- there appear to be no clear guidelines as to the fertilizer types and application rates appropriate for rice growing under current conditions. Immediate decisions need to be made, and clear recommendations issued as soon as possible.

- the need for Potassium on certain soils has not been conclusively proven. Yet the country seems to be importing a relatively large proportion of this nutrient. This issue must be investigated with a view to optimizing the use of the limited foreign exchange available.

REFERENCE

- at the present time the alternative of using local fertilizers is not feasible because of their relatively high transport costs associated with their low nutrient content.

1.14 SMALLHOLDER CREDIT 9.13

The World Bank's experience has shown that no viable means has yet been found for delivering financial services to the smallholder.

World Bank draws the conclusion that the farmers should form credit and savings associations, which would be guided by BTM and drawn into the financial framework once they have reached a certain level of viability.

World Bank emphasizes that smallholder support services are essential. Especially, there is a need for better extension services.

In order to utilize credit delivery systems, other conditions must be fulfilled. Most importantly, costs of inputs and outputs must be such that the farmer will risk some of his present or future income on fertilizers, being reasonably convinced that he will make a profit.

1.15 FERTILIZER COSTS 9.14

FOB and freight costs represent around 60 percent of selling price and therefore constitute the most important potential for reduction of costs to the farmer.

A cost saving would result with orders of around 10,000 MT in bulk. This would necessitate a bulk handling facility. The quality of stores in the port area should be improved.

New Supply Sources 9.14.1

New sources of supplies should be investigated. For example, if the freight costs between Mauritius and Madagascar could be reduced, Mauritius could become a very competitive and, complimentary source of

REFERENCE

supply. This issue is investigated in greater detail in Volume II, Section 9.14.1.

Donor countries should ensure that freight is on a Liner-Term basis and not on FIOS. Bank charges and interest rates are high, and should be investigated. Present import duties of 5 percent should be removed altogether.

Transport Costs 9.14.2

Transport costs represent the highest component of local costs for the average rice market - 9 percent of selling price. For the cotton market transport costs fluctuate considerably between 8 percent and 23 percent of selling price depending on the route and method of transport.

Not much can be done about reducing transport costs in the short-term. Long-term action should include improvements in the railway system and road network.

1.16 INFORMATION SYSTEMS 9.15

Sectoral statistics as well as macro-data in Madagascar are absent or weak, and are generally published with considerable time-lags. The need for a much better internal statistical information system than at present is crucial.

Originally, data collection was the responsibility of the Direction de la Vulgarization Agricole (DVA). With the launch of the 1984-1985 Agricultural Census, a new, separate, statistical office was created under MPARA (Direction de la Programmation des Donnees Statistiques) while the DVA continued to be in charge of data collection through its extension workers in the field.

Some of the problems with the current information system are:

- assessment of the data is of a subjective nature. Data thus obtained are highly unreliable

- resources available to DVA are inadequate, for its primary role of extension, let alone for the successful coordination, supervision and monitoring of a data collection exercise

- extension workers have no transport and therefore cover only very small geographical areas

- extension workers have only primary education and it is doubtful whether they can comply with the necessary rigorous requirements of the surveys.

The private sector has a functional need for better marketing information, both at the collection level and in the processing and presentation of data. Better marketing information is required to avoid the problem of over or under-ordering of supplies.

Data which would in most countries, be accessed through a computerized system, are in Madagascar stored in handwritten or typed file notes or tables. In today's competitive environment private sector investors and operators, importers and exporters, require virtually instant information in order to operate effectively and efficiently. The system in Madagascar is obsolete and unmanageable.

REFERENCE

2 REPORT SUMMARY

2.1 FERTILIZER USE

2.1

Madagascar's farmers have never been intensive users of fertilizers. The main users of chemical fertilizers have been the modern agricultural enterprises involved in export crop production, and to some extent, intensive rice farmers. Fertilizer use in the 1970's and the beginning of the 1980's was severely restricted by three factors:

- inefficient management of the supply system by MPARA
- continuous deterioration of the transport network
- the relatively high price of fertilizer against farmgate crop prices.

2.1.1

The liberalization program initiated in 1984 resulted in a large increase in fertilizer imports and consumption in 1987. This was followed by a sharp decline in imports in 1988 when a heavy devaluation of the Malagasy Franc changed the relationship between fertilizer costs and crop values.

Domestic fertilizer production is limited to non-chemical fertilizer or additives such as farmyard manure etc, in very small volumes and to dolomite.

2.2

The 1984 surge in commercial fertilizer imports reflected increased participation in the market by new private enterprises. Fertilizer imports became diversified by product type.

Since 1974, FOFIFA, the state research body, has coordinated all agricultural research in Madagascar. A diverse range of fertilizer research efforts in Madagascar over the last 15 years has been carried out at local, regional, and national levels. However, the impact on fertilizer use levels has been minimal.

REFERENCE

Madagascar's fertilizer consumption averages only 3.3 percent of the theoretical required level, and at best (in 1987) 4.7 percent of the total requirement. The largest fertilizer gap is in food crops where on average, only 2 percent of the theoretical requirement is applied. 2.6.4

2.2 GOVERNMENT POLICIES, ACTIONS AND IMPACTS 3

The application of several structural measures adopted by the Government in the early 1980s resulted in: 3.1.3

- the restoration of more appropriate relative prices through substantial adjustments of the exchange rate of the Malagasy franc
- the introduction of a liberalized import regime which aimed at eliminating the discretionary element in the allocation of import licenses and foreign exchange allocations
- increases in producer prices for major agricultural crops; the abolition of price controls an administrative impediments to domestic trade; and
- the progressive elimination of quantitative restrictions on imports.

The structural adjustment reforms have, however, taken time to produce an impact, and a combination of circumstances resulted in a sharp decline of about 11 per cent in real GDP during 1981 - 1982.

Government's involvement in the procurement of fertilizer has been considerable over the last ten years, with Government setting the rules for fertilizer procurement. 3.3

Traditionally, the procurement and distribution of fertilizers for export crops has been by parastatals responsible for individual crops. Before 1983 Government's involvement was total, with the Direction des Approvisionnements of MPARA serving as the sole channel for fertilizer procurement and distribution.

REFERENCE

Government intervention has largely constrained the development of an efficient fertilizer marketing system. Its impact on the sector can be summarized as follows: 3.4

- efficient marketing has been constrained by arbitrary rules for fertilizer allocation and distribution

- efficient distribution has been constrained by insufficient maintenance and development of transportation networks

- efficient consumption has been constrained mainly by pricing policy and other policies that, among other things, has led to the closure of distribution shops in remote rural areas and the non-availability of fertilizer types needed.

2.3 FERTILIZER MARKETING 4

Fertilizer marketing patterns in Madagascar differ according to area and crop. Fertilizer is mainly used on rice, primarily in the highlands. It is practically only in this area that a functional fertilizer marketing system is developing to supply both large and small farmers. Since rice production is dominated by smallholders, the marketing issues in this report apply mainly to fertilizer supply to smallholder paddies. 4.1

MPARA's involvement is now greatly reduced and the deregulation and devolution exercise is still continuing. The liberalization of fertilizer marketing is still in a transition stage and Government intends to end its involvement eventually.

Fertilizer suppliers in Madagascar can be categorized as: 4.4

- Importers:- The real commercial importers who have consistently imported under commercial conditions are COROI and SEPCM.

REFERENCE

- Distributors:- The main distributors at national level are COROI, SEPCM, AGRICO, OMNIUM, ECOPLANT and SEIM. COROI is the oldest and largest distribution network.

- Stockists and Retailers:- They buy fertilizer from the distributors to sell to the farmers, and are mainly active in the highlands.

- Various Extention Programs:- Programs such as ODR, ODASE and FIFAMOR occasionally supply fertilizer to farmers, but are gradually withdrawing from this activity.

Smallholder rice fertilizer is supplied by the major commercial suppliers. For other food and industrial crops, fertilizer is still supplied by the respective relevant parastatals, or imported direct by the users. 4.5

The fertilizer marketing system differs essentially for aid-in-kind and for commercial imports. Aid-in-kind has been supplied mainly by NORAD and is the main (if not exclusive) provider for the rice crop. Commercial importation is used to supply cotton and sugarcane requirements.The marketing cycle involves a process of import planning, followed by importation, distribution, retailing, financing and finally payment by the primary distributor to the Government. These individual stages differ according to whether the fertilizer imports are aid-in-kind or commercial. Some of the problems associated with fertilizer aid-in-kind are that it is: 4.6

- often late

- allocated on an arbitrary basis

- not sold to distributors on a commercial basis.

REFERENCE

2.4 SMALLHOLDER CREDIT

4.7

The first World Bank smallholder credit project, valued at US$ 14.2 million, came into force in August 1981, but failed to increase the volume of lending to smallholders.

4.7.1

Smallholder target groups for BTM (the domestic lending bank) loans with World Bank assistance were aimed at: seasonal credits; medium-term credits for the rehabilitation of existing plantations; long-term credits for the establishment of new plantations; and experimental credits for a variety of development projects.

4.7.3

Loan recovery rates are generally poor. Many local community groups have been struck off the list of credit worthy borrowers, because their members have been unable or unwilling to repay loans.

Since 1981 annual disbursements of credit to smallholders have been minimal. The smallholder credit system will remain a major limiting factor in enabling farmers to demand fertilizers unless rice prices become high enough to enable the farmers to save and pay cash.

2.5 FERTILIZER SUPPLY LOGISTICS

5

5.1

The transport network consists of:

- 4 main ports and 18 secondary lighterage ports, plus a navigable canal
- a fairly extensive road system: 50,000 km of which 5,200 km is paved
- 2 unconnected railway systems (northern and southern) of considerable length (863 km in total).a well developed air network consisting of 56 airports of which 17 are all-weather and 5 international.

A map of the transport network can be found in Appendix I.

REFERENCE

The life-line of the country is the corridor of road and rail linking the port of Toamasina with Antananarivo and the central highlands.
Until the early 1980's, Government policy was to extend state control over the entire transport sector, especially with regard to its external links. This policy resulted in the transport sector becoming disconnected from the rest of the economy. Lately, the Government has made an effort to improve communications with regional capitals by all-weather roads, improved road maintenance, and improved transport organization and services.

At the ports, the pattern of usage is changing. The importation of fertilizer is no longer done mainly by COROI and SEPCM. A number of smaller importers, such as Agrico and Ecoplants have entered the field. Average port performance indicators are improving. Major fertilizer importers are now performing their own clearing operations, rather than using clearing agents. 5.2

Transportation of fertilizer up-country is by truck and railroad. The major route for inland fertilizer transport is from Toamasina port to the central highlands. Traditionally, trucks have been more flexible, but more expensive than rail. Presently, there is an excess of heavy truck capacity which has made tariffs competitive. 5.3

There are storage facilities along the transport circuit from the ports to final distributors. Most fertilizer shipments (except COROI) transit by port storage sheds either because documentation is not ready for clearance; or, in the case of large shipments, trucks and railway wagons are inadequate for the tonnages involved. There is approximately 55,000 sq m of covered storage space at Toamasino Port (the largest in Madagascar), of which about 18,000 sq m is used for fertilizer. 5.4

2.6 FERTILIZER PRICING 6

Different pricing procedures have been followed for Aid-in-Kind and for commercially imported fertilizer. For commercially imported fertilizer, 6.2
particular circumstances rather than established

REFERENCE

rules have dictated MPARA's setting of selling prices. Selling prices for commercial imports vary significantly depending on whether or not they have been subsidized by Government. Fertilizer imports financed by donor credit lines can qualify for Government subsidies under special circumstances. Locally financed imports and imports for industrial cash crops are not eligible for Government subsidies.

MPARA is responsible for determining the selling price of Aid-in-Kind which is also impacted by the various donors' different rules. The guiding criterion is a value cost ratio of 2 applied to the estimated selling price of paddy for the coming harvest season. 6.3

2.7 DONOR INVOLVEMENT IN FERTILIZER 7

Donor involvement in fertilizer in Madagascar is relatively small when compared to that in many mainland African countries. Involvement exists at four different levels, each dominated by one major donor agency: 7.1

- Policy dialogue - World Bank
- Fertilizer-specific programs - FAO
- Supply of Aid-in-Kind - NORAD
- Credit for fertilizer imports - IFAD

7.5,7.6

Other donors have included the FAO, France (an important source of foreign exchange credits for fertilizer imports), Italy and Japan. 7.7

There is little evidence of donor coordination at any level within the fertilizer sector. A World Bank-sponsored donor meeting reportedly only highlighted the differences between donors. 7.8

REFERENCE

2.8 ECONOMICS AND PROJECTIONS OF FERTILIZER IMPORTS VERSUS RICE IMPORTS 8

Madagascar's economy depends heavily on rice production. Rice is the staple food and is grown by the vast majority of smallholders. Imports are currently only 6 percent of domestic consumption.The demand for fertilizer is not only a function of availability, but of the relationship between input and output prices at the farm level. 8.1

Four different output options are analysed: 8.1.3

Zero Option: Traditional farming methods without fertilizer

Option 1: Improved methods without fertilizer

Option 2: Improved methods and 300 kgs of NPK or equivalent fertilizer per hectare per planting cycle.

Option 3: As in OPTION 2 but with the additional use of 66 kgs of UREA.

All four scenarios show very low historical, financial benefit-cost ratios for paddy production from 1984 - 1988 except during 1986 as illustrated below:

The Option 2 strategy is the only feasible one in the medium term, which includes both improved general farming methods and the use of fertilizer. A forecast can be made that the rice sector will need additional fertilizer imports rising from about 33,000 MT in 1989 to 137,000 MT in the year 2000.

Financial Benefit/Cost Ratios in Paddy Production 1984 - 1988 Estimated at Farmgate Level.

Year	ZERO OPTION	OPTION 1	OPTION 2	OPTION 3
1984	1.07	1.51	1.47	1.67
1985	1.01	1.43	1.40	1.59
1986	1.38	1.99	2.11	2.42
1987	1.10	1.59	1.69	1.93
1988	1.14	1.66	1.66	1.93

REFERENCE

Option 3, although giving fairly good benefit-cost ratios has not been included in the broad projection model because it will for technical reasons have a limited application. Only under very well controlled conditions will the farmer reap the full benefit of the urea, which is otherwise likely to be washed away with the irrigation water. The significant fluctuations from year to year in the different options largely reflect the variations in paddy price at farmgate level. 8.2.4

The analysis (illustrated in detail in the main body of the report) indicates that at import parity prices, the Madagascar economy benefits if it imports fertilizers rather than rice. The problem is how to arrive at import parity price relationships without causing a social crisis. The need to keep food prices down for consumers is a reality which cannot be dismissed. In the medium-term this implies that fertilizers will need to be subsidized. 8.1.6

2.9 CONSTRAINTS ON FERTILIZER USE 8.6

The 1985 agricultural census showed, among other things, that nearly half of Madascar's farmers were illiterate. This implies that they have difficulties in understanding modern farming methods, or even simple instructions on packets of fertilizers or chemicals. Detailed investigations of a sample of 1,600 rice farmers revealed that modern methods in general, and fertilizers and chemicals in particular, were rarely used.

The following are some of the constraints that supress production volumes in the smallholder sector: 8.7

- the crop pricing system which has kept down basic foodstuff prices, while fertilizers have remained comparatively expensive

- high transport costs for agricultural producers, especially smallholders, coupled with a virtual absence of transport facilities both for excess produce and agricultural inputs

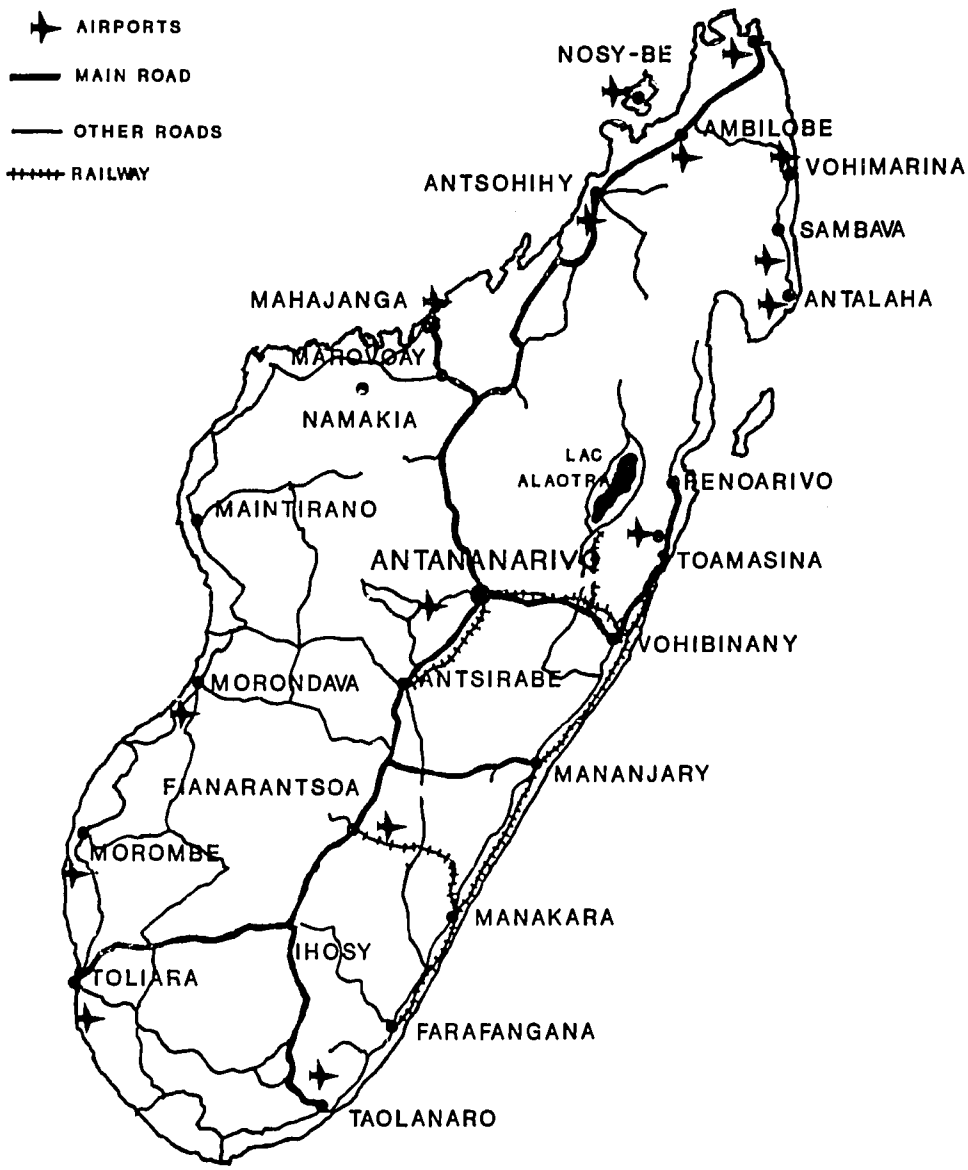
a smallholder credit system that has been ineffective.

APPENDIX I

MAP OF MADAGASCAR'S TRANSPORT NETWORK

MADAGASCAR

COMMUNICATION NETWORK



APPENDIX II

LIST OF ACRONYMS

LIST OF ACRONYMS

1 **CROP AND REGIONAL DEVELOPMENT PROJECTS**

AFAFI	-	Rice Development
FAFIFAMA	-	Livestock Development
FANALAMANGA	-	Forestry Development
FIFABE	-	Regional Development (Rice mainly) (Maravoay Irrigation)
FIFAMANOR	-	Rice, Food Crops and Cattle Development
FIFATO	-	Regional Development (South)
FOFIFA	-	Agricultural Research (Parastatal)
HASYMA	-	Parastatal for Cotton Production and Marketing
NAMISOA	-	Soya Bean Production and Marketing
NAMAKIA	-	Rice Development
OCPG	-	Development of Coffee, Pepper, Cloves, Vanilla
ODR	-	Extension Services Project for Rice and Smallholder Food Crops (Highlands)
OFMATA	-	Tobacco Marketing (Parastatal)
SAMBAVAVA VOANIO	-	Rice Development
SIRAMA	-	Sugarcane Production, Refining and Marketing (Parastatal)
SIRANALA	-	Sugarcane Production Refinery and Marketing
SOAMA	-	Regional Development (Andapa irrigation)
SOAVOANIO	-	Coconut Development

LIST OF ACRONYMS (CONTD.)

SODEMO	-	Regional Development (Moroadavo Irrigation)
SOMALAC	-	Regional Development (Lac Alaotra Irrigation)
SOMAPALM	-	Palm Oil Plantation and Refinery
SORIFEMA	-	Manioc and Tapioca Development

2 MAIN COMMERCIAL FERTILIZER DISTRIBUTORS

AFAFI	-	Regional distributor based in Fiarantsoe. Agent for Hoechst products
AGRICO	-	New private company. Distributes fertilizer aid.
COROI	-	Nationalized company. Main importer and distributor with largest country-wide network of 17 branches.
ECOPLANT	-	New private company representing overseas suppliers.
OCM	-	A private company. It only distributes fertilizer aid. It has stores in Antananarivo and 27 selling points (ex-MPARA) around the country.
SAFAFI	-	Created in 1982 for the coordination of Lutheran Church projects in Madagascar. Receives some free fertilizer from NORAD.
SEIM	-	Mainly a producer of cooking oil. It only sells fertilizers and other inputs to its contract farmers and on direct orders.
SEPCM	-	A private company, and the oldest fertilizer supplier in Madagascar. Caters mainly for cotton and sugarcane needs.

LIST OF ACRONYMS (CONTD.)

3 OTHER

BNI	-	Bank (Industry)
BTM	-	Bank (Agriculture)
COMADEX	-	Mining Enterprise
CCCE	-	Bilateral Credit Institution (France)
CMC	-	Coastal Shipping Company
CMN	-	Coastal Shipping Company
DVA	-	Direction de la Vulgerization Agricole
FMG	-	Malagasy Franc FMG 1,620 - 1,670 = 1US$ (June 1988)
MPARA	-	Ministry of Agriculture
PFP	-	Policy Framework Paper
SMTM	-	International Shipping
ZEMA	-	Organic Fertilizer Enterprise
ZTE - REN	-	Urea Plant Project (Defunct)

MADAGASCAR FERTILIZER SECTOR STUDY

FINAL REPORT

VOLUME II

MAIN REPORT

NOVEMBER 1989

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Mr John Thomas
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Madagascar

Dear Mr Thomas

RE: A.I.D CONTRACT NO. 623-0101-C-00-9015-00
MADAGASCAR FERTILIZER STUDY

We are pleased to submit the final report of the Madagascar Fertilizer study. Ammendments have been made to the report as per your comments on the draft report.

This is Volume II, the main body of the report, which reviews and analyses in detail, the findings of the study on Madagascar's fertilizer sector. The main emphasis of this report has been to assesses the role and importance of fertilizer in Madagascar's agricultural sector; identify parties involved and their roles; as well as to identify constraints to more efficient and increased fertilizer use.

This report (as well as Volume I: Executive Summary and Recommendations) presents recommendations to USAID on the various issues pertaining to Madagascar's fertilizer sector that need to be addressed, especially considering the on-going liberalization program.

Yours sincerely

Howard Digby-Johns
Managing Director

A list of partners is available from the above address

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INTRODUCTION

This report presents the findings of a fertilizer sector review undertaken for USAID/Madagascar, by Price Waterhouse. Two primary factors influenced the commissioning of this study:

(i) Madagascar's extremely low fertilizer usage.

(ii) The ongoing liberalization of Madagascar's fertilizer marketing systems.

The review was undertaken during the period May to August 1989. The study team of seven comprised of specialists in economics, agronomy, fertilizer marketing and finance and transport logistics.

This report in three volumes presents the consultants' findings and recommendations. Volume I presents the study's executive summary and recommendations. Volume II is the main report which reviews and analyses in detail, the various aspects of Madagascar's fertilizer sector. Volume III contains the annexes to the study.

The objectives of the study are set out in the Terms of Reference (Volume II, Appendix I). They call for an assessment of the role and importance of fertilizer in Madagascar's agricultural sector; the identification of parties involved and their roles; and the identification of constraints to more efficient and increased fertilizer use. Particular attention has been given to defining the role of the private sector in the fertilizer marketing system and the successes or failures encountered in promoting fertilizer use. An area examined in detail is commercial vis-a-vis Aid-in-Kind fertilizer supplies and their impact on fertilizer use.

Acronyms are used extensively in this report. They are listed and explained in Appendix II.

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1 INTRODUCTION

1.1 PURPOSE OF THE MADAGASCAR FERTILIZER SECTOR STUDY

The economic focus for the Government of the Democratic Republic of Madagascar (GDRM) in the next three decades will continue to be on agriculture. And within agriculture the focus should be on efficient use of farm land, particularly by smallholder farmers.

Fertilizers have a central role to play in increasing farm land efficiency. But low levels of fertilizer usage have affected programs primarily directed at smallholders. This has also affected the rice farmers in the central highlands.

Liberalization of the marketing systems in Madagascar has brought into the open a number of problems and constraints in the production and distribution mechanisms which affect agriculture in general, and smallholders in particular. The actual and potential roles of the private sector in the fertilizer sector is the specific subject of study in this report.

The study analyses the causes of low fertilizer use, gives information on the fertilizer sector, and highlights the problems associated with donor supplies of fertilizers and of food stuffs. It deals with policy aspects and impacts as regards pricing and distribution mechanisms, and also with the impact which these policies have on fertilizer economics at the farm level. The study provides a summary of recommendations and conclusions on the above and related issues of fertilizer policy, institutional arrangements, infrastructure, and credit mechanisms.

1.2 THE MADAGASCAR ECONOMY

The economy of Madagascar is summarized by national account estimates of the resource base (GDP) and of the use of resources. Latest published official estimates at the time of writing are found in "INVENTAIRE SOCIO-ECONOMIQUE 1976 - 1986" by the Direction Generale de la Banque des Donnees de l'Etat, February 1988.

Table 1 The 1986 GDP is estimated to have had the following origins:

	FMG billions.	Percent of GDP
Primary sector	605.0	43%
Secondary sector	219.6	16%
Tertiary sector	413.3	29%
Government salaries	130.0	9%
Indirect taxation	42.8	3%
TOTAL	1410.7	100%

The primary sector is comprised mainly of agriculture, forestry and fishing, and dominates the economy. The secondary sector is taken to represent industry but appears to include a number of activities in addition to industry.

The tertiary sector covers trade and commerce, transport, communications , non-GDRM services and salaries of domestic servants.

Table 1.2 The GDP is used in the following broad categories (1986)

	FMG billions	Percent of GDP
Private consumption	1081.9	77%
Public consumption	190.4	13%
SUB-TOTAL CONSUMPTION	1272.3	90%
Gross capital formation	198.0	14%
Exports	231.9	16%
SUB-TOTAL USES:	1702.2	121%
less:		
Imports	291.5	21%
TOTAL RESOURCE USE:	1410.7	100%

1.2.1 Consumption, Savings and Investment

Measurement and classification problems exist as to what constitutes private sector versus public sector consumption, but the sub-total for all consumption as 90 percent of GDP is probably close to a correct estimate. The implication is that domestic savings are at the very low level of 10 percent of GDP.

Unless savings are invested in a very efficient capital formation, their low level causes a very slow growth in GDP. This has been Madagascar's main problem throughout the 1970's and 1980's. Savings have been low, and they have not been put tc uses which yield rapid returns.

Net resource injections from abroad, mainly in the form of donor funds, enabled the country in 1986 to maintain a capital formation rate equal to 14 percent of GDP. This net capital import contribution finances nearly one-third of all capital formation. The structural adjustment program on which the country has embarked since the mid-1980's has in particular, aimed at increasing the efficiency of investment by concentrating on productive sectors and projects. As a medium term measure they also involve massive resource injections from abroad, as shown below.

Unpublished PFP projections for 1989 to 1993 imply no increase in savings as compared with 1986 levels (as a percentage of GDP). But the investment rate is increased, to stimulate economic growth. Therefore, the current account deficit has to be larger than in the past, and will have to finance about half the capital formation.

Table 1.3

PERCENTAGES OF GDP

	Domestic Savings	Gross Investment	Current account deficit
1987	8.3	14.9	6.5
1988	7.7	16.3	8.6
Projections:			
1989	8.0	17.4	9.4
1990	8.2	20.3	12.1
1991	8.3	17.3	9.0
1992	8.3	15.4	7.1
1993	8.5	15.4	6.9

1.2.2 Negative Economic Growth Rates and Incomes Per Capita

Economic growth has at times been strongly negative, according to data series for 1978 - 1979, supplemented by estimates by the World Bank for 1980 - 1984 (Country Economic Memorandum, March 1986), all based on 1970 prices.

Thus, between 1978 and 1984, GDP decreased over the period as a whole by 10 percent, ie by 1.65 percent per year. Taking into account a simultaneous growth in population by about 2.8 percent per year, the average annual decrease in incomes per capita amounted to about 2 percent per year. Over the whole period 1978 - 1984 it would appear that incomes per capita were reduced by more than 23 percent.

This decline appears to have been a continuation of trends which began in the early 1970's. Thus, estimates by Frederick L.Payor in "INCOME DISTRIBUTION AND ECONOMIC DEVELOPMENT IN MADAGASCAR" (World Bank Discussion Papers No.37, August 1988) indicate that GDP in 1971 amounted to 244.3 FMG billions and had by 1984 reached 247.8 FMG billions measured in constant 1970 quasi-factor prices.

Using Payor's data, it is possible to estimate that 1971 per capita incomes were reduced by 27.6 percent by 1984.
This implies that the average rate of decline of incomes per capita during this 13 year period would appear to have been nearly 2.45 percent per year.

The PFP comments: "the sharp decline of about 11 percent in real GDP during 1981-82 was followed by modest growth averaging 1.8 percent per year between 1983-87, though still well below the rate of population growth." Total GDP 1988, on the basis of preliminary data, might have been growing by 1.8 percent, implying a continued decline in incomes per capita.

1.2.3 GDP Projections

Table 1.4

Projections for 1989 - 1993 are that total GDP will grow by the following percentage rates per year:

	1989	1990	1991	1992	1993
GDP %	4.5	4.5	4.6	4.7	4.7
Gross Domestic Income %	4.3	4.2	4.3	4.6	4.5
GDP per capita %	1.2	1.1	1.2	1.6	1.7
Consumption per capita %	0.9	0.9	1.6	1.7	1.1

Related macro-economic data projections listed above for savings, investment and current account balance would seem to indicate that the GDP projections are on the high side. This is especially clear in the implied sudden jump in growth rates from a level of 2 percent per year or less, during recent years, to 4.5 percent in 1989 and 1990 and then higher still.

However, it is possible to achieve higher growth rates in the short run by stimulating activity levels and efficiency, even though it will take some years for the full impact of increased investment to be felt in productivity and output. The present study indicates that there are critical bottlenecks and inefficiencies in the input-output system in agriculture. If these were removed, the impact could be rapid, as regards agricultural output and marketing.

1.2.4 Prices and Inflation Rates

According to preliminary data the inflation rate was 27 percent between 1987 and 1988 and has been optimistically scheduled to be reduced to 9.5 percent this year (1989). This seems to be a very fragile scenario, which is likely to fail if there are any substantial price shocks.

1.2.5 External Financing Needs to 1993

Estimated or projected total external financial requirements of the Madagascar economy are indicated below with estimates of how they might be met. At present there is a foreseen financing gap representing funding requirements for which no donor commitment has been identified or foreseen. (All estimates in US$ million.)

Table 1.5

	Total financial requirements	Total identified financing	Debt relief	Financing gap
1987	560	348	212	0
1988	540	337	203	0
1989	622	409	213	0
1990	672	487	0	185
1991	617	518	0	99
1992	568	495	0	73
1993	566	508	0	58

If the financing gap cannot be met, imports will have to be reduced below the projected level. Such a reduction would have a negative impact on capital formation and/or on consumption and would be likely to slow down the adjustment program. There are also risks that export targets cannot be met, either because of supply constraints within the economy, or because of demand constraints abroad, particularly with respect to agricultural exports.

1.3 DEMOGRAPHIC AND ECOLOGICAL FACTORS

1.3.1 Population Growth Rates

Population growth in Madagascar is reported at growth rates ranging from 2.8 percent to 3.1 percent per year. A population census was carried out in 1975. Depending upon which growth rates are used, the 1989 population would be in the range of 11.19 million to 11.66 million. Statistics of births and deaths are uncertain, and the consultants are not aware of any representative sample surveys since the 1975 census.

1.3.2 Urban-Rural Distribution

Urban-rural and regional population distributions are uncertain, except for the census year. It appears, however, from Payor's discussion paper that the urban population during a ten-year period since the 1975 census might have been growing at a rate of 6.8 percent annually, while the rural population is growing at 1.77 percent. By 1985 the urban population was estimated to have reached 24 percent of the total population.

1.3.3 Transfer Problems in Rural-Urban Food Marketing and Transport

Rapid growth of the urban population poses particular problems of food security. More than one-quarter of all food produced in Madagascar must enter the marketing system and be transferred to urban areas, if the towns are not to depend on imported food. This estimate does not take into account the possibility that urban and rural consumption per capita are likely to differ. What is certain is that the transfer problem will grow very rapidly.

1.3.4 Rapid Growth of Traffic Demand and Relative to Population Growth

A continuing divergent population development means that traffic demand on the system connecting urban and rural areas will be bound to increase faster than average population growth and that smallholders will have to market increasing percentages of their crops for urban consumption.

In the meanwhile, many farmers are becoming less, not more, inclined to market their output. One must bear in mind that the increasing population pressures in rural areas, in spite of migration, means that the average smallholder has to feed more mouths from the same fields.

1.3.5 The Under-Nutrition Problem

Under-nutrition data collected by F.L.Payor (op.cit) from nine studies in different localities indicate that between 27 percent and 67 percent of sample children were below the 80 percent weight-for-age limits. It is not known how systematic or representative these studies were, but there is general agreement that there is an under-nutrition probiem in Madagascar. The IBRD Country Economic Memorandum of 1986 suggested that 50 percent of rural and urban populations alike were below absolute poverty income levels in 1977.

The present study has not attempted to estimate the amount of food needed to deal with the under-nutrition problem, nor how this food need would be translated in a market demand for food crops. Our demand analysis in this respect is restricted to estimating the growing output requirements associated with maintaining existing average consumption levels for rice.

1.4 AGRICULTURAL PRODUCTION

For the purposes of this report, the text and accompanying tables to Chapter 2 give a statistical picture of the agriculture of Madagascar. They indicate for different crops (rice, coffee, cotton, sugarcane, tobacco, maize, manioc, pepper):

- cultivated area in hectares by province
- production
- yield per hectare
- in many cases also by type of farmer
- theoretical fertilizer requirements
- fertilizer use by type and crop and by region.

1.4.1 Trends and Prospects

The agricultural sector as a whole appears to have been on an upward-trend during the period 1983-1986. (Macro-economic sector data for 1987 and 1988 do not as yet appear to be available).

The sector has in the recent past been constrained by significant distortions arising from state and local GDRM interventions in pricing and marketing, inadequate farmer services, and deteriorating rural transport infrastructure. Beginning in 1982, government liberalized or increased prices for several major crops (eg rice, groundnuts, coffee) and allowed private traders to compete with state enterprises. It also began to transfer the distribution of some agricultural inputs to operators in the private sector.

1.5 POTENTIAL RESOURCES IN AGRICULTURE

The resource base has recently been described in the following terms:

"Madagascar belongs to the group of countries termed least developed in the world. It is also the fourth largest island in the world with a total land surface of 592,000 square kilometers. Its population, estimated at about 11.2 million in 1988, is growing at an annual rate of 3.1 percent."
"The climate is varied and subject to regular cyclones, especially on the east coast. The size and the rugged topography have contributed to persistent transportation problems. Madagascar has a varied resource base, with good potential for agriculture, and is notably endowed with many minerals. Agriculture is the mainstay of the economy, providing employment for about 80 percent of the population and accounting for roughly 40 percent of GDP and over 80 percent of export receipt from goods. "

"The traditional exports are coffee, vanilla, pepper, and cloves. The principal staple is rice, grown mostly on small- and medium-scale private holdings. Manufacturing, which accounts for 16 percent of GDP, is poorly integrated and highly dependent on imported inputs."

(Policy Framework Paper 1989 - 1991, [April 20, 1989])

Madagascar's agricultural sector is largely based on production for subsistence, and above all it involves production by smallholder farmers. Their output probably represents about two-thirds of the total value of agricultural production. Regional variations have great importance and contribute to wide differences in farming systems and production patterns. The poor communications network has tended to encourage the development of production "islands" in various areas, which are poorly integrated with one another.

Estimates for 1975-1985 imply that the annual planted area of twenty major crops increased by 1.75 percent per year. It is not known to what extent marginal land yields less than average planted land. It is likely, however, that land for irrigated rice is becoming increasingly scarce.

Existing estimates of potentially arable land indicate that annual planted area of major crops in 1985 corresponded to about 30 percent of potentially arable land, as evaluated in 1975. It is not known what unutilized marginal land would yield for expanding smallholders. The large unutilized areas indicate, however, that Madagascar has much more land to spare for its expanding farming population, than many other countries in Africa. Theoretical and actual agricultural yield data, which figure repeatedly in this report also indicate that the agricultural potential is very substantial for lorg-term future development.

1.6 SOME ECOLOGICAL ISSUES

Madagascar suffers from serious soil erosion problems caused by grass fires and deforestation in particular. Widespread soil erosion is destroying valuable land resources at an alarming rate. Resulting flash floods also cause damage to irrigation areas, flood land cultures silting, covering them in sand, or washing them away.

Increased agricultural activities, whether by more intensified or more extensive work in the field, have an inevitable ecological impact. But the consultants did not get the impression that increased fertilizer use would seriously affect the ecological system.

Indeed might be argued that increased fertilizer use would be ecologically beneficial, compared to the alternative of a more rapid extension of areas under cultivation. Such an extension would not only include land which at the moment is functioning as a sponge in the seasonal cycles, but would also increase the number of roads and access roads, culverts and run-off channels which are associated with agricultural activities.

2 FERTILIZER USE

2.1 THE HISTORY OF FERTILIZER USE

Madagascar's farmers have never been intensive users of chemical fertilizers. Fertilizer use has been limited mainly to modern agricultural enterprises involved in export crop production and to some intensive rice farmers in Madagascar's Highlands.

In the last two decades fertilizer use has fluctuated between 20,000 and 30,000 MT a year. Compared to a total cultivated area estimated at just under 3 million hectares, fertilizer use by Malagasy farmers is minimal.

The use of fertilizer in the 1970's and the beginning of the 1980's was severely limited for the following reasons:

- scarcity of foreign exchange
- inefficient management of the supply system by the MPARA
- continuous deterioration of the transport network
- at farm level, the high costs of fertilizer against the farmgate prices of the crops produced.

2.1.1 Fertilizer Use in the 1980's

The liberalization program initiated from 1984 onwards has progressively led to the liberalization of all imports and the privatization of the fertilizer distribution system. This resulted in a large increase in fertilizer imports and consumption in 1987. This favorable impact of the liberalization policy on fertilizer use was however dampened by the devaluation later in the same year. Fertilizer use in 1988 plunged back to the 1980 level, and fertilizer imports reached a low of about 13,000 MT. This is indicative of the further reduction that will take place in fertilizer use in 1989.

2.1.2 Fertilizer Use by Type

Types of fertilizer used by Malagasy farmers have been extremely varied. Up to 10 different types of compound fertilizers have been used in the same agricultural year, as well as some 20 other single fertilizer types. Data for fertilizer use presented in tables 2.14 to 2.29 have retained only the main NPK fertilizers. (Full sets of tables containing all the different types of fertilizer are presented in the Appendix III of this volume)

The large private farmers and the parastatals in charge of crop specific development projects (SIRAMA and HASYMA in particular) mostly use single fertilizers. Smallholder farmers, however, prefer the compound NPK for easy handling and application to crops. The diversity of types present in the market reflects the lack of a fertilizer procurement policy rather than a market response to demand. Users, especially smallholder farmers, tend to adapt to the availability of fertilizers in the local market: the most popular fertilizer for rice is the 11.22.16 but, if not available, it will be replaced by any other type.

2.2 FERTILIZER RESEARCH

Fertilizer research in Madagascar has been marked for the last 15 years by a diversity of research efforts undertaken at local, regional and national levels, seemingly without much impact on the level of fertilizer use in the country. Since 1974, FOFIFA coordinates all agricultural research in Madagascar.

2.2.3 Research on Industrial Cash Crops

Fertilizer research on industrial export crops is carried out by the parastatals in charge of these crops (SIRAMA and SIRANALA for sugar, HASYMA for cotton, OFMATA for tobacco). Fertilizer research on sugar and cotton is undertaken at local level and results are continuously passed on to the plantation farmers.

2.2.4 Research on Smallholder Food Crops

FOFIFA is specifically responsible for research on smallholder crops (rice, maize, manioc, groundnuts, coffee, cotton, pepper etc). FOFIFA's research efforts on smallholder crops are complemented by the research undertaken by various crop development and regional development programs. For the various crops these include:

- Rice, ODASE and ODR at regional level and IRRI at national level,

national level,

- Coffee, pepper, cloves and vanilla - OCPG (Operation Cafe, Poivre et Girofle)

- Barley - Fertilizer research is undertaken by the above bodies on specific related crops on the bases of fertilizer trials and demonstration plots - MALTO.

Additionally, a special fertilizer research body has been created under FOFIFA on FAO funds: the PEM (Program d'Engrais Malagasy) concentrates on the research and promotion of fertilizer use on paddy.

2.2.5 Impact of Fertilizer Research on Fertilizer Use

The impact on fertilizer use by smallholders, generated by the FOFIFA research programs has been minimal. The main reasons are:

- a lack of links between the research and the extension bodies

- a focus on station research rather than on-farm research

- severe financial constraints

- outdated and badly maintained research stations and poor research quality

- the difficulties met when trying to establish a blanket fertilizer recommendation at national level when soil and climatic types are very variable across the country and when supply of different fertilizer types is unreliable.

In view of FOFIFA's clear present shortcomings, a National Agricultural Research Project, presenting a 10 year masterplan for agricultural research has been prepared by FOFIFA and ISNAR and has been submitted to the World Bank in June 1989 for approval. The project aims at refocussing research priorities and improving its quality and efficiency through a heavy emphasis on human resource development, at strengthening the linkages between research and extension, and at ensuring long term institutional viability of the organization.

2.3 FERTILIZER TYPES USED AND ASSOCIATED CROPS

The principal types of fertilizer imported and used in Madagascar are:

2.3.1 Nitrogenous Fertilizers

- Sulfate of Ammonia - SO4 (NH4)2 with 46 percent of N in the form of pearls and supergranules: for sugarcane and soils with sulphur deficiency.

- Urea (46 percent of N): for cotton and as a supplement of other fertilizers for rice, maize and pepper. The high concentration of N in urea diminishes its transport cost per fertilizing unit, but it is easily washed out by rains and should thus be applied in consecutive doses.

- Nitrates: for fruit trees and flowers. They act rapidly but are easily washed out and should be banned from flooded paddy fields.

2.3.2 Phosphated Fertilizers

- Hyper Reno - (PO4)2Ca3, natural tricalcium phosphate finely ground and with percent of P2O5: for acid soils on tanety, fruit trees and industrial reforestation.

- Supertriple - (POH)2Ca, with 45 percent of P2O5 under monocalcium form: for sugarcane.

- Bicalcium phosphate - PO4Ca, having 40 percent of P2O5: for rice nurseries.

2.3.3 Potassic Fertilizers

- Chlorite of Potassium - KCL, with 60 percent of K2O , used as a complement of other fertilizers: for manioc, maize, sugarcane and pepper.

- Sulfate of Potassium - SO4K2, with 48 percent of K2O and 18 percent of sulphur: for tobacco, food/vegetable crops and fruit trees.

2.3.4 Compound Fertilizers

- NPK (diverse formulas), the principle ones being:

  - 11:22:16 for rice and maize
  - N20:10:10 for coffee, manioc
  - 16:16:16, 15:15:15, 8:20:20 when 11:22:16 is not available.

Extension agents recommend compound fertilizers to the farmers because they are very rich in fertilizing units (and therefore cheaper per unit of fertilizer) and they are easier to use.

2.4 ALTERNATIVE FERTILIZERS

The alternative fertilizers available to Madagascar are essentially organic.

2.4.1 Organic Fertilizer of Purely Vegetable Origin

Waste from harvested Crops

This includes groundnut shells, banana leaves and stems, sugarcane waste, cotton bushes, maize, manioc, and tobacco stems, the hay of rice, etc. Their quantity and availability remains to be evaluated. However, for most cultivated plants, their quantities are greater than the harvest itself, and they should be recovered for use in fertilizing the soils.

Waste Products Derived from the Transformation of Crops into Consumer Food Products

These include: residues from coconuts (10,500 MT a year); the skim of sugarcane (27,500 tons a year); residues from coffee shelling (10,000 MT a year); waste from rice of which 50,000 MT are available from rice mills but only a small quantity is used as bedding; the humid waste of sisal (600,000 tons a year) of which only 10% is incorporated in the sisal growing soils.

On a national level the role of waste materials may be negligible, but locally they are important fertilizers for soils situated around the transformation units.

Interplanting

The technique used to interplant perennial crops (coconut palm, oil palm, etc) with creeping vegetable plants, brings nitrogen and organic matter to the soils enabling it to fight against soil erosion and weeds. Practically all covering plants are used on the 400,000 ha of coconut palms of SAMBAVA, and on the 1,000 ha of oil palm in Tamatave where they restitute about 20 tons/ha/year of organic matter to the soils.

2.4.2 Organic Fertilizers of Purely Animal Origin

These are principally;

a) waste from slaughter slabs (residuals of intestines bellies, hooves, etc) estimated at 7,500 tons for 250,000 slaughtered animals every year. This is used by vegetable producers in the area

b) bone phosphates produced several years ago by PROCHIMAD from the bones of cows exported as boneless meat. The quantity of bones varied around 3,000 MT a year. Its composition was: 5 percent organic nitrogen, 26-29 percent bicalcium and tricalcium phosphate, 34 percent of Calcium Oxide.

2.4.3 Organic Fertilizers of Multiple Origin

a) Manure

Farm Manure

Farm manure is a mixture of animal droppings and vegetable beds. About 1.2 million tons per year are used in Madagascar against a potential use of tens of millions of tons. Farm manure is the main fertilizer used by the farmers of the Highlands where the cultivated areas become more scarce and where the farmers cultivate relatively intensively.

Farmers mainly use farm manure on paddy fields. Its application maintains actual yields for several years without interruption. Manure is applied to the tanety's crops (manioc, maize, beans) only if it is available in excess of other needs.

Parc Manure

Parc manure is constituted by the animal droppings trampled in the sheds where the animals stay over night without the addition of vegetable beds. Its availability is important in the South and South West of Madagascar, but is not widely used for agriculture mainly because of handling and transportation problems as well as the reluctance on the part of the cattle holders to give it away.

Artificial Manure

Artificial manure is obtained by decomposition of diverse organic refuse after the addition of mineral nitrogen. It is found only on some advanced farms.

Household Waste

Household waste contains substantial organic and mineral substances. Some farmers deposit their household waste in holes in the garden and dig them up after some time to manure crops around the house. The city of Antananarivo manages a transformation unit of household waste in compost. It is however too expensive for use as manure by the farmers.

b) Organic-Biological Fertilizer from ZE-MA

The industrial experiment by the State to produce an organic-biological fertilizer from the waste of sisal and other diverse ingredients (fish waste, algua, dolomite, etc) has failed. This was because the marketed product was too expensive per unit of fertilizing element.

2.4.4 Mineral Fertilizers of Local Origin

a) Guano

The bat caves along the coast contain considerable amounts of guano: the cave of Andoharano for example, is estimated to contain a reserve of 10,000 tons with 15 percent of P205 and 4 percent of N. These reserves are currently un-exploited

The island of Juan de Nova has a reserve of 4,000,000 tons (containing 25-30 percent of P205). The legal status of the island however is not yet determined

b) Phosphate Nodules

The phosphate nodules in the Mahajanga basin contain 36-50 percent lime phosphate. Their importance has not been evaluated.

c) Dolomite

Dolomite has whose potential for increased use. SOMADEX has outlets through the industrial users PROCHIMAD and SOVEMA. But hitherto, the main users of agricultural dolomite are concentrated in the regions of Fianarantsoa (Tsorana, Ambalavao) and Antananarivo (Anstirabe). Guano and phosphate nodules are active nutrients. It must be stated that dolomite is not an active nutrient. It is used to correct soil acidity levels.

Agricultural clients, principally the wine growers FIFAMANOR, TOMBONTSOA and some supervised rice growers, use dolomite to correct the calcium and magnesium deficiencies of the tanety soils and to remedy the negative effects of acidity of the latter.

Despite an incentive price for dolomite of 12FMG/Kg in 1980 (subsidized at 50 percent), its use at farmer level is very low and far from being related to the area cultivated on tanety.

The following are some of the reasons for this low usage:

- the majority of farmers are more familiar with the NPK fertilizers because of the attention it has received from the extension services
- this is a highly labor intensive operation. It is difficult for farmers to apply the recommended dose of 1 ton/ha, which needs to be spread evenly by hand
- farmers do not understand that the application of dolomite only responds on a 5 year rotational basis. They expect immediate results after the first year
- farmers have noticed that dolomite is destroying organic matter and that if they do not supplement it with manure, soils become very hard.

Some farmers have taken the dolomite as a fertilizer, using it

alone and experiencing disappointing results.

The following measures should be taken in order to re-stimulate the use of dolomite:

On the Highlands: Applications of 300-500 Kg/ha should be recommended to farmers. The application should be renewed after every 2 or 3 years. Extension efforts on the use of dolomite should begin with the larger farms. It is to be hoped that a trickled-down effect will then spread the use of dolomite to surrounding smallholder farmers who should benefit from their know how and from their results). Emphasis should be made on food crops and high value crops (flowers and ornamental plants) and on perennial crops (trees, grape-vines, banana trees). This should ensure profitable returns on the use of dolomite after the first year.

On the East Coast: The half-peat or peat acidic soils of this part of Madagascar would greatly benefit from a massive application of dolomite. Dolomite application will almost certainly be beneficial right after the first or second year of cultivation. No serious action has yet been taken to increase the use of dolomite on these soils.

2.5 PRESENT RECOMMENDATIONS ON FERTILIZER TYPES

Technical recommended levels of fertilizer per crop are given in the table below.

Table 2.1: Technical recommended levels of fertilizer application per hectare, per crop.

Crops	Recommended levels			Recommended Types and quantities	
	N	P	K	Types	Quantities
Paddy	60	60	45	11.22.16 Urea	300 66
Manioc	20	10	50	20.10.10 KCL	100 66
Maize	150	160	120	11.22.16 Urea KCL	300 250 175
Coffee	170	85	85	20.10.10	840
Sugarcane	100	75	150	S.A. TSP KCL	500 165 250
Cotton	140	0	0	Urea	300
Tobacco	30	30	50	16.16.16. SO4K2	200 40
Pepper	200	50	100	20.10.10. Urea KCL	500 200 80

As far as cloves and vanilla are concerned, no references are available regarding their recommended fertilizer types and levels of application. However levels of fertilizer use, if any are however minimal.

2.6 TECHNICAL FERTILIZER REQUIREMENTS

2.6.1 Total Theoretical Fertilizer Requirements

Madagascar's theoretical fertilizer requirements have been calculated from the areas under cultivation for each main crop in 1985 (as 1985 gives the most reliable crop production and hectarage data), and the quantities of fertilizer recommended per hectare for each of those crops (see table 2.4 above). Madagascar's total theoretical fertilizer requirements, for one year calculated on the basis of tables 2.1 and 2.2 to 2.6, are presented in table 2.6 and summarized below:

Summary of table 2.6: Total theoretical fertilizer requirements for a representative year (base 1985).

Crop	Cultivated Hectarage (ha)	Total theoretical requirement (all types of fertilizer) (MT)
Paddy	1,183,520	433,168
Manioc	329,250	58,195
Maize	126,480	101,500
Coffee	223,200	187,488
Sugarcane	59,000	54,992
Cotton	32,954	9,886
Tobacco	3,803	913
Pepper	6,035	4,836
TOTAL		850,978

Note: Crop production figures for the main crops for 1985 to 1988 are presented in tables 2.2 to 2.6 in Appendix III of this volume. These are the official MPARA statistics (census figures for 1985 and regional estimates for the following years).

Total theoretical requirements as presented above indicate a maximum fertilizer absorbing capacity rather than realistic fertilizer requirements. In reality, fertilizer recommendations will vary locally with soil and climatic conditions.

2.6.2 Nature of the Data

Data on fertilizer sales are based on the returns on sales made by distributors and main users of fertilizer on a half-yearly basis to the Direction des Approvisionnements Agricoles. They have been supplemented, where possible, by direct sales figures from users and distributors of fertilizer (in particular HASYMA and SIRAMA). The data presented in tables 2.14 to 2.28 therefore are approximations only. They should be considered as indicative of relative magnitudes rather than of absolute quantities (the validity of the data is further discussed in chapter 8).

2.6.3 Theoretical Requirements Versus Actual Fertilizer Sales

The table which follows summarizes the results of table 2.6 and table 2.14 which present estimates of fertilizer sales by fertilizer type and by crop in 1985. Sales of fertilizer in 1985 are fairly representative of the period 1985-1988 (see tables 2.14 to 2.17, Appendix III).

2.6.4 Theoretical Fertilizer Gap

The summarized table shows that Madagascar's fertilizer consumption is on average only 3.3 percent of the required level, and at best (in 1987) 4.7 percent of the total requirement.

Summary of Table 2.6 and 2.14 fertilizer requirements as against fertilizer sales:

Crop	Cultivated Hectarage in ha (1985)	Total theoretical requirement (all fertilizer types) in MT	Estimated Total sales (all types of fertilizer) in MT 1985	% Gap
Paddy	1,183,520	433,168	13,521	96.8%
Manioc	329,250	58,195	33	99.9%
Maize	126,480	101,500	*	100.0%
Total Food Crops:		592,863	13,554	97.7%
Coffee	223,200	187,488	200	100.0%
Sugarcane	59,000	54,992	4,446	91.9%
Cotton	42,850	9,886	8,413	14.9%
Tobacco	3,803	913	685	24.9%
Pepper	6,035	4,836	0	100.0%
TOTAL		850,978	27,722	96.7%

* Any fertilizer used for maize, which is negligible, is principally purchased for rice; but no data is available for how much fertilizer is actually applied to rice and how much is applied to maize.

2.6.5 Food Crops

The largest existing fertilizer gap is for food crops (at around 98 percent). Fertilizer sales for paddy may be over-estimated since smallholders will use at least some of the purchased fertilizer on other food crops, (maize and manioc in particular), and on some smallholder grown export crops (pepper, coffee, tobacco). The fertilizer gap for rice, therefore is even

larger than the 97 percent indicated above.

It is worth testing the assumption that all NPK fertilizers are applied to paddy. The highest figure for sales is 16,414 MT for all complex NPKs in 1987. Converting it into fertilized hectarage, gives 54,700 ha. This would mean that only 4.5 percent of total area cultivated to rice received the recommended rates of fertilizer, and that 95.5 percent received no fertilizer.

2.6.6 Industrial Crops

The statistics shown for sugarcane, in the above table, could be misleading. The hectarage includes both industrial plantations and the small areas of sugarcane around villages growing naturally, receiving no particular attention from smallholders. The area cultivated under industrial plantations averages 13,000 ha, representing a theoretical fertilizer requirement of 11,900 MT of fertilizer as compared to sales of 4,446 MT if all sugarcane fertilizer is in fact used by estates, the fertilizer gap for commercial cane is only 62 percent.

The size of the fertilizer gap is however still alarming, especially since both SIRAMA and SIRANALA have not been subject to the constraints of fertilizer availability. The smallest fertilizer gap is found for cotton. However, fertilizer use on this crop varies from year to year.

Data for fertilizer sales in 1985 for other crops are not available.

2.7 PROFITABILITY OF FERTILIZER USE

2.7.1 Financial Value Cost Ratios for 5 Years

Financial Value Cost Ratios (VCR) for Madagascar's principal crops presented in Table 32 in Appendix 1 and summarized below were calculated for the last 5 years on the basis of:

a) costs of fertilizer dosages recommended per hectare over 5 years (Table 30), and

b) costs of surplus production obtained per hectare over 5 years, using the recommended dosages of fertilizer (table 31).

Paddy

It should be borne in mind that the VCR for paddy has been, over the last 5 years, consistently lower than for other crops and is hardly higher than 2, which is the acceptable minimum level required for farmers to apply fertilizer.

This low VCR for paddy is explained by GDRM's pricing policy which, allowing for subsidies on fertilizer prices, systematically maintained the producer price for paddy at low levels. This was done in order to ensure adequate consumption and affordability of rice by consumers.

Other Crops

All other crops have higher VCRs, generally in the order of 5 or 6 (34 for manioc). The increase in fertilizer prices in 1987 greatly affected the VCRs of all crops in 1988. Exceptions can be made for pepper which has seen a notable increase in producer prices, and for cotton which has been less affected by increases in fertilizer prices, since its producer price is partly determined by production costs.

Summary of table 2.32: Financial Value cost ratios for Madagascar's main crops, 1984 to 1988.

Crop	1984	1985	1986	1987	1988
Paddy	2.1	2.0	3.4	2.7	2.1
Manioc	31.8	31.5	34.1	34.1	18.5
Maize	4.9	5.8	6.6	6.6	3.5
Coffee	4.4	5.6	5.6	8.1	6.0
Sugarcane	5.6	5.6	6.7	7.8	3.3
Cotton	5.7	5.7	5.7	11.8	9.6
Pepper	3.1	6.0	5.9	8.5	11.2

VCRs for all crops except paddy are at a level which more than justifies fertilizer use. However, fertilizer sales and import figures, and in particular the theoretical fertilizer gap calculated and discussed in section 2 above, show that farmers have not used the recommended fertilizer rates.

It is evident that problems in fertilizer use do not only originate from the agricultural pricing policies, but also from other fundamental problems in the fertilizer sector.

2.8 INFORMATION SYSTEMS

Throughout the present study, sectoral statistics as well as macro-data have been absent or weak and generally published with considerable time-lags. Whether as a planned or an unplanned economy, Madagascar will need a much better internal statistical information system than at present exists. This applies in particular to agricultural sector data for:

- agricultural inputs, outputs, and destinations
- commercial sector data relating to agriculture
- labor force
- population
- areas under cultivation
- yields
- costs

- prices
- market prices as against official prices.

2.8.1 Data Sources

The quality of official data is highly variable.

2.8.2 MPARA Statistics.

Originally, data collection was the responsibility of the Direction de la Vulgarisation Agricole (DVA) which mainly used extension workers in the field to gather data. A national agricultural census was carried out in 1969 giving detailed data for all crops and farmers. Since then, some crop specific surveys have been carried out, particularly in 1974-1975 for rice.

In 1984-1985, with financial and technical support from the FAO and the UNDP, a new national agricultural census was carried out resulting in very detailed publications of data per crop, region, farming system, etc. It is with the launching of the 1984-1985 census that a new, separate, statistical office was created under MPARA (Direction de la Programmation des Donnees Statistiques) while the DVA still continued to be in charge of data collection through its extension workers in the field. However, while the new statistical office was set up with the objective of creating its own data collection unit with enumerators in the field collecting data from a fixed sample of agriculturally (soil, climate, crops etc.) homogenous areas, this has not been implemented to its full extent due to limited funds.

Collection of Data by Extension Workers

At present, the statistical unit has to rely on the data collected by the extension workers under DVA in order to produce national statistical agricultural data. These data are highly criticable: extension workers receive a questionnaire from DVA that relates to areas cultivated under each crop and estimates of yield. The extension worker assesses the situation regarding these two elements in the area in which he is based. Assessment is done solely by eyesight, there are no direct, objective measurements involved. It is more the general impression of the extension worker that is thus entered in the questionnaire. The extension worker does however have to give a quantitative as well as a qualitative assessment and is asked to give an estimate of cultivated area and yields for each crop, as well as

a qualitative statement regarding the relative state of area and crop compared to the previous year.

Undoubtedly, the problems with this system are many.

Firstly as the assessment is of a purely subjective nature, the data thus obtained are highly unreliable.

Secondly, as we have noted above, the organization and means available to the DVA are very inadequate, in terms of extension work to be carried out, let alone in terms of successfully coordinating, supervising and monitoring a data collection exercise.

Thirdly, extension workers have no transport and can therefore only cover a small geographical area.

Fourthly as was noted above, extension workers have only primary education and it is doubtful whether they can comply with rigorous statistical requirements. It should also be noted that every year the statistical unit does carry out training courses for these extension workers regarding the collection of agricultural data.

The experience is however disappointing because as soon as an extension worker is trained there is a tendency to move them to another department of the MPARA.

A last related point concerns the high turnover of extension workers in terms of areas where they are stationed. It would seem that extension workers are geographically very mobile from one year to the next and that they, in almost all cases, do not leave behind them in their station, the papers concerning data collection accumulated during their stay in the area. Thus new extension workers in areas do not have written reference to the agricultural situation regarding production areas and yields in the previous years. All these elements highlight the very unreliable nature of the data collected by the DVA.

The DVA uses these collected data in the form that they are and estimates national and regional data on their basis. The statistical unit however tries to refine slightly the estimation system used by taking from the extension workers' data, only the qualitative assessment part and the relative quantitative assessment. The latter is obtained from the relative difference between the current year and the past year in cultivated area and yield (and should thus logically reflect the opinions expressed in the qualitative assessment). These qualitative

evaluations are then applied to the data stemming from the 1984-1985 national agricultural census.

The difference between the DVA data and the statistical units's data is that the latter's is based (even if in the past) on some reliable detailed data. It is probably for this reason that MPARA has decided to give the statistical unit primary responsibility for the publication of the official national agricultural data estimates. The statistical unit also collects data from the parastatal organization in charge of crop specific development programs.

2.8.3 Parastatal Organizations

Parastatals responsible for sugarcane (SIRAMA), cotton (HASYMA), tobacco (OFMATA), and others undertake their own data gathering and processing. Industrial sugarcane production is easily recorded by the responsible parastatals (SIRAMA and SIRANALA). These data are communicated to MPARA's statistical unit and are used to estimate the total national sugarcane production. On the basis of the 1969 and 1984-1985 agricultural census it has been found that sugarcane cultivated by smallholders for food and alcohol production represents more than half of the total national sugarcane production.

HASYMA, for cotton and OFMATA for tobacco, have a monopoly on the growing and marketing of these crops (whose cultivation is government licensed). The two organizations have their own records for cultivated area and production data which are accepted without alteration by MPARA's statistical unit.

2.8.4 Fertilizer Statistics

Fertilizer Supply

There is no reliable fertilizer data collection system. Two main sources of information exist. The are MPARA's Direction des Approvisionnements Agricoles, and the customs department.

MPARA's requires from, historically, all MPARA warehouses, and, currently, from all private distributors, the following data:

- a six monthly return on fertilizer stocks at the beginning of the period
- fertilizer receipts during the period
- fertilizer sales and losses during the period

- stocks at the end of the period.

These statistics are compiled by the distributors and are sent regularly but not by all of them, to the DAA. These six monthly returns enable the DAA to check sales of agricultural inputs to farmers/retailers against the payments made by the distributors to the DAA for the fertilizer allotments received during the period.

Typically distributors pay the DAA for fertilizer only when it is sold, and DAA can thus experience enormous delays of repayment, especially so when Aid in-Kind fertilizer has been received at an inappropriate period of the agricultural year. Furthermore distributors will be tempted to report in their six-monthly returns to DAA fertilizers in stock which may already have been sold in order to maintain their cash flow and delay payment to MPARA.

It would appear that MPARA does not carry out any physical checks of stocks and has thus no control over the situation. Furthermore, the six-monthly returns, when received by the DAA are filed away in regional files which are not used again. The data are not checked for internal consistency, nor are they compiled in a form that could be used for planning or monitoring purposes.

It is therefore not so much a pure information gap that exists for fertilizer supplies but more a total absence of any form of exploitation of the data by the DAA (The DAA will not even admit that these data exist unless it is advised that the knowledge of their existence comes from the distributors who send these returns to the MPARA).

A second, even more unreliable, source of information on fertilizer supply can be obtained from the customs statistics. Major criticisms regarding these data are that they do not appear to record systematically all fertilizers imported, and secondly, that the classification of imports is done for fertilizer, by source of provenance and nature of fertilizer rather than by type of fertilizer . In respect of data analysis it is thus a very meager source of data.

Fertilizer Consumption

In view of the limitation of agricultural data collected, it is hardly surprising that no data exist on fertilizer consumption for the smallholders. It is however possible to cross-check

different related sets of data such as:

- the six-monthly return slips on fertilizer stocks and sales by region and distributor
- the direct fertilizer imports of main users
- the agricultural production data by region.

The agricultural production data by region should enable the approximation of quantities of fertilizer used for each region, and by further extension, the use by crop. These data would however be highly approximative and used as a crude indication only. It should be noted that the efforts involved in collecting these data from MPARA, the various distributors and retailers (which might or might not be reluctant to give away data on sales, and which will appear to be different from the returns concerning the same sales sent to MPARA), the development programs and the main users, might hardly be cost effective for the quality of information that will be obtained.

In view of the need to monitor fertilizer use and plan fertilizer policy, the design of an information system on both aspects of fertilizer supply and use, should be considered a high priority.

Note

Most tables reproduced here are summarized forms of the original data. Original data are presented in the annex in Volume 3.

COMMENTS ON THE PRESENTATION OF FERTILIZER DATA

Abbreviations used in the tables for different types of fertilizer have been based on the original French versions.

Abbreviations should read as follows:

KCL:	Chlorure de Potasse	- Potassium Chloride
P.A.:	Phosphate d'Ammoniaque	- Ammonium Phosphate
Phosp.naturel:	Phosphate Naturel	- Natural Phosphate
Phosp.Bic.:	Phosphate Bicalcique	- Bicalcium Phosphate
Phosp.Tric.:	Phosphate Tricalcique	- Tricalcium Phosphate
S.A.:	Sulfate d'Ammoniaque	- Ammonium Sulphate
Sulf.Pot.:	Sulfate de Potasse	- Potassium Sulphate
SSP:	Super Phosphate Simple	- Single Super Phosphate

TSP:	Super Phosphate Triple	- Triple Super Phosphate
Sultr.Ammon.:	Sulfonitrate d'Ammoniaque	- Ammonium Sulphonitrate
Sultr.Pot.:	Sulfonitrate de Potassium	- Potassium Sulphonitrate
Nitr.Ammon.:	Nitrate d'Ammoniaque	- Ammonium Nitrate

2.9 PAST PERFORMANCE OF THE FERTILIZER SECTOR

2.9.1 Domestic Fertilizer Production

Domestic fertilizer production, after the failure of the urea ZE-REN plant in Toamasina, is restricted to non-chemical fertilizer, although very limited in volume. Of particular importance to the agricultural sector is the local production of dolomite which is currently used in the agricultural sector to a limited extent for long-term soil improvement and to correct the acidity of tanety soils. SIRAMA also imports single component fertilizers and blends them at the plantation's site. The volumes involved are however very limited.

2.9.2 Fertilizer Imports

Before the liberalization policy, Madagascar obtained fertilizer either through aid programs or through direct imports. The aid programs (FAO, NORAD, Italy, Germany, Japan, EDF) contributed 52,350 MT of fertilizer in kind over 1975-1985 (ie about 5,000 MT a year). Direct imports of fertilizer were subject to Central Bank and Ministry of Commerce and Industry quotas and represented over 1978-1984 a total of 116,660 MT (ie about 16,600 MT per year). The main importers were SIRAMA and HASYMA and the parastatals COROI and SINPA.

From 1985 onwards, the general liberalization policy led to MPARA's disengagement from the fertilizer distribution network. Private distributors and users were encouraged to import fertilizers directly. This resulted in a surge in commercial imports which was accompanied by a large increase in fertilizer donations in kind. This brought the level of total imports for 1986 and 1987 to record levels of 32,101 MT and 35,371 MT, respectively (see tables 2.7 to 2.13). Concurrently, new private enterprises entered the fertilizer distribution network and types of fertilizer imports became more diversified.

The heavy devaluation of the Malagasy Franc during 1987 strongly affected fertilizer imports. Importers who had ordered fertilizer imports but had not yet paid for them were heavily penalized. In addition, the availability of subsidized Aid-in-Kind on local markets barred most private distributors from continuing commercial importation. As a result, in 1988 total imports fell to 19,822 MT of which 5,500 MT were fertilizer donations in kind. In 1989, commercial imports totalled only 6,220 MT (up until June).

2.9.3 Fertilizer Sales

Nature of Available Data

Fertilizer sales data have been used as a proxy for fertilizer consumption data. They are based on half-yearly returns on sales filled by each distributor/user of fertilizer and sent to the MPARA's Direction des Approvisionnements Agricoles. This data reporting on stocks, sales and losses of fertilizer by type is however not very reliable. It is used by the MPARA to check distributors' repayments of fertilizer credits and hence may be falsified by distributors to avoid timely reimbursement of credits. Furthermore it would seem that the MPARA neither checks these half-yearly returns for internal consistency, nor does it carry out physical checks at distributors' stores, making the data highly unreliable. As witnessed in the full data presented in the annex (vol.3), some distributors clearly fail altogether to send in the returns.

Despite the serious shortcomings of the sales data, it is the only available data source and is at least indicative of actual average sales,especially when considering a four year period.

Fertilizer Sales by Region

Fertilizer sales have fluctuated in the last 4 years between 22,500 MT and 40,000 MT, averaging 30,000 MT a year (see table 2.21, Appendix III and the summary by region below).

Summary of Table 22.1 of fertilizer sales by region (MT):

Region	1985	1986	1987	1988
Antananarivo	22,623	23,806	32,807	21,143
Fianarantsoa	1,510	1,076	0	0
Toamasina	888	2,177	6,138	222
Mahajanga	3	22	0	199
Toliara	1,305	1,157	559	4
Antsiranana	1,393	1,061	342	991
MADAGASCAR TOTAL	**27,722**	**29,299**	**39,846**	**22,558**

The bulk of the fertilizer, ie 70 to 90 percent, is sold in the Antananarivo region. Antananarivo is the main fertilizer procurement center in the country and is distributed from there to the remaining areas. Figures for Antananarivo include most of the Fianarantsoa sales, as well as the fertilizer sales for HASYMA (which will be directed mostly to Mahajanga and Toliara, see Table 2.26); and for SIRAMA (of which more than half will be used in Antsiranana and the remainder in Mahajanga and Toamasina, see Table 2.27).

From the data presented above it is, however, still obvious that the bulk of fertilizer sales takes place in the Highlands which is the most intensively cultivated region of Madagascar.

Fertilizer Sales by Crop

Fertilizer sales by crop are based on the same half-yearly returns as discussed above. They have been complemented by data given by HASYMA for cotton and SIRAMA for sugarcane. It appears from the table below, illustrating summarized fertilizer sales by crop, (summary of tables 2.14 to 2.17 and 2.22 to 2.27), that some crop development programs (such as for tobacco, manioc, OCPG, oil palm, forest) have not consistently sent fertilizer sales data to MPARA.

This makes it difficult to judge their historical performance in fertilizer use. On the other hand fertilizer sales data for rice probably include, as was noted above, fertilizer uses on other smallholder food or cash crops such as tobacco, sugarcane, pepper etc.

Summary of Tables 2.14 - 2.17 of fertilizer sales by crop (MT):

Crop	1985	1986	1987	1988
Paddy	13,521	15,634	26,419	7,272
Sugarcane	4,446	2,920	3,907	10,106
Cotton	8,413	8,908	3,421	4,816
Tobacco	685	-	-	-
Manioc	33	-	-	-
Oil Palm	-	291	-	180
OCPG (coffee/pepper)	-	-	5,889	183
Forest	624	1,546	211	-
TOTAL	27,722	29,299	39,847	22,558

The variations in fertilizer sales for rice from 1985 to 1988 are neither explained by variations in area cultivated nor by variations in yields (see table 2.2). As noted above, fertilizer sales figures for rice are unreliable and the only conclusion to be drawn from the above figures is that fertilizer sales increased in 1987, reflecting the general increase in fertilizer availability in the market.

Fertilizer sales for sugarcane include only the sales for SNBCE (Nosy Be and Brickaville) until 1987. Figures for 1988 include SIRAMA as a total (ie Nosy Be, Brickaville, Ambilobe and Namakia) thus explaining the large increase in fertilizer sales.

The decrease in fertilizer sales for cotton in 1987 and 1988 is directly linked to the halving in area cultivated for cotton (see table 2.3).

Fertilizer Sales by Type and by Nutrient Content

The most frequently used fertilizer types in order of importance are (see table 29):

- the NPKs - which accounted for an average of 72 percent of total fertilizers during 1985-1987 (59 percent in 1988),
- urea - accounting for 32 percent of fertilizers (but 44 percent in 1988) and
- sulphate of potassium - accounting for about 10 percent of fertilizers (but 17 percent in 1988).

Compound fertilizers are most popular with smallholder farmers, as was noted in section 2.3. The most favored NPK type is 11.22.16, replaced if unavailable by 16.16.16 or by other NPK types depending on their availability in the markets. Urea and sulphate of potassium are mostly used on the cotton and sugar plantations. Fertilizer sales in NPK content are summarized below (MT):

Summary of Table 2.28 of fertilizer sales by NPK nutrient content

NPK contents	1985	1986	1987	1988
N content	5,513	6,509	8,434	5,477
P content	1,934	2,741	3,384	1,116
K content	3,793	4,261	6,000	3,242

3 GOVERNMENT POLICIES, ACTIONS AND IMPACTS

3.1 ECONOMIC POLICY BACKGROUND

3.1.1 Structural Adjustment

The present study of fertilizer distribution has been carried out in the context of ongoing structural adjustment of the whole Malagasy economy. The Government has implemented several adjustment programs during the 1980's which have to a degree succeeded in reducing external and domestic financial imbalances.

3.1.2 Falling GDP Per Capita

The Government has adopted these structural adjustment programs because, throughout the 1970s, the Malagasy economy grew at a slow pace, with real GDP rising at an annual rate of less than 2 percent. Real GDP per capita was steadily falling between 1970 and 1980.

During the same period, administrative controls multiplied in all sectors, several of which were nationalized. Towards the end of the 1970s a large-scale, poorly coordinated investment program was implemented, which had little medium-term impact on the country's productive capacity but resulted in the quadrupling of its external debt.

Expansionary financial policies were pursued together with intensified quantitative restrictions on trade, resulting in substantial external and domestic disequilibria, pronounced distortions in relative prices, and an accumulation of external payments arrears.

3.1.3 Structural Measures

In the early 1980's the Government took several structural measures aimed at reducing the structural rigidities and pricing distortions. Applications of these measures resulted in:

- the restoration of more appropriate relative prices through substantial adjustments of the exchange rate of the Malagasy franc;

- the introduction of a liberalized import regime which aimed at eliminating the discretionary element in the allocation of import licenses and foreign

exchange allocations;

- increases in producer prices for major agricultural crops; the abolition of price controls and administrative impediments to domestic trade; and

- the progressive elimination of quantitative restrictions on imports.

The structural adjustment reforms have, however, taken time to produce an impact, and a combination of circumstances resulted in a sharp decline of about 11 percent in real GDP during 1981-82.

3.1.4 Vulnerability to External Shocks

Madagascar remains vulnerable to external shocks, because results of structural adjustment policies have been slowed by:

- budgetary slippages,

- administrative complications in the reform of foreign trade

- delays in the implementation of public enterprise reforms.

3.1.5 Sustainable Growth

During 1983-87 there was a modest growth in real GDP averaging 1.8 percent per year though still well below the rate of population growth. Madagascar now appears to be back on a sustainable growth track, supported by the International Monetary Fund, the World Bank and bilateral donor inputs.

For the years 1989 - 1993 real GDP is projected to grow at an average rate of 4.6 percent per year. These projections hinge on a number of assumptions, including that balance of payments gaps will be covered by foreign aid. They might therefore be slightly on the optimistic side, depending upon the extent to which donors and lenders are prepared to roll over debt schedules, to convert loans to grants, or to provide fresh funding to help Madagascar over a critical phase in the structural adjustment process.

3.1.6 Short Time-Frame for Adjustment Impact

Successive programs have tended to allow too short a timespan for adjustments which will take some years to have full impact on the economy. It is probable however, that real GDP per capita will now increase.

3.1.7 Reducing Vulnerability to External Shocks

To reduce vulnerability to external shocks, the Government has formulated an adjustment program orienting the country toward an open and market-oriented economy. It contains far reaching structural reforms in the areas of internal and external trade, the financial and public enterprise sectors, social policy, and public expenditure programming. But aggregate demand has to be constrained, so as to prevent inflation and the resurgence of unmanageable import surpluses.

3.1.8 Export Liberalization

Liberalization of the export sector means that all agricultural products, with the exception of vanilla, can be exported freely at prices negotiated directly between exporters and importers. Moreover, domestic trade in export crops has been liberalized. All economic agents are allowed to operate in all stages of domestic trade without any restriction. The practice of classifying operators and of limiting their trade functions according to their position in the trade chain has been abolished.

3.1.9 Import Liberalization

The present official position is that:

- all economic agents are allowed to import and receive the total amount of foreign exchange requested at the prevailing exchange rate.

- no import licenses are required, and no administrative restrictions of any kind currently apply or will be imposed in the future on the opening of letters of credit or the means of financing imports.

- therefore, importers can use their own resources, borrow from the banking system, or avail themselves of foreign loans, including suppliers' credits, to

finance their imports.

3.1.10 Medium-Term Policies

The authorities will pursue policies and implement reforms to redefine the relative roles of the private sector and the State; amplify the use of price signals as a resource-allocative mechanism and continue the transformation of the economy from and administratively controlled to an open and market-oriented one. This transformation will be actively supported by a flexible exchange rate policy.

3.1.11 Rice Exports from 1990 Onwards?

Of particular importance to the present study, is the demand for (and need for) fertilizers for the rice growers. Government's aim is to attain rice self-sufficiency and become net exporter of rice. The relevant strategy measures are envisaged as promotion of incentives to producers and private sector traders.

Thus, the authorities expect that, with price and agricultural reforms previously implemented, Madagascar will become a net rice exporter (in years with normal weather) beginning in 1990. Our own views are that fertilizer distribution and marketing still has to be considerably improved, before the rice growers will have enough of a surplus for exports. Our different scenarios for increased rice production therefore concentrate on the need to produce more rice to keep pace with a growing population and to eliminate rice IMPORTS.

Transport constraints, referred to elsewhere in this study, will further hamper production of rice for exports. In the meanwhile, export parity prices for rice at the farmgate are likely to remain and well below import parity prices so that farmers are unlikely to be willing to produce a surplus for exports.

But, with time, improved infrastructure would result in higher export parity prices, and potentially make rice exports profitable at the farmgate.

Direct Government intervention in the fertilizer sector relates mainly to food crops. In the following sections the policies described relate mainly to fertilizer for rice. Fertilizer used for industrial crops (sugar, cotton, tobacco) is treated in a different section, since policies and actions have been different for these industrial export crops.

3.2 INDUSTRIAL EXPORT CROPS

3.2.1 Procurement and Distribution

Actual practice deviates from the policy principles. For industrial cash crops, procurement and distribution of fertilizer is undertaken by the parastatals responsible for crop (SIRAMA and SIRANALA for sugarcane, HASYMA for cotton, OFMATA for tobacco). Historically sugarcane and cotton parastatals have benefitted from international credit lines or program financing. These have enabled them to disregard the otherwise binding constraint of foreign exchange availability in the country. They have thus always imported their own fertilizers, either directly from abroad, or through existing distributors such as COROI or SEPCM. The imports often consist of single element fertilizer. The blending into composite fertilizer can be done on the plantations.

Since the inception of the liberalization policy on imports, some of the larger farmers (especially on sugar plantations) now prefer to import their own fertilizer directly. As a result the parastatals' role in procuring and distributing fertilizer and other agricultural inputs has become increasingly limited to smallholder farmers in recent years.

3.2.2 Input Prices

Sugar and cotton parastatals import their agricultural input needs at world prices. This in effect is cheaper for them because they can have the fertilizer delivered right to plantation sites, thus avoiding the higher costs otherwise charged by the distributors for storage and transport.

Since the parastatals are virtually in a monopolistic position concerning sales of fertilizer to farmers, they also have been able to charge the price they want. This monopolistic rent might be decreasing now that at least the larger farmers can import their own input needs directly, and when, in principle, anybody is allowed to procure and distribute imports.

3.2.3 Output Prices

For the three industrial crops, output prices are actually set according to a number of criteria. For tobacco and cotton, prices are set by specialists. In the case of cotton, the price is determined and discussed by a Committee representing producer members, HASYMA, the textile industry, the oil industry, MPARA,

the Mines and Energy Ministry, the Trade Ministry, Direction of Plan, and the Finance Ministry. The Committee determines both the policy for the cotton sector and producer prices. Producer prices are determined on the basis of production costs (at world prices) and world prices for cotton fibre.

The final price paid to the producer relies for 55 percent on three monthly averages of world market prices and for 45 percent on costs of production.

For sugarcane, the producer price is a system of partial payments, based on the results of the previous year.

3.2.4 Subsidies

In-so-far-as these parastatal organizations are in a virtually monopolistic position regarding both the prices at which they sell their inputs and output prices, they are not subsidized by the Government. It should however be noted that the inputs they import are exempt from customs duties and taxes, and that, at least for the sugar plantations, they are very heavily indebted towards the Government.

3.3 DOMESTIC AGRICULTURAL PRODUCTION

3.3.1 Procurement

Procurement policies

Over the past decade the procurement of fertilizer has been constrained by the availability of foreign exchange. Major sources of finance for the procurement of fertilizer have been credit lines opened by international organizations or bilateral donors, and donations of fertilizer in kind. Government has set the rules for and been increasingly involved in the procurement of fertilizer considerable over the period.

Before 1983, Government's involvement in procurement was total. The Direction des Approvisionnements (MPARA) served as the only channel for fertilizer procurement and distribution. However, since the move towards liberalization in 1984-1985, Government's involvement in procurement has progressively decreased. Government intervention, theoretically limited to the negotiations on grants and fertilizer donations in kind, is in fact still to be found through the procurement of fertilizer and its allocation. The Direction des Approvisionnements (an MPARA arm), has decisive power over the allocation of donor's

fertilizer among existing distributors.

As the constraints regarding the use of foreign exchange have been lifted, direct imports of fertilizer by the users or distributors have been made possible.

The progressive move towards liberalization of fertilizer procurement however, has not had beneficial effects on the supply of fertilizer in the country. The system whereby commercial imports coexist with fertilizer donations has in effect caused major disruptions to: the fertilizer supply system; the affordability and availability of fertilizer; and the companies involved in fertilizer imports and distribution.

Indeed it appears in retrospect that Government's policy in fertilizer procurement was not sufficient to ensure that on the one hand the various aid programs were well coordinated, and on the other hand that these supplies from aid sources were compatible with a liberalized system of commercial imports.

The problems encountered with various donor programs highlight their lack of integration. Fertilizer Aid-in-Kind does not appear to stem from a well planned procurement exercise corresponding to the needs of the agricultural sector.

There are discrepancies in terms of what types of fertilizer are demanded and supplied, quantities needed and donated, and the timing of fertilizer arrival in the country. Furthermore, donors have specific ties to fertilizer aid and their rules for distribution and procurement differ. Treatment of counterpart funds differ according to donor, as do sales prices of fertilizer to the farmers. Differing sales prices, to farmers in particular, disrupt the market when competing against commercial imports of fertilizer at world prices.

Furthermore, Aid-in-Kind has not been integrated with economic policy. Particularly in the case of the 1987 devaluation, IFAD and NORAD donations adversely affected the fertilizer market by supplying cheap fertilizer while commercial imports, ordered before the devaluation, became prohibitively expensive and could not be sold on the local market.

Finally Government's policy in relation to donor fertilizer in kind has not been compatible with the move towards liberalization of the commercial imports of fertilizer. While commercial imports are purchased at world prices, donations in kind have been supplied to the local market at a lower cost.

This has caused major disruptions to the supply system and commercial importers have had to incur excessive costs. It would also appear that some donor fertilizers sold cheaply have found their way to commercial users.

Allocation of Aid Fertilizer

Government's policy towards various aid resources has been confused. Unless otherwise specified by bilateral donor agreements, the disposal of aid supply has not been made according to specific criteria or defined systems.

Allocation of aid fertilizer since the liberalization, has been generally been through local tender. For each untied fertilizer donation, the Direction des Approvisionnements Agricoles calls for tenders for the clearing and forwarding of the fertilizer.

Thereafter, Government commissions each fertilizer aid arrival to a single company for customs clearance, forwarding and collection of funds. But it commissions the distribution of fertilizer to a number of companies.

There seems to be no system governing the allocation of fertilizer for distribution amongst the different companies. Each buyer is expected to clear his allotment with the company selected to carry out clearing and forwarding within a suitable period. Government procedures appear undefined in this area, since there seems to be no fixed rules relating to the payment of the fertilizer allotments.

The company selected for clearing and forwarding is responsible for collecting the funds from the different companies which have been allocated fertilizer for distribution. But the cleaning company has no real authority to ensure the success of this fund-recuperating operation. Some companies never pay for the fertilizer received. This in turn means that the clearing company cannot pay Government for the fertilizer.

The lack of a defined and stable system for aid fertilizer allocation has:

- been identified as a major constraint to the liberalization of the fertilizer sector
- created a situation of unfair competition amongst distributors

- resulted in major delays in the recovery of counterpart funds by the Government.

3.3.2 Distribution

Before 1982, Government, through the Direction des Approvisionnements Agricoles (under MPARA) was heavily involved in fertilizer distribution through a network of warehouses throughout the country, staffed by Government personnel. Between 1982 and 1985, Government started reducing its monopoly by enabling a parastatal, COROI, to handle some Government warehouses.

From 1984 onwards, with the liberalization policy, the monopoly position of the state was abolished and private traders could compete against the Government's supply system.

The new system has progressively been implemented with on the one hand COROI expanding its previous role under private management rules, and on the other hand, private companies which wished to do so, taking over MPARA regional warehouses and shops. The implementation of this system meant that the Government's distribution network was gradually taken over by the private sector.

This policy had the desired effect of creating competition the different distribution companies between in major rice producing areas. However the relative withdrawal of Government from the distribution network has also meant that outlying, less accessible and less profitable areas have seen a decrease or total abandonment of fertilizer supply. This is because competition between private companies occurs mainly in the major rice producing/fertilizer consuming areas of the Highlands (Antananarivo, Antsirabe, etc). Whereas this policy might be financially viable for the companies, it may seriously affect the development of outlying areas. Currently, these areas rely mainly on the fertilizer provided through the various development programs.

The way Government apportions fertilizer aid to arbitrarily selected distributors has adverse effects on the fertilizer distribution system as well as various donor programs, state organizations and other parastatal or private development programs.

The lack of Government rules about the planning of aid fertilizer or its methods of disposal has created yet another

disruptive element in the fertilizer market. Commercial importers and users have no way of knowing when a fertilizer donation will arrive or what type it will be.

Illustrative of this particular problem is the current (July 1989) situation where a supply of Italian aid of Urea has been expected to arrive in the country for the last two months. But nobody can determine whether or not it will arrive and when. In the meantime, commercial importers will not import urea for fear that they will be unable to sell it with the price differential between the donated and imported fertilizer. Moreover, farmers do not want to buy other fertilizer types as a substitute in case they can obtain a cheaper and better type of fertilizer later on. This leaves commercial distributors with stocks of unsold fertilizer.

The general feeling amongst users and distributors is that aid fertilizer in kind is not a reliable source of supply.

3.3.3 Input prices

Inputs prices for rice and to some extent other food crops in the past have tended to be set by Government at lower than world levels. Government subsidies on these inputs were given in order to ensure the use of fertilizer on these important target crops. Also, producer prices of rice were kept low.

A major policy change was implemented with the 1985 liberalization policy where, along with the liberalization of imports, prices of crops were also liberalized. The steep and uncoordinated devaluation in 1987 however greatly increased the cost of fertilizer, causing Government to reintroduce some form of administered pricing lest farmers stop the use of fertilizer altogether.

The administration of prices by Government has not followed any specific pattern. Prices of fertilizer appear to be set on a case by case basis. Different concessions are made according to the fertilizer source and to the distributors and users involved. Inconsistency of Government policy regarding input price subsidies is evident. Prices are subsidized. Customs duties and taxes remain unchanged for some inputs, but do not apply through the whole spectrum of importers.

This pricing policy, or lack of systematic pricing rules, has resulted in the coexistence of different price sets for the same product. This has resulted in various price structures which

may or may not favor certain consumers or crops. Efficiency in distribution has been affected by this ad hoc price setting system whereby importers and distributors have no reliable sources of information; for supplies of fertilizer due in country, or for their selling prices.

3.3.4 Output prices

Output prices for rice were kept artificially low to ensure affordability of rice for the urban dwellers until 1985 when the ceiling consumer price of rice was eliminated.

The effects of this liberalization were however softened by the constitution of a 'buffer stock' for rice which was based on cheap rice imports (or donations in kind). This buffer stock served the Government as a reserve to be used for rice releases on the local market when local prices tended to increase.

The policy of setting price ceilings for rice has had detrimental effects on production levels, as input subsidies have not been high enough to offset the low selling prices of outputs. In general the output/input price ratios have been such that farmers have not seen any benefit in producing surplus rice for sale. This has especially been the case in the region of Lac Aloatre and in some more remote areas, where rice production potential has been severely constrained by its unfavorable price.

Although prices have been liberalized since 1986 and the floor price for rice almost doubled between 1982 and 1985, price still remains at a level which cannot support the economical use of fertilizer at world prices to many smallholder farmers. This makes the use of fertilizer only marginally attractive to farmers.

The problem is even more acute in remote, less accessible areas, where farmers cannot dispose of their surplus production even if prices were favorable.

As indicated above, few rice farmers use fertilizers even on the Highlands. At present world market prices for fertilizers, it is either too risky or only marginally profitable to use NPK. If domestic rice prices were to increase by 50 percent, a very large number of small holders in the Highlands would find fertilizer use profitable. The radius of profitable use would extend from the main distrubution centers. But outlying farmers would still not be able to overcome high transportation costs. For most farmers in the Highlands, and for all farmers in outlying areas, improved husbandry techniques without fertilizers would generally be a recommended option. But such

farmers also have to overcome the high cost of bringing surplus rice to urban markets.

3.3.5 Subsidies

Direct subsidies on fertilizer stem from the input price settings as seen above. Another form of direct subsidy results from the various exemptions to custom duties and taxes given to some importers and some parastatal crop development organizations. Subsidies of the latter sort are far from being uniformly applied and vary from organization to organization.

A form of indirect subsidy is given unofficially through the diverse delays of repayment of donated fertilizer by the distributors to Government. This, however does not directly affect the consumer.

3.3.6 Transportation

The lack of consistency in Government's policy regarding transport infrastructure has led over the years to a drastic deterioration of the road, rail and naval network. Most roads, especially in the rural areas, have been totally neglected and need major rehabilitation works.

The effect of this deterioration in the rural transport network has been two-fold. Firstly, the movement of fertilizer and produce in most areas has been seriously constrained. Secondly, the price of fertilizer increases as one moves away from the more accessible routes.

3.3.7 Promotion

Various efforts have been made through Government, donor and non Governmental organizations to promote the use of fertilizer amongst the smallholder farmers. However, effort has not been distributed evenly throughout the country. The main promotion efforts have been focussed on the Highlands where, for example, seventeen different operating programs exist in Antsirabe while the South East has at best only two.

Government's active policy in promoting fertilizer use has been limited to its involvement through the Direction de la Vulgarisation Agricole (DVA). It seems to have left aside any coordinating or integration role for existing policies on fertilizer promotion emanating from donor or non Governmental organizations.

(1) The DVA (Direction de la Vulgarisation Agricole)

The extension arm of the MEARA - DVA - is responsible for the promotion of fertilizer use amongst smallholder farmers.

It divides the country into 22 extension areas (called CIRVA = conscription de Vulgarization Agricoles) out of which 6 are under direct project control rather than under DVA control.

The 16 areas under DVA are manned by some 1,500 extension workers. But while in the Highlands the extension worker/farmer ratio is high at around 1:250, the ratio decreases when moving outwards to the coastal areas. An average ratio for the country is estimated at 1:1000.

Over the last decade or so, the DVA has suffered many financial and technical constraints resulting in the following:

- understaffing
- lack of control over the activities undertaken in the field by extension workers
- lack of mobility for extension arising from workers or lack of transport
- no dissemination of research results to farmers
- in general, very poor coordination and monitoring of activities in the field.

Typically messages given to farmers concerning fertilizer usage emanate from historical research findings, which have remained unchanged for the last 15 years.

This has undoubtedly led farmers to be skeptical in their reception of the extension message. This has been exacerbated by the fact that fertilizers recommended no longer correspond to the types of fertilizer available on the market, and also because the level of instruction of extension workers (recruited some 20 years ago with only primary education) is often less than that of the farmers themselves.

This situation prompted the World Bank to finance in 1987, a new Program National de Vulgarisation Agricole in 3 extension areas. The new strategy of farm visits and training has been adopted. New extension workers have been recruited, increasing the extension worker/farmer ratio to 1:500 in these three areas. Extension workers receive fortnightly training from technical specialists. New means, to especially in transport facilities have been given to extension workers, and links between DVA and research have been developed.

The new program has also changed the emphasis of extension work away from themes on fertilizer usage towards crop husbandry themes adapted to the farmers' current environment conditions. Extension messages on fertilizer use are now seen more as the last of all themes to be passed on to the farmers, once all the other conditions have been met.

The new extension program launched by the World Bank has been beneficial in-so-far-as it has initiated a new dynamism in the organization of the DVA.

(2) Parapublic Organizations

Parapublic organizations encompass both the regional development projects and the specific crop development projects.

These programs all have an extension element which is organized broadly on the same basis as the DVA extension program. Their financing means however differ significantly according to whether or not they are supported by international donor funds.

Similarly, some of them are engaged in research efforts which are directly linked to the farmers. Messages on fertilizer usage can thus be more adapted to the specific soil and climatic conditions of the area and to the availability of fertilizer in the area. Demonstration farms and demonstration plots are also developed for specific crops (vegetable plots especially), helping the farmer to identify direct benefits of good husbandry practices and fertilizer usage.

For the parastatal organizations which maintain a monopoly over the purchase of the harvested crop and its marketing

(such as HASYMA, SIRAMA, etc.), extension efforts are well organized since it is to the organizations advantage and benefit to give the farmer the best advice.

HASYMA however seems to have encountered problems in its extension efforts to smallholder farmers since it recently largely increased the number of farmers and areas involved in cotton production, without a corresponding expansion in the extension facilities available.

(3) Other Non-Public Organizations

Other non-public organizations are also involved in the promotion of fertilizer use amongst smallholder farmers. They do not receive any specific Government support and rely mostly on support from missionaries, with or without international donor support. These small programs are usually well organized, spread into remote rural areas, and extend their efforts beyond purely agricultural advice. These programs however have limited funds and their success in promoting fertilizer use will be very dependent upon the availability and prices of fertilizers.

Finally, judging from the level of fertilizer use in the country, there has clearly been a problem either in the methods applied in the promotion of fertilizer use, or other factors such as poor input/output price ratios which have adversely affected the use of fertilizer.

Delivery to Farms

The rural access transport infrastructure is generally so poor that the distribution of fertilizer is limited to those accessible areas where distributors maintain stores and shops. These typically are situated along the main roads. Distribution away from these centers is through retailers situated 5 to 10 Km away from the main roads, who are supplied from the main stores. Farmers purchase their supplies from these retailers, either by ox cart or by foot, since there is a lack of both transport and accessible roads. This situation seriously affects fertilizer use away from the main roads.

The incentive for farmers to obtain fertilizer supplies through these means is further constrained by the unfavorable price for fertilizer, and by the fact that farmers in remote areas are not stimulated to produce surplus production if there is no local market for surplus at harvest time.

3.4 A SUMMARY OF THE IMPACT OF GOVERNMENT INTERVENTION

The various Government interventions and actions have been outlined above with their general effects on the fertilizer sector. Summarizing the effects of those policies, one can note that:

1) Efficient marketing has been constrained by arbitrarily fixed rules for fertilizer allocation and distribution, subsidies on fertilizer prices, and various concessions made for various importers and users of fertilizer.

2) Efficient distribution has been constrained by a total lack of Government involvement in the maintenance and development of transportation networks. Also the lack of rules in the allotment of fertilizer to various distributors has limited the beneficial effects of liberalization to certain areas and certain crops.

3) Efficient consumption has been constrained mainly by the pricing policy. But also by the various other relevant policies. Other relevant constraining policies have been responsible for the closure of distribution shops in remote areas, deterioration of rural transportation networks, an unreliable fertilizer supply system and the unavailability of the fertilizer types needed.

4 FERTILIZER MARKETING

4.1 OVERVIEW

Madagascar's agricultural production is scattered in pockets around the country, with the Highlands being the main production area. Rice is by far the most important crop, and is grown throughout the country. Each cash crop, on the other hand is concentrated in a specific areas; coffee along the east coast, sugarcane in the north-east and west, and cotton in the mid and south-west. Most of the (limited) fertilizer used in Madagascar (about 30,000 MT) is applied to three crops: rice (1.2m ha), and sugarcane (59,000 ha), cotton (about 30,000 MT). Hardly any fertilizer is used on coffee (223,000 ha).

The marketing of fertilizer in Madagascar differs according to area and crop. The issue applies mainly to fertilizer supply to smallholder rice farmers in the Highlands. Fertilizer is used on rice mainly in the Highlands and only there is a fertilizer marketing system developing to supply the large growing food and cash crops, estates and smallholders growing rice and other food crops.

Most of the marketing effort in this limited area, is along the main trunk routes. The state of the roads severely limits penetration of the country-side. The total fertilizer market for this area is currently about 24,000 MT. At FMG 400,000 per MT, assuming a 40% gross margin for the whole distribution chain, the distribution business is worth about US$ 2,400,000 a year. At the moment, this amount constitutes what is available to support the supply network from importer to stockist.

The state, through MPARA, has been deeply involved in fertilizer marketing in Madagascar. As a result marketing has undergone profound and frequent changes. Although MPARA involvement has been reduced in the last few years, the devolution exercise is still continuing. It is important to highlight that fertilizer marketing is still in a transition stage. The Government intends to eventually entirely terminate its involvement.

4.2 TERMINOLOGY

The following translation of French terms is used for the purposes of this report:

a)	Operateurs economiques	-	commercial importers and distributors.
b)	Operateur principal	-	primary distributor.
c)	Operateur secondaire	-	secondary distributor.
d)	Revendeur	-	stockist.
e)	Sous revendeur, detaillant	-	retailer.

The expressions "primary" and "secondary distributors" apply primarily to the disposal of fertilizer aid. A company can be a primary distributor for one aid shipment and a secondary distributor for another. Stockists supply 'sous revendeurs' and 'detaillants', ie retailers, but also do retail trade on their own account. The '<u>organisme d'encadrement</u>' is translated as extension service, but with additional functions, such as credit evaluation and supervision.

4.3 EVOLUTION OF FERTILIZER MARKETING

Fertilizer marketing in Madagascar must be seen in the perspective of the size of the fertilizer market, which is very limited.

4.3.1 Aid Imports and Commercial Imports

Madagascar's fertilizer imports have always been highly dependent on aid, either in the form of Aid-in-Kind mainly for rice, or as financial credits for commercial import, especially for cotton and sugarcane. Given the chronic shortage of foreign exchange, very little has been imported using the country's own reserves of convertible currency. Commercial imports only took off in 1987 when CASA foreign exchange was made available for such imports, and declined thereafter, when high prices and aid fertilizer undermined them.

Whereas limited commercial imports have always been handled entirely by the commercial companies, the imports of aid-in-kind have undergone substantial changes:

- Aid imports before 1982, were handled exclusively by MPARA.
- Aid imports since 1982, have been handled by a primary distributor appointed by MPARA.

4.3.2 Distribution

The distribution of fertilizer has also followed the MPARA import policy regarding aid fertilizer. Fertilizer distribution in Madagascar, past and present has been handled as follows:

- Up to 1982, distribution was the monopoly of the Direction des Approvisionnements Agricoles (DAA) of MPARA, from the port to their arrival at final destination in the selling stores of CIRAA (Circonscription Regionale des Approvisionnements Agricoles).

- From 1982 to 1984, COROI was given the distribution of aid fertilizer to the CIRAA and COROI stores.

- From 1984, COROI was also given the handling of aid fertilizer, as well as the distribution. MPARA rented its stores in the ODR area to COROI (as per agreement with IFAD).

- From 1986, the handling and administration has been entrusted to a primary distributor (originally COROI), with secondary distributors receiving a share set by MPARA for their own distribution and sale. Since that year the MPARA has progressively rented out its stores to other distributors.

  In the past, and also at present MPARA has retained some stores in certain areas where private distributors have shown no interest.

4.3.3 Retailing

The retail trade has been linked to the progressive disengagement of MPARA.

- Up to 1982, the retailing of fertilizer was largely dominated by the MPARA supply network, where selling operations used to be carried out by Government agents/employees. COROI and SEPCM maintained a small presence in some areas of the Highlands, and were the only suppliers of stockists.

- From 1982, stockists could buy fertilizer from COROI at a price that enabled them to compete with CIRAA sales. Meanwhile, the proceeds from CIRAA sales were paid to COROI, which then had to pay the Government.

Currently, the retail trade has almost entirely been left to the private sector, except in some remote areas where some selling points are still maintained by Government agents. In the areas where organizations such as HASYMA and SOMALAC operate, they undertake their own sales from their own stores.

4.4 THE SUPPLIERS

The fertilizer suppliers in Madagascar can be categorized as follows:

- The Importers. The genuine commercial importers which have consistently imported under commercial conditions are COROI and SEPCM. Small quantities were imported in 1987 by Hoechst and SEIM, under CASA, but they have not imported again. HASYMA and SIRAMA, the state cotton and sugar monopolies, have also imported.

- The Distributors. The main distributors at national level are COROI, SEPCM, AGRICO, OMNIUM, ECOPLANT, and SEIM. COROI has the oldest and largest distribution network. They have all received a share of fertilizer aid supplies for distribution and sale. There are other smaller private companies which sell aid supplies mainly in the Highlands.

- Regional Distributors. Apart from the distributors given above, AFAFI and SAFAFI are essentially regional distributors.

- The Stockists and Retailers. They buy fertilizer from distributors and sell it to the farmers. They operate mainly in the Highlands.

- The Various Extension Programs, (ODR, ODASE, FIFAMANOR, etc) They sometimes supply fertilizer to farmers. In general, however, they are withdrawing from this activity.

The main importers and distributors and their capacity are summarized hereunder. Profiles on some of the major companies are given in Annex 3.

- COROI. A nationalized, Government-owned company, it is the main importer and distributor with the largest country-wide network of 17 branches. The company, and therefore the branches, are involved in many activities such as managing plantations, buying agricultural produce, and supplying inputs (including fertilizer). It also has a wide network of stockists, which supply both farmers and retailers.

- SEPCM. A private company, and the oldest fertilizer supplier in Madagascar. It has catered mainly for cotton and sugarcane needs. Its involvement in distribution is limited. It has 5 depots from which it supplies its customers.

- OCM. A private company, operative since 1982. It has various activities, from vehicles to agricultural inputs and production. It has only distributed, but never imported fertilizer aid. It has stores in Antananarivo and 27 selling points (ex-MPARA) around the country. It uses its own lorries for distribution. It does not carry out extension work.

- AGRICO. A new private company (about 2 years old). It markets various agricultural inputs, such as equipment and veterinary products, and distributes fertilizer aid.

- ECOPLANT. A new private company (about 2 years old). It has only distributed, but never imported, fertilizer aid. It represents overseas suppliers and has 30 selling points in the country, having taken over some of the MPARA selling points. It sells mainly to small holders and provides advice.

- SEIM. Mainly a producer of cooking oil. It has diversified to achieve economies of scale. Agricultural inputs are only a side activity. It only sells inputs to its contract farmers and on direct orders. It has, three selling points.

- AFAFI. A regional distributor based in Fianarantsoe, and operating exclusively in that province. It does not have as much access to aid fertilizer as the other distributors. Nevertheless, it has been able to actively expand its area of operations from the Highlands to the coffee growing areas of the coast. It is the agent for Hoechst products.

- SAFAFI. Created in 1982 for the coordination of Lutheran Church projects in Madagascar. It has a variety of activities. It receives some free fertilizer from NORAD. The fertilizer is sold at SAFAFI extension centers at prices that the farmers can afford. These prices are the same throughout their area of operation, which is wide, from Antsirabe in the Highlands to Farafangana on the South East coast.

4.5 THE CONSUMERS

The consumers of fertilizer can conveniently be split up between farmers and plantations and the various crop sub-sectors.

- Rice. Fertilizer is used mainly by the small farmers of the Highlands. They are supplied by the commercial suppliers named in section 4.4.

- Cotton. Fertilizer is used by the large cotton plantations (mainly mid-west) and the small farmers (mainly south-west). They are supplied by HASYMA, the state cotton monopoly. With the liberalization, plantations in particular can buy their own inputs, but in practice HASYMA is still a convenient supplier as it supplies on credit.

- Sugarcane. Fertilizer is used by the large plantations and smallholders. They are supplied by SIRAMA, the state sugar monopoly. There is also a large Government sugar plantation, SIRANALA, which imports its own requirements.

- Coconuts. Fertilizer (about 2000 MT) is used mainly by SOAVOANIO, a state company.

- Coffee. Despite being the second most important crop (area-wise), hardly any fertilizer is used on coffee by smallholders. Some is used by the coffee plantations (about 200 MT).

- Other Crops: smallholders. Some fertilizer is used in the Highlands on food crops such as potatoes, and vegetables (carrots, tomatoes, etc). Maize, wheat and soya use very little fertilizer. MALTO provides some fertilizer for its barley growers. Cash crops scattered in different corners of the country such as clove, pepper, vanilla, cocoa, etc, use hardly any fertilizer.

- Other Crops: large holdings. Commercial plantations, state farms, cooperatives, etc. Oil palm (200 MT), tobacco, etc, also use fertilizer depending on financial resources.

4.5.1 Consumer Information

Information on fertilizer available to consumers again varies depending on the crop. It is supplied mainly by the various extension services, and to a limited extent by some fertilizer suppliers.

- Rice. Information is provided by the various extension programs, such as ODR in Antsirabe, SOMALAC in Lac Alaotra, SAMANGOKY in Samangoky, FIFABE in Maravoay, FAFAFI, etc.

- Cotton. Information is provided by the extension services of HASYMA.

- Sugar. Information is provided by the extension services of SIRAMA and SIRANALA.

- Tobacco. Information is provided by the extension services of OFMATA.

- Coffee. Information is provided by the extension services of Operation Cafe in Toamasina and ODASE in the South East.

- Others. FIFAMANOR for potatoes. MALTO for barley.

4.6 THE CURRENT MARKETING SYSTEM

The marketing system in operation at the moment and as described in this section, applies essentially to the Highlands. Fertilizer marketing in the cotton and sugarcane growing areas is essentially carried out by the parastatals HASYMA and SIRAMA which are responsible for those sub-sectors.

The fertilizer marketing system for Aid-in-Kind differs essentially from that of commercial imports. Aid-in-Kind is the dominant (if not exclusive) provider for the rice crop, mainly in the Highlands. Commercial importation is used to supply cotton and sugarcane requirements. There is therefore a considerable difference between the two marketing systems, and they will be treated separately.

The current MPARA involvement is limited to negotiations of aid supplies, their allocation, and their price setting. Since the advent of SILI, commercial fertilizer importation uses available foreign exchange without Government allocation. Fertilizer imports under bilaterally negotiated credits still require Government involvement.

Despite heavy investment in two fertilizer producing ventures, a ZE-REN Urea plant in Toamasina and a ZEMA organic fertilizer plant in Amboasary-Sud in the South-East, there has been no fertilizer production in the country. All chemical fertilizers are imported. There are no bulk blending or bagging facilities, all fertilizer therefore arrives as a finished product in 50 kg bags.

4.6.1 Aid-in-Kind Imports

Aid-in-Kind has been supplied mainly by NORAD. Although the fertilizer is for the Government(MPARA), an amount is set aside to be given free to NORAD beneficiaries such as SAFAFI, ROMANOR, and FIFAMANOR.

Import Planning

There is not much planning of aid imports by MPARA as these imports are subject to bilateral negotiations and are difficult to plan.

Importation

After bilateral negotiation, MPARA appoints a distributor to handle the aid on arrival, who arranges clearing and forwarding, customs clearance, insurance claims, and some transport. MPARA also apportions the consignment between the distributors. Secondary distributors buy from the primary distributor, and arrange transport for their purchases. Part of the fertilizer is supplied free to bilaterally designated organizations.

Distribution

The secondary distributors sell their supplies as they see fit. Most of them maintain their main stores in Antananarivo, since using the ex-MPARA regional stores tends to be risky and expensive. Marketing methods, of course, vary. COROI, for example, has a network of captive stockists who only market COROI supplies and rents some of its MPARA stores to them. Distributors compete for stockists, and offer them different

incentives. Some stockists deal with more than one distributor. Ecoplants makes active use of ex-CIRAA distribution channels. A number of distributors use CIRAA vehicles (paying only for fuel) to transport fertilizer to outlying areas.

Retailing

A good system exists between stockists and retailers. Fertilizer is sold either in 50 kg bags or in smaller quantities out of the bags. The established companies such as COROI and SEPCM have stockists who work only with them. Others make use of the ex-MPARA selling points and agents. Terms of sales by stockists to retailers (sous revendeurs) and users vary.

Retailers may carry fertilizer supplies or use ox-drawn carts to reach villages off the main routes.

Credit and Finance

No credit lines or finance seems to be needed for the primary distributor, except for the direct costs of the consignment.

Payments

The reconstitution of the funds from aid fertilizer is a complex affair. Government subsidizes fertilizer prices using these funds, so that the primary distributor pays the Government a price agreed between the two parties, which has no direct relation to the CIF value of the fertilizer. The payment arrangements are also agreed between MPARA and the distributor. Payment is to be made from 13 to 24 months from arrival. However, payment terms for secondary distributors to the primary distributor have only lately been changed to 30 percent cash, 30 percent at six months, and 40 percent at 12 months. There are no interest rate charges and in practice no legal penalties for default.

The primary distributor is paid by the secondary distributors and repays Government the agreed amount for the fertilizer. The amount depends on the agreed price.

Each primary distributor gives stockists and retailers different payment conditions. Indeed payment conditions vary for different stockists of one distributor as each stockist has different records, agreements, etc, as befits a market system.

Problems

There are many problems with the current fertilizer Aid-in-Kind:

- It is often late, causing shortages and prolonged storage.
- It is not sold to distributors on a commercial basis.
- It leads to unsecured debt to Government.
- It is more convenient than commercial imports, thus making it detrimental for commercial imports which become less preferable.
- It is allocated on an arbitrary basis.
- It does not ensure payment of countervalue funds.
- It is not necessarily bought by secondary distributors on arrival.

4.6.2 Commercial Imports

Import Planning

Distributors plan their commercial imports according to their perception of the small farmer market, availability of finance, and of foreign exchange. Imports for quantity buyers are based on tender specifications. Quantity buyers, like HASYMA and SIRAMA , know their requirements, but also must consider finance and foreign exchange availability.

Importation

Most commercial importation has been carried out by COROI and SEPCM using foreign exchange credits provided by CCCE, World Bank, and FIDA. HASYMA and SIRAMA have also used CORDI and SEPCM. However, fertilizer can now be imported using SILI. Each of the credits has its own rules and regulations.

Further details are given in Chapter 7.

A 5% tax on fertilizer imports was introduced in November 1988.

Distribution

The commercial imports are generally imported for a specific customer and therefore are not distributed by the importer.

For the commercial imports not destined to HASYMA, SIRAMA and the large end-users, the importers use their distribution and selling networks to sell the fertilizer.

HASYMA and SIRAMA carry out their own distribution.

Retailing

Follows the same pattern as distribution.

Credit and Finance

For commercial importation, the importers need credit lines or own finance. Fertilizer imports require substantial finance that most companies do not have, or bank credit lines. It has been reported that bank credit lines are difficult and lengthy to obtain. This is a constraint to commercial importation. Some companies, eg Ecoplant (with a share capital of FMG 1,000,000 (US$ 625)), are unlikely to be able to secure much bank credit.

In fact in the past, credit has essentially been provided by the credit lines extended by the donors for imports. The CCCE has been providing substantial amounts of funds for the import of fertilizer. The user of these funds had 9 to 12 months interest-free repayment period, and therefore did not need local currency credit lines.

With the advent of SILI, of course, importers have to have the local currency credit lines to open the required instruments for importation, eg letter of credit.

Payments

As this is normal commercial trading, there are no standard payment systems at all the levels. Payment conditions depend on agreements between the parties concerned.

Market Share

The market share of each distributor can be approximated by the quantity of the aid supplies they have received. COROI currently has the largest market share.

Promotion

There is very little, if any, promotion of fertilizer by the suppliers. The activity tends to be left to the extension services provided by the state (CIRAA) or by specific programs, like ODR, ODASE, etc. COROI does a limited amount of demonstrations.

Incentives

The liberalization of fertilizer marketing in 1986/87 saw the advent of commerce in agricultural inputs in Madagascar. New private companies were created, drawn by the country's enormous potential in the agricultural sector.

The availability of aid supplies to distributors has been an important stimulus, possibly the key one. Companies have not only had access to considerable quantities of fertilizer without up-front investments of funds, they have also enjoyed a very generous and lax repayment regime.

The current situation of being able to sell fertilizer without any particular effort with regard to promotion and advertising has also encouraged new distributors to extend their network. This easy situation may not last as competition increases with broader availability.

The possibility of continuing in the distribution trade without making any commercial import is finally an incentive for those distributors that depend on supplies purchased locally from aid organizations or other distributors.

4.6.3 Effects of the Combination of Aid Fertilizers and Commercial Imports

Availability

Fertilizer availability at national level is affected both positively and negatively by fertilizer aid. The aid helps to ensure availability (and maintain reasonable prices). On the

other hand the poor planning of aid undermines commercial importation, and therefore availability. The current MPARA involvement affects national availability negatively, as the aid could be better integrated into the marketing system.

With regard to availability in the field, some MPARA involvement may be beneficial to ensure that fertilizer is available in areas that the distributors do not find profitable or expedient to serve. Even such involvement should not be institutionalized. It should rather be part of specific project type initiatives.

Demand for different fertilizer types is limited by availability

The rice farmers of the Highlands seem to be inflexible in their demand for very specific types, such as NPK 11:22:16, which must also be of the right color (grey in the case of the NORAD material). On the other hand, in some areas, other material, such as the pink NPK 11:22:16 from Brazil (now considerably deteriorated), is bought as no alternatives are available.

The private sector has not improved national availability through imports mainly because conditions still militate against commercial importation and favor aid distribution. Although it may have increased availability in the field, this has only been concentrated along the main trunk routes. In general, the distributors cannot be said to have improved availability throughout the country. Such availability is likely to have been reduced since the phased withdrawal of MPARA.

The risk with aid incentives is that they are not sustainable in the long run. If and when they are withdrawn, the distributors might have to return to a lower, affordable level of business which would not enable the country to meet the self sufficiency objectives in food production. (See Chapter 8 for development scenarios).

Use

The effects on availability have clearly affected use. The net effect of policy changes and interventions by the Government have decreased fertilizer use.

The Current Situation With Aid Fertilizers Versus Commercial Imports

The fertilizer import liberalization and the availability of CASA and FIDA credits for commercial fertilizer imports, greatly spurred importation in 1987. This was paralleled by imports of fertilizer Aid-in-Kind. The ensuing over-abundance of fertilizer, did not spur consumption because the heavy devaluations (and credit conditions) led to huge increases in fertilizer prices. Therefore, after peaking in 1987, fertilizer imports have plummeted, in step with demand.

After being caught with unsalable fertilizer and having to compete with cheaper aid supplies, importers are very wary of committing themselves to new imports. They now prefer to await definite information on the supply of aid fertilizer, such as the long expected supply of Italian aid UREA, before making a decision. Besides, the handling of aid fertilizer tends to be a more interesting business.

The distributors are still holding old stocks, such as part the NORAD shipments, as well as unsold IFAD-financed stocks. The latest shipment of NORAD 11:22:16 which arrived in January 1989, remained largely unsold by June 1989.

Counterpart funds

The payment of counterpart funds by many primary distributors is far in arrears. For example, only 10 percent of the value of the fertilizer donated by the EDF in 1986 has been repaid. It appears that this situation is the rule rather than the exception.

4.6.4 Payment systems for Fertilizer Imports

There are three payment systems in operation for fertilizer imports, ie Aid-in-Kind, bilateral and multilateral credit lines. Both bilateral, and multilateral credit lines are for commercial imports under Balance-of-Payments Support Arrangements.

a) Aid-in-Kind

Every shipment of Aid-in-Kind is subject to bilaterally agreed, specific payment rules, which may differ from donor to donor. Usually the primary distributor has a facility to delay payments for the fertilizer 13 months to 24 months

after physical arrival of fertilizer in port. (See Chapter 5).

b) Bilateral Credit Lines

Under bilateral credit lines of foreign exchange (eg CCCE) some are tied to a country of origin, while others are not. Whether tied or untied, some are restricted to certain commodity categories, others leave the choice to the Malgache authorities.

Primary distributors/importers can make use of these credit lines to import fertilizer. Repayment facilities vary from credit.

Under the bilateral credit lines, it is not only the foreign exchange that is given on credit to the Central Bank, but in addition, the credit facility is passed on to the importer.

c) Multilateral Credit Lines

Multilateral credits lines of foreign exchange have been granted by the World Bank (CASA) and other institutions (SILI) to the Central Bank. Importers have been able to draw on these foreign exchange funds if they pay the counterpart up-front in local currency.

Such local currency is obtained by the importer from his own resources or commercial bank facilities independent of other institutional arrangements.

4.6.5 Constraints

Importation

Extremely little importation is financed via the normal channels, ie through the banking system. With the advent of SILI, on the Open General Licence - type system, importers have had to secure the necessary local currency credit lines through the banking system to import. The precarious financial position of the interested parties and the difficulty in establishing such credit lines, are likely to be important constraints to commercial importation. This is somewhat reflected in the fact that CASA credits have not been snapped up - they require normal banking operations that other credits, eg CCCE, do not.

The system is currently developing into one in which the financial viability and availability of a company will determine whether it can import or not - as should be the case. In any event, foreign exchange availability is no longer a constraint to fertilizer importation.

A further constraint to importation under commercial conditions is foreign exchange risk. As importers start to import, they may incur a foreign exchange risk if they negotiate delayed payment. Given the devaluation record, this may discourage importers.

It has been reported that external payment delays are currently not legal. If this is indeed the case, then either the importers will have to take up the very onerous burden of pre-financing the import or the banks will have to do so. To pay cash well in advance of sale (which in Madagascar may take a long time) is likely to be beyond the capability of many, if not all, companies.

tribution

The constraints to private sector distribution are primarily the limited market and the limited margins. After the devaluations, fertilizer prices increased considerably. This depressed demand and margins. Government intervention through the continuation of price-setting by MPARA for Aid-in-Kind fertilizer, resulted in tight margins.

There are too many exceptions in the import and pricing systems for fertilizer. There should be no such exceptions. Rules on taxes, custom duty, regional subsidies, payment terms for distributors, interest, etc should be clearly uniform across the board.

4.7 SMALLHOLDER CREDIT

The smallholder credit system has been described in considerable detail in two reports: "Approvisionnement Du Monde Rural En Facteurs De Production" by SEDES, January 1983, Section 1.4 "Le Credit Agricole" pp 48-55; and a recent report (28 June 1988) by the World Bank dealing with the experiences of its first agricultural credit project in Madagascar: "Premier Project De Credit Agricole - Rapport D'Achevement", CREDIT 1064-MAG.

The first credit project came into force in August 1981 and was terminated in December 1986 (termination originally planned for

June 1984). Project costs were estimated at US$14.2 million, the IDA contribution amounted to US$11.5 million and eventual drawdowns came to US$10.93 million. (A follow-up project 1804-MAG amounting to US$10 million was agreed on 31 July 1987).

4.7.1 Smallholder Target Groups

BTM loans, with World Bank assistance, were aimed at:

(a) seasonal credits

(b) medium term credits for the rehabilitation of old coffee plantations and for the planting of sugarcane and purchase of draft animals

(c) long-term credits for the establishment of new plantations of permanent crops; and

(d) experimental credits for a variety of development purposes.

The project did not achieve its objective of increasing in the volume of lending to smallholders. Only 2 percent of the IDA funds intended for this purpose were drawn down. The main use of the funding under the project has been to finance imports to the agricultural sector, in particular fertilizer imports.

4.7.2 Administration and Approval of Loans

The system which generally applies in administration and approval of loans to smallholders, and the problems of cost-recovery can be described as follows.

a) The local community group at the lowest level, which may be a village, and the local representative of the agricultural extension services draw up a list of prospective borrowers.

b) A representative of BTM, one from the local community group and the extension officer examine the list and make a decision regarding each individual loan application.

c) BTM then will finance the loans and the local community group assists in disbursement and cost recovery.

d) If the recovery rate falls below 95 percent at the date due, the local community group is struck off the list for loans the following year.

4.7.3 Loan Recovery Rates

Recent past experience at field level is that many local community groups have been struck off the list of credit worthy borrowers, because their members have been unable or unwilling to repay loans.

The loan recovery rate on the 1977/78 seasonal loans was only 22 percent at the dates due. The low loan recovery rates in the village or community loan distributions has caused BTM to put a brake on smallholder lending. Our understanding of this is that bad default rates would cause any accountable financing institution to react in the same way. The World Bank report takes a similar view, regarding BTM's backtracking as judicious. Hence, lack of funds in the banking institutions is not the limiting factor.

4.7.4 Interest Charges

The interest rate for such loans went up from 10 percent in 1979 to 16 percent in 1988. The current interest charge now is 18 percent as against a normal commercial lending rate of 21 to 22 percent.

4.7.5 Small Loans of Short Duration

One must bear in mind that the individual smallholder credits for fertilizers will normally run for only 5-6 months, between land preparation and harvesting. The financing need for an individual farmer seldom exceeds the value of fertilizer for an area of one hectare. At the farmgate level the cost of 300 kgs of fertilizer, ie enough for one hectare, would amount to approximately US$110 at the current import parity cost of fertilizers bought at world prices.

Most smallholders have less than one hectare and their individual borrowing needs would be for less than US$90 dollars per planting-harvesting cycle.

4.7.6 Farmer's Risk Avoidance

Under prevailing circumstances it is not surprising that farmers will rather resort to traditional barter borrowing, or not borrow at all. The farmer borrows a bag of fertilizer against agreed repayment in the form of so many kilos of rice. No cash changes hands, but if the farmer's harvest fails, or if the price of rice goes up after the harvest, he or she will regret

having parted with the rice. He will feel, rightly or wrongly, that he would have done better borrowing in cash and repaying in cash, or by not borrowing at all. The local seasonal variations in rice prices, between harvests, can be very large and cause much agony to farmers who have had to dispose of their crop immediately upon harvest.

4.7.7 Minimal Impact on Target Group

Altogether it is thought that perhaps 6,000 smallholder families producing foodcrops have been assisted out of 25,000 borrowing households in total. Spread over a number of years, the annual disbursements have been dismal, and indicate that the smallholder credit system will remain the chief limiting factor in enabling farmers to demand for fertilizers.

4.7.8 Identification of Constraints

The domestic lending bank that BTM used in the disbursement process is regarded as especially qualified to deal with rural financing, since it has a vast network of rural branches (44 branches and 22 sub-branches in 1988).

These BTM problems do not appear to be a limiting factor to smallholder credit as such. BTM's agricultural lending is substantial: 35 percent of BTM's total lending in 1987 was directed to the agricultural sector, of which only 6 percent went to agricultural production, and 29 percent to the financing of commercial transactions. Out of the 6 percent for agricultural production, only 2 percent of BTM's total lending went to smallholders.

The Credit Delivery System at the Rural End

A substantial increase in smallholder credit would seem possible within the resource base available to BTM. The constraining factors are to be found in delivery systems at the rural end, in the risks to the borrower and the risks to the lender, and in the number of stages that credit approvals have to pass.

Extension Services

One cause of limited distribution of smallholder credit has been the very slow development of the agricultural extension services which Madagascar has experienced since 1983, combined with the slow movement of the loan disbursement mechanism. The World Bank

has made this observation and remarks that, as a result, the agricultural sector is turning inwards on itself and increasingly resorting to a non-monetary subsistence economy. "The population increase makes it more difficult for the farmers to return to using the market mechanism".

Field interviews have revealed that the extension officers are a declining ratio in relation to the growing population of farmers. Their effectiveness is also limited by immobility caused by the lack of adequate and reliable vehicles. Irrespective of whether development will take place through smallholder credit, or through the farmers earning enough to be able to pay for themselves without loans, improved extension services are indispensable.

Need for Cash Earnings through Realistic Pricing of Inputs and Outputs

Our analysis elsewhere in this report has shown that the majority of traditional smallholders are not earning enough of a cash surplus in their on-going operations, to make it worthwhile to improve their land by spending money. Our scenarios to year 2000 indicate that fertilizers will be necessary, and not merely desirable, and that about one-third of all farmers will have to be brought into fertilizer usage systems. There is no possibility that such a number can be reached by any rural credit delivery system. Therefore, they must be able to pay for inputs as they need them.

A more effective reflection of world market prices for food crops and for agricultural inputs, at farmgate level would, on present indications, give farmers the incomes and incentives to improve their productivity. The World Bank report likewise remarks that intermittent Government interventions in the pricing mechanism have made the producers less inclined than otherwise to buy inputs.

In the same context the World Bank report reviews its estimates of Value Cost Ratios in paddy production. The 1986 ratio of 3:1 is regarded as giving incentives to development. The post-devaluation ratio of 1987 fell to 1.3:1 because of a lower paddy price and rising input prices. The Bank regards this as having a negative impact on the ability of the farmers to repay their season loans for 1986/87 and also on their willingness to contract new loans.

4.8 CONCLUSIONS

4.8.1 A System in Transition

Fertilizer marketing in Madagascar has gone through a rapid transition from a Government-run system to a privatized one. This has been a key policy change. The rapidity of the change, in conjunction with other structural changes, made the transition messy. The result was an upheaval of the system which affected fertilizer use and supply. Fertilizer marketing is still in this transition phase. The situation is complicated further by the flexible way in which rules are applied, and in which exemptions and special considerations are rife. The result is a lack of confidence in the system by both suppliers and users. There is therefore an urgent need to stabilize the situation and establish an environment conducive to development.

4.8.2 The Design of a Marketing System

A plan for the development of the marketing system needs to be drawn out which will not only define the roles of the Government, private sector, and of aid organizations , but also the operational details required to regulate the system, for both the short and long-term. For the short-term, the pricing and disposal of aid fertilizer issues, need particular attention.

4.8.3 Regulation of Aid

Rules and procedures for fertilizer aid need to be set out. Planning and liaison with the private sector need to be improved. Allocation by MPARA introduces an arbitrary dimension, and therefore a more equitable system needs to be adopted. The same conditions should apply to all recipients. Set conditions also need to be laid down to regulate the payment of countervalue funds. This will be especially important to ensure not only that funds are paid to Government but also that distributors develop according to their means. Institutional development should not be subsidized by aid fertilizer.

4.8.4 Concentration on Domestic Distribution and Retailing

In the short-term, because the fertilizer supply system is still stunted, efforts will need to concentrate on developing domestic distribution and retail functions before importation. Solutions will need to be sought to supply areas which the private sector will not serve.

5 FERTILIZER SUPPLY LOGISTICS

5.1 OVERVIEW OF THE TRANSPORT SECTOR

5.1.1 Introduction

Madagascar can be described more as an archipelago than a single island in the context of transport analysis. The development of transport in Madagascar has been influenced by:

- rugged topography
- tropical climate with heavy rains and cyclones
- uneven population distribution with concentrations in a few isolated regional centers
- lack of construction materials in some parts of the country

The transport network consists of:

- 4 main ports and 18 secondary lighterage ports, plus a navigable canal
- a fairly extensive but disjointed road system: 50,000 km of which 5,200 km is paved
- 2 unconnected railway systems of considerable length: Northern system-700km Toamasina/Antananarivo/Antsirabe Moramanga/Lac Alaotra; Southern system-163 km Manakara/Fianarantsoa
- a well developed but poorly served air network: 56 airports of which 17 are all-weather. There is one international airport (Ivato) in Antananarivo.

The lifeline of the country is the corridor of road and rail linking the port of Toamasina with Antananarivo and the central highlands.

5.1.2 Ports and Coastal Shipping

Shipping is the only means of transporting freight between many areas of the country which have no access to all-weather roads.

There are 5 main ports (1985 tonnages including petroleum products):

Toamasina	1,194,000	63%
Mahajanga	183,700	10%
Nosy Be	123,700	7%
Antsiranana	117,500	6%
Toliary	66,500	4%
TOTAL		90%

The 10 percent balance of sea freight is handled by smaller exclusively coastal shipping ports.

A modest increase of 13 percent in dry cargo is forecast for all ports from 1984 to 1995.

An independent port authority, SEPT, has been created for the administration of Toamasina Port; all others are under the control of the MTMT.

Madagascar shippers are the state-controlled SMTM with 2 cargo vessels for external trade; and CMN with 9 vessels for coastal and intra-island trade.

The east coast Pangalanese intra-coastal waterway is being rehabilitated, but traffic will remain light.

5.1.3 Railways

The 2 unconnected single track systems comprise the following segments (1984 tonnages) [see Table 2.1]:

- Northern sector: 220,500,000 net ton-km
- Southern sector: 3,600,000 net ton-km

Rail traffic is no longer directly proportional to GDP because of competition from other transport modes. From 1980 to 1984, there was actually a small decrease in ton-km for the northern sector.

There are approximately 1,000 freight wagons of all descriptions, including 200 covered wagons.

5.1.4 Roads

For the 10 year period 1972-1982 there was virtually no change in the size of the road network (approximately 4,000 km paved and 10,000 km unpaved), although much of it seriously deteriorated during the same period. The road network now comprises approximately 50,000 km of roads of which 5,200 km are paved, 5,300 km are engineered earth and gravel and 39,500 km are feeder roads and tracks.

Between 1976 and 1984/85 there was a decline in the number of vehicles from 104,000 to 46,700 (of which 42,000 were in working order and 17,000 were commercial vehicles).

5.1.5 Evolution of Government Policies

Until the early 1980's, Government policy was to extend state control over the entire sector, especially with regard to its external links. This basically non-economic end in itself caused the transport sector to become disconnected from the rest of the economy. Government price controls for transport tariffs were based on unattainable operating cost estimates and institutional capacity to manage the sector was insufficient.

Lately, government policy has become more pragmatic in order to:

- connect regional capitals by all-weather roads
- improve the road/rail corridor of Toamasina/Moramanga/Antananarivo
- improve road maintenance.
- improve transport organization and services.

5.2 IMPORTATION

5.2.1 General

Apart from a small amount of magnesium and lime and fertilizer compounds produced by Somadex and Soabe in Antsirabe, the total requirement of chemical fertilizer must be imported from commercial or grant sources.

The relative importance (in terms of tonnage) of the ports involved in fertilizer imports and the ultimate use thereof during the last several years is roughly as follows:

- Toamasina (potatoes, rice, wheat, maize, coffee) 60%
- Mahajanga (cotton, sugar) 20%
- Toliary (cotton) 5%
- Nosy Be (sugar) 5%
- Port St. Louis (sugar) 5%
- Morondava (sugar) 5%

5.2.2 Off Loading at Port

In Toamasina (described in the remainder of this section), fertilizer is unloaded by ship crane on to the quayside or directly onto port carts, nearby waiting lorries or transported to the port storage sheds. Once the final conveyance (lorry or covered railway wagon) is available, the sacks are loaded from the sheds onto port carts and then towed to the conveyance. All stevedoring is done by the port deckers up to the point of actual loading into the final conveyance. The transporter's personnel (usually daily hires from the port area) then load the vehicle. (The term vehicle embraces both lorry and wagon). Evacuation rates for fertilizer rarely exceed 350 tons/day for two 7-hour shifts.

As adequate documentation on transporters' vehicles/wagons are not immediately available, most imported fertilizer will first need to be stored.

Average port performance indicators are improving. For example, the target for shifting dry cargo in sacks, is 120 tons per shift-team per day; actual performance has progressed from 85 to the current 110 tons per shift-team per day.

5.2.3 Clearance

Currently, major fertilizer importers usually perform their own clearing operations rather than using clearing agents. This is done in order to save expense and gain time by commanding better control over the clearing process. This pattern only changes when import volume is so great that agents are employed to clear lower priority commodities.

Customs clearance is performed by the importer or clearing agent. Clearing agents have open accounts with Customs which simplifies payment formalities while importers must pay duties and taxes immediately. Requisitions for overtime by customs authorities are routinely demanded and granted by the importer/clearing agent in order to avoid difficulties.

5.3 TRANSPORT

This section dwells mainly on the transport pattern from Toamasina port to the central highlands, the major route of inland fertilizer transport for Madagascar. Some is also transported from Mahajanga and the other ports to inland destinations, usually for large clients in cotton and sugar growing areas. Alternative routes to the highlands are Mahajanga to Antananarivo, Morondava to Antsirabe, and Manakara to Fianarantsoa, but these are seldom used.

Up-country deliveries of fertilizer are made by lorry and railroad. Lorries are obviously a more flexible form of transport and although they are generally more expensive, this is not the case in Madagascar as there is an excess of heavy lorry capacity and tariffs are extremely competitive.

Heavy lorries (usually 20 ton trailers) use the main axis roads, and smaller lorries and pick-ups complete the distribution in the highland regions. COROI has its own fleet of lorries which they supplement with those of trucking contractors when necessary. For large shipments, convoys of 10-20 lorries are sent back and forth with a rotation time of about 2 or 3 days between Antananarivo and Toamasina.

Four or five covered wagons are typically all that can be obtained in terms of rail transport of fertilizer, with a rotation time of approximately 1 week to Antananarivo. The total number of cargo wagons leaving Toamasina average 10 to 20 per night; and a shunt locomotive is permanently on station at the port. Some operators prefer to load railway wagons as late as possible to minimize the risk of theft. In the past, special wagons were used for bulk fertilizer, but since the collapse of the Zerem project, there are no bulk movements in Madagascar of chemical fertilizers.

Roughly one-half of the fertilizer is dropped off at storage depots in Antananarivo with the other half continuing on to Antsirabe and Fianarantsoa. If the mode of transport is by rail, the Fianarantsoa shipments are transferred to lorries at Antsirabe.

5.4 STORAGE

There are storage facilities all along the transport circuit from the ports to the final distributors. Once again this section will concentrate on the Toamasina central highlands area which is the most representative for the country.

Most fertilizer shipments transit by the port storage sheds either because documentation is not ready for clearance or, in the cases of large shipments, lorries and railway wagons are not available in sufficient quantities to handle the tonnage involved. There is approximately 55,000 sq meters of covered storage space at the port. As the port authorities prefer to segregate storage for fertilizer, (a relatively dirty commodity) 18,000 sq meter is used only for fertilizer. It was reported that the available space is sufficient to temporarily store approximately 30,000 MT. The port charges demurrage after eight days which rapidly becomes penal in order to encourage importers to clear their merchandise quickly so as to maximize the port's revenues. Demurrage rates on CIF values are as follows:

- 8 to 22 days: 1.6%
- 23 to 37 days: 2.5%
- 38 to 52 days: 4.5%
- over 53 days: 9.0%

The importers and clearing agents have additional storage facilities in Toamasina which can accommodate 5,000 to 6,000 MT of fertilizer if the need arises.

After arrival in the Highlands, the importers either unload into their inland storage facilities or transport directly to clients' premises for delivery into clients' stores.

Although the railways also have storage facilities at Toamasina, they are rarely used for fertilizer.

Importers of other commodities have their own railway sidings at inland storage facilities and this considerably enhances the transport of their commodities by rail.

5.5 DISTRIBUTION

The timing of fertilizer distribution in the central highlands is conditioned by the growing seasons. The main rice planting season starts in October. Because of access problems on secondary roads after the start of the rains in October, fertilizer ideally needs to be available in rural stores for distribution by the end of September.

The implications of this constraint are obvious: in order to minimize stocking costs throughout the system, shipment arrivals to Toamasina need to be programmed to allow for transport and stocking to be accomplished by September.

Fertilizer stocking for other crops varies according to their seasonality as well, but rice remains the main determinant of fertilizer distribution patterns in the central highlands.

5.6 CONCLUSIONS REGARDING FERTILIZER LOGISTICS AND CAPACITY

5.6.1 General

- The dominant position of the state in the transport sector is declining in favor of private sector participation especially in road transport.

- There are presently approximately 30 private sector firms in the fertilizer and other agricultural inputs sector; although good for competition, this is probably an excessive number for the market involved and a shakeout is likely.

- The overall emphasis will be on rehabilitation and not new transport infrastructure/capacity in the medium term (next 5-10 years); this contrasts with the over-emphasis on new investment in the '70's which left the country with excessive external debt.

- There is adequate fertilizer storage capacity, both at regional warehousing centers and at rural distribution points in the central highlands.

- There is considerable interaction between various high priority projects and the need for improved transport in Madagascar, eg:

  - ports rehabilitation needs better rail and road evacuation

  - IFAD highlands rice project needs transport for inputs

  - Lac Aloatra rice intensification needs an improved transport network for the delivery of rice to consumers

- certain experienced freight operators attain port evacuation rates from Toamasina in excess of 900 tons/day whereas other less efficient operators, including fertilizer importers, manage less than one-half those rates

- the strength and suitability to Madagascar conditions (e.g. high incidence of rain and multiple handling) of bagging materials for fertilizer is variable. Shipments from South-East Asia are especially prone to damage

5.6.2 Sea Transport

- Coastal shipping is the only means of transporting freight between many areas of the country with no access to all-weather roads

- Sea access to the east coast is subject to problems of high winds, waves and cyclones (December-February)

- The Pangalanese canal traffic will continue to be light even after rehabilitation; the canal generally serves fertile areas with high precipitation where fertilizer use is not perceived to be highly necessary.

- The most difficult problems facing the Madagascar ports subsector have been institutional weaknesses.

- The port of Toamasina has adequate capacity to handle present traffic.

- There are rainy conditions in Toamasina for over 300 days per year which slows cargo evacuation as ships close their hatches and pier cargo needs to be under cover when it rains.

- Mahajanga port is constrained by need for lighterage and the relatively long distance by road from the central highlands.

- The port of Manakara has minimal covered storage capacity.

- Several ports are subject to silting and shallow draft, especially Mahajanga and Manakara.

5.6.3 Road Transport

- Since 1985, the decline in road traffic has been reversed.

- There is at present over-capacity most of the year in the heavy road fleet resulting in extremely competitive road tariffs in relation to rail tariffs; in fact truckers are currently engaging in marginal cost pricing rates as low as FMG 20/ton-km whereas rates should be around FMG 45/ton-km to be profitable; in comparison, rail tariffs average around FMG 35/ton- km.

- The Toamasina/Antananarivo corridor and the Mahajanga/Antananarivo are now adequate for present traffic though the latter is of low standard.

- The Highlands are a net importer of freight tonnage, which results in inefficient use of transport vehicles moving to ports unloaded and returning fully loaded.

- Average rotation (round trip) times between Toamasina and the central highlands are approximately 2 days for lorries.

5.6.4 Rail Transport

- One-half of the Malagache population lives in areas served by rail.

- The railroad will remain the main and most reliable means of transport for bulk commodities (not time-sensitive) from Toamasina to the highlands for the foreseeable future.

- Long term projections for rail traffic indicate that it will not grow significantly due to increased road competition; these projections will stabilize at approximately 225 ton-km per year.

- Three more locomotives will be added to the northern rail network shortly, thereby reducing traction availability problems experienced in the past.

- Goods are sometimes left immobilized on the Manakara/Fianarantsoa line for 4-5 days.

- Average rotation (round trip) times between Toamasina and the central highlands are approximately 1 week for railway wagons.

- Railroad storage facilities are limited, especially in Antananarivo.

5.6.5 Constraints

- The main fertilizer distribution constraint in the central highlands is one of timing. This is due to poor accessibility to rural areas during the October-April rainy period, it is necessary for fertilizer to be at all distribution points by the end of September in time for the main rice planting season.

- The overall peak capacity of the transport system is subject to strain when there are simultaneous demands upon all or part of it for movements of various types of freight. Thus, for example, if 2 large cargos of cement and fertilizer were to arrive at Toamasina at the same time, the port and ancillary evacuation system would not be able to cope.

- Fertilizer has lower priority than rice, wheat and sometimes cement, and therefore it is often difficult for fertilizer importers to obtain sufficient railroad wagons to evacuate large fertilizer imports; e.g. although there are approximately 200 (30/35 ton each = 6000 tons total capacity) covered railroad wagons suitable for fertilizer transport, operators usually manage to secure only 4 or 5 for evacuation of imports at Toamasina.

- Customs clearance for fertilizer, while not presenting major difficulties, is usually subject to the irregular practice of systematically requiring overtime work payments from importers to customs personnel for their official duties regardless of what time of the day they are performed.

- Delays in port evacuation are commonly exacerbated by delayed documentation, especially for imports of grant fertilizer, because of poor coordination amongst the various parties involved: donors, ministries, importers.

- Documentary credits for fertilizer are subject to excessive delays in the Central Bank (approximately 1 month), because of lengthy clearing formalities.

6 FERTILIZER PRICING

6.1 INTRODUCTION

Under the pricing liberalization policy which is progressively being implemented by Government, two main forms of price interventions remain for fertilizer inputs. Both of them only relate to foodcrop fertilizer.

6.1.1 Input and Output Pricing Policies

The Goverrment's move towards a gradual liberalization of rice consumer prices using the 'stock tampon' necessitated a concurrent intervention on fertilizer prices. With paddy producer prices below free market level, the use of fertilizer purchased at market prices would not be financially profitable for smallholders.

Following the 1987 devaluation, the need for Government intervention on fertilizer selling prices became even more urgent. If private importers were to offer fertilizer at its full cost, it would remain unsalable and importers would soon be driven out of business. This would compromise the food security policy of the country and also jeopardize the development of a commercial fertilizer marketing network.

On the other hand, industrial cash crops allow for financially profitable use of fertilizer at its full cost since their price structures are based on a cost plus basis. There is thus no government intervention on the fertilizer selling prices for these industrial export crops.

6.1.2 Fertilizer Pricing Procedures

MPARA has not adhered to any clear rules for the determination of fertilizer selling prices. For Aid in-kind, differences exist according to donors, whereas in the case of commercially imported fertilizer, particular circumstances have dictated MPARA's intervention in the setting of fertilizer selling prices.

6.2 DETERMINATION OF SELLING PRICES FOR COMMERCIALLY IMPORTED FERTILIZER

6.2.1 Nature of Commercial Imports

For the last 5 years, very few fertilizer imports have been purely commercial. Fertilizer imports, whether by private distributors or parastatals such as HASYMA, SIRAMA or SIRANALA, have usually been financed by international donor credit lines or programs.

Purely commercial imports in which importers use either their own funds or a local bank credit are rare. The CASA and SILI funds available for these operations have been sparingly used. Imports of a purely commercial nature have been limited to some COROI and SEPCM imports in 1987 (mainly SIRAMA orders) and to a SIRANALA order for import in 1989.

6.2.2 Pricing Mechanisms

Pricing for the two types of commercial imports differs. Fertilizer imports financed by donor credit lines can qualify for Government subsidies under exceptional circumstances. They are mostly used for food crops especially paddy. Locally financed imports and imports for industrial cash crops (mostly financed by donor credit programs) are not eligible for government subsidies.

6.2.3 Fertilizer for Sugar and Cotton

HASYMA, SIRAMA and SIRANALA obtain their fertilizer requirements either by direct imports (possibly using one of the main distributors), or by placing local orders, according to the cheapest source of supply available.

Directly imported fertilizer is bought at world market prices, and delivered by ship to the closest coastal point to the plantation. Sale to the planters and smallholder farmers on the plantations is at the import price plus costs of import duties and taxes (SIRAMA and SIRANALA are exempted) and a small margin (estimated at 5 percent). This price is usually lower than the price of fertilizer ordered from locals which includes high storage, transport and distribution costs, as well as the margins of principal and secondary distributors.

6.2.4 Commercial Fertilizer Imports for other Crops,(mainly Paddy)

The price setting for commercially imported fertilizer for paddy and other food crops normally relies on free market mechanisms. As a result of the fertilizer price hikes the 1987 devaluation, stocks of commercially imported fertilizers priced at full cost were building up at distributors' stores. At the same time Aid-i-K fertilizer continued to be available at subsidized prices. These exceptional circumstances justified renewed Government intervention on the determination of fertilizer selling prices.

6.2.5 Locally Financed Fertilizer Imports

There was no Government intervention in the selling prices of locally financed fertilizer imports. Importers and distributors were free to set selling prices. If they chose to sell fertilizer at less than full costs they would not be directly compensated for the losses incurred. MPARA's only concession was its leniency towards the recovery of existing debts to the Treasury, stemming from previous allocations of aid-in-kind or credit financed imports. In practice however, MPARA's position regarding unpaid debts does not significantly differ from the past situation. Distributors and importers have always benefitted from the system by accumulating payment arrears. Other special arrangements concerning fertilizer pricing might have been made between the MPARA and importers on a case by case basis but these remain unknown to the consultants.

6.2.6 Credit Financed Imports

Fertilizer imports financed by donor credit lines are treated differently given the credit line conditions. This has in particular been the case for the 1987 import (arrived in Madagascar in 1988) of 4,000 MT of 16.16.16 and 3,000 MT of 8.20.20 by COROI under financing facilities opened by IFAD (65 percent) and CASA (35 percent).

This fertilizer had been financed by IFAD on the condition that countervalue funds should be used by ODR. Since COROI could not sell the fertilizer at its full costs, and funds were required by ODR, a subsidy was negotiated between MPARA, COROI, IFAD, the World Bank and NORAD. Price was determined at 350 FMG/Kilo (corresponding to the price at which fertilizer donations in kind were sold to paddy farmers). The level of subsidy was determined working backwards from this basis.

6.2.7 Price Setting Mechanisms for the IFAD/CASA Import

The price mechanisms required two major steps:

1) Direct subsidy on the selling price

As seen below, the price at full costs was 423.53 FMG/Kilo as against a desired price of 350 FMG/Kilo.

Costs of 4,000 MT of 16.16.16 and 3,000 MT of 8.20.20:

CAF value:	284,121 FMG/MT	(or US$ 210.46/MT at US$= 1,350FMG)
SGS	2,764 FMG/MT	
Transit	32,000 FMG/MT	
Banking charges	19,000 FMG/MT	
FIOS*	5,100 FMG/MT	
Local insurance	7,545 FMG/MT	
Price at central store	350,530 FMG/MT	
Margin primary distributor	13,000 FMG/MT	
Selling price main distrib.	363,530 FMG/MT	
Transport and margin secondary distributor	60,000 FMG/MT	
Real market value retail price	423,530 FMG/MT**	

* FIOS relates to freight payments. Freight for fertilizer imports into Madagascar can be negotiated and paid for either on a liner-team or FIOS basis. On a FIOS basis importers are responsible for the costs of all port operations (ie hiring cranes, stevedoring costs, etc) in addition to any demurrage that might be payable.

** Price applicable in Antsirabe.

A first subsidy was negotiated with NORAD for 40 FMG/Kilo. This subsidy would be paid out of the previously accumulated NORAD counterpart funds. Concurrently however, a second form of subsidy had to intervene in order to equal the retail price (now of 383.53 FMG/Kilo) to the desired level of 350 FMG/Kilo.

2) Indirect subsidy on the selling price.

A second level of subsidy was negotiated with IFAD and the World Bank.
The second level of subsidy was determined by working backwards from the desired retail price (350 FMG/Kilo) as illustrated below. The real costs of fertilizer importation and distribution are subtracted from the retail price plus subsidy in order to obtain the corresponding subsidized CIF value in FMG.

Desired retail price	350,000 FMG/MT
NORAD subsidy	40,000 FMG/MT
First level subsidy retail price	390,000 FMG/MT
Real costs as per CIF value:	
SGS	- 2,764 FMG/MT
Transit	- 32,000 FMG/MT
Banking charges	- 19,000 FMG/MT
FIOS	- 5,100 FMG/MT
Local insurance	- 7,545 FMG/MT
Margin primary distributor	- 13,000 FMG/MT
Transport and margin secondary distributor	- 60,000 FMG/MT
Hypothetical CIF value	208,591 FMG/MT

The second subsidy intervened at the CIF value level, where the donors agreed to a subsidy on the exchange rate. On the basis of the hypothetical CIF value in FMG and of the real CIF value in foreign currency , a fictitious exchange rate is calculated for the FMG against the billed currency.

Hypothetical CIF value of import:	208,591 FMG/MT
Real CIF value of import:	284,121 FMG/MT
Real CIF value in foreign currency:	US$ 210.46/MT

(at real exchange rate of US$ = 1,350 FMG)

Fictitious exchange rate: US$ 210.46 = 208,591 FMG
or: US$ 1 = 991.11 FMG

After discussions between the three parties (MPARA, donors and COROI) it was agreed that COROI would reimburse the credit line in FMG, applying the fictitious exchange rate to the amount of the loan drawn in foreign currency.

The pricing mechanism used in this particular case thus involved two levels of subsidy:

- a direct subsidy given on a per ton basis, and financed through the NORAD countervalue funds, and concurrently,

- an indirect global subsidy given by applying a fictitious exchange rate to the credit drawn, and financed by the donor extending the credit fund.

6.3 DETERMINATION OF SELLING PRICES FOR FERTILIZER DONATIONS IN KIND

6.3.1 Price Determination

MPARA is responsible for determining the selling price of Aid-i-K. Its guiding principle is a value/cost ratio of 2 applied to the estimated selling price of paddy for the coming harvest season. The rule followed to establish the amount to be paid by distributors to the Treasury is similar to the procedures described above. Once the desired retail selling price has been determined on the grounds of the value/cost ratio, the hypothetical CIF price of the import is arrived at by subtracting from the retail price estimations of transport costs, costs of transitaire, import duty, storage and other incidental costs as well as the profit margins of primary and retail distributors.

6.3.2 Costs of Aid in-Kind to the Distributors

General costs are usually much higher for aid-in-kind than for commercial imports because of the conditions attached to maritime transport. In the case of aid-in-kind, the shipper is generally not responsible for the unloading of the fertilizer from the ship. These costs have to be added to the other costs of the distributor. Additionally, aid-in-kind is per se more expensive than commercial imports because it is not obtained by competitive bidding and is subject to donor country specific requirements. Costs equalling a fixed percentage of CIF costs (duties, SGS, insurance, etc) are thus higher than for commercial imports.

6.3.3 Implementations of the Pricing Policy

For each arrival of aid-in-kind, one unique retail price is theoretically set by MPARA on the basis of a VCR for paddy of 2. Fertilizer should normally be sold at this price regardless of the selling point since related costs (especially transport) have already been taken into account in the determination of the subsidy.

In reality however, importers complain that prices are not determined in accordance with the VCR and the real marketing costs but are arrived at by rule-of-thumb. The pricing mechanism followed for the 1988 arrival of 5,000 MT of urea from NORAD is quoted as an example.

Farmers complain that recommended selling prices are not respected by all distributors. Whereas in theory MPARA controls selling prices to farmers, no action is taken against malpractices.

6.3.4 Conditions of Payment of Aid in-Kind

The procedures followed to reconstitute the countervalue funds generated by the sale of fertilizer donations in kind comprises three steps:

- contract between the donor and MPARA
- contract between MPARA and the primary distributor
- contract between the primary distributor and the secondary distributor.

1) Agreement protocol between the donor and MPARA

For each fertilizer donation in kind, a contract is signed between the representative of the donor country and the MPARA. It specifies the value of the donation in foreign currency and the uses of the countervalue funds. MPARA is solely responsible for their reconstitution and payment in a special account opened at the Treasury under the Ministry of Finance. The delay given to the MPARA to reconstitute the countervalue funds is generally three years, starting from the date of arrival of the fertilizer at port.

2) Contract between MPARA and the primary distributor

The contract between MPARA and the primary distributor specifies that the latter is responsible (among other things) for the reconstitution of the countervalue funds. Their payment has to take place between the 13th month and the 24th month after arrival of the fertilizer at port. The contract does not stipulate any minimum payments per period.

3) Contract between the primary and the secondary distributors

Delays given to secondary distributors for payment of the fertilizer to the primary distributor have been fixed by MPARA as follows:

- 30 percent in cash at reception of fertilizer at the port,
- 30 percent payable in 6 months*
- 40 percent payable in 12 months.

* Sometimes the primary distributor will cover his risks on the 70 percent credit by requesting from the secondary distributor promissory notes for the 30 percent amount in 6 months and for the 40 percent in 12 months.

6.3.5 Problems experienced with the reconstitution of the countervalue funds

The main problems present themselves at two levels:

1) The contracts between MPARA and the Treasury, the MPARA and the primary distributor, or the primary and the secondary distributor, do not specify any penalties for payment delays, neither in terms of interest rates to be paid, nor in terms of legal sanctions to be applied.

2) Vis-a-vis the Treasury, MPARA is solely responsible for the reconstitution of countervalue funds.

The lack of safe-guards in the contracts between the different parties has led to an accumulation of outstanding arrears, especially at the primary distributor level. It is argued that flexibility in the contracts is argued as necessary in the present circumstances of a private fertilizer marketing system in its infancy stages. Margins on fertilizer distribution are still too low to enable private distributors to cover their cash flow and investment needs. The delays in payment of countervalue funds act as unofficial credit lines thereby filling the gap left by the banking system.

6.4 COSTING AND PRICING CONSIDERATIONS

6.4.1 Fertilizer Marketing Cost Data

Relevant cost data for a typical order of 3,000 MT of urea made by a private importer are set out below. It has been assumed that the urea is imported in June 1989 from Europe and that the distribution to rice planters will be made from the importer's store in Antsirabe within a radius of 80 kms (ie the average distance for a rice planter from Antsirabe).

Table 6.1: Cost data for an order of 3,000 MT of urea in 50kgs bags

		US$	FMG	
Rate of exchange	1,670			
F.O.B.		145	242,150	42%
FREIGHT		63	105,210	18%
		208	347,360	60%
INSURANCE		3	5,210	1%
		211	352,570	61%
BANK CHARGES			10,421	2%
S.G.S.			2,421	0%
IMPORT DUTY			17,629	3%
TRANSITAIRE			16,000	3%
TRANSPORT (ANTSIRABE)			52,000	9%
INTEREST			15,866	3%
LOSS			2,115	0%
STORAGE			0	0%
PROMOTION			0	0%
SUNDRIES			3,340	1%
			472,362	81%
MARGIN - IMPORTER/MAIN DISTRIBUTOR			56,683	10%
(includes transport up to 50 kms from store)				
MARGIN - RETAILER			529,046	91%
			52,905	9%
(includes transport up to 30 kms from retail store)			581,950	100%
Summary:				
C.I.F.			352,570	61%
LOCAL COSTS BEFORE MARGINS			119,792	21%
MARGINS			109,588	19%
LOCAL COSTS INCLUDING MARGINS			229,380	39%

6.4.2 F.O.B. Prices

The FOB prices quoted to the main importers hardly vary. In normal circumstances the difference in price obtained is about 5 percent.

Importers can expect a quantity discount of 10 percent for an order above 5,000 MT and 14 percent for an order above 10,000 MT compared to an order of just 3,000 MT. The effect of volume imported per shipment on the final costs of fertilizer to the farmers will be analyzed later.

The following are the ruling FOB prices in June 1989 for an average import of 3,000 MT:

	Price per MT
NPK 16.16.16	192 US$
Sulphate of Potassium	543 DM
Triple Super Phosphate	470 DM
Ammonia Phosphate	550 DM

6.4.3 Freight

Freight rates obtained by the main importers vary up to 40 percent for a given volume of import. The quotations obtained for a 3,000 MT shipment in 50 kg bags vary between US$50 to US$70 per ton. We have assumed a freight cost of US$63 in our cost analysis for a shipment of 3,000 MT but would like to point out that with more regular orders by the importers, this rate could be sensibly improved.

Larger volumes would attract fairly good savings in freight costs - up to 12 percent for a shipment of 5,000 MT. If the fertilizers are imported in bulk as opposed to the present method of importing in 50 kgs bags, freight cost could be reduced by some 40 percent, ie US$30 per MT.

COROI and SEPCM have been trying to reduce freight costs by consolidating their shipments with those of importers of Reunion Island and Mauritius. In order to achieve this, orders should be planned well in advance. However the present state of the fertilizer market does not encourage this practice.

Some of the official costings prepared by the Ministry include an important element of FIOS cost. When freight is paid on FIOS basis - as opposed to liner-term - the importer is responsible for the costs of all port operations in addition to any demurrage of up to US$4,000 PER DAY. FIOS can be avoided thus reducing the cost of fertilizers. Importers are now conscious that unless liner-term is specifically requested, shippers will provide freight on a FIOS basis. However they believe that donor

countries should be requested to supply fertilizer on a liner-term basis and not on FIOS basis as has been the case recently.

It is interesting to note that it is not uncommon for importers to import quantities of between 100 MT to 1,000 MT. As a result freight costs could escalate as high as US$81 per MT.

6.4.4 Insurance

Insurance can be paid either locally or overseas for a CIF import. When paid locally insurance premiums cost between 2.5 and 3 percent of CIF and 1.2 and 2 percent of CIF when paid overseas.

Because of foreign exchange restrictions, insurances were mainly paid locally in FMG. Even after the liberalization of foreign exchange, importers thought that it was more practical to pay in FMG on the principle that the FMG was depreciating at a higher rate than the costs of borrowing locally. However the latest fertilizer orders have been on a CIF basis and it seems that importers may adopt this method of payment for insurance purposes in the future.

6.4.5 Bank Charges

Bank charges include commission on "overture de lettre de credit", "commission d'utilisation" and "commission de domiciliation" and amount to 3 percent of CIF value.

6.4.6 S.G.S

All imports of more than 50 MT of fertilizers are subject to verification and approval by SGS. The cost is 1 percent of FOB.

6.4.7 Import Duty

Fertilizers are now subject to import duties at the rate of 5 percent CIF. This applies also to donor fertilizers. Import duty of fertilizers used to be 20 percent but in the early 1980's it was reduced to nil, and thereafter increased to 5 percent as from 1986. Presently there is no indication that it will be removed.

6.4.8 Transitaire

The main services provided by Transitaires include unloading, storage in port, liaison with port authority and other Government departments. Their remuneration varies between 15,000 and 20,000 FMG per ton depending on the type of fertilizer. We have assumed an average cost of 16,000 FMG in our cost analysis.

If the volume for one shipment exceeds 10,000 MT, "Transitaire" costs could be increased by 9,000 FMG per ton due to additional storage costs which become inevitable as a result of the limited transport capacity from the port to the main towns.

6.4.9 Interest

Interest rates of commercial banks vary between 18 percent to 23 percent per annum. We have assumed in our cost analysis an average interest cost of 4.5 percent of CIF. Normally fertilizers arrive at the port in August, the bulk is sold in November-December and the rest is sold during the second season in June. Over the past two years some importers have stored fertilizer for longer periods because donor fertilizer was available concurrently at cheaper prices.

6.4.10 Storage

Importers do not build up storage costs in their costings, and consider it to be fixed cost and therefore recoverable through their margins. However any marked increase in the volume of fertilizers would result in new storage requirements, and new costing.

6.4.11 Promotion

Importers do not build up promotion costs in their costings. However the main ones incur promotion expenses. These include the cost of demonstration staff in their main selling points and agencies as well as small teams of instructors. It is estimated that promotion costs are equivalent to 1 percent of CIF.

6.4.12 Importers/Wholesalers' Margins

Margins of importers/primary distributors vary from one importer to another and are generally lower for the sugar and cotton markets than they are for the rice market.

Rice market margins vary between 10 to 18 percent of total costs before margins. We have adopted 12 percent as being a good average. Margins include the cost of transport to retailers which are within a radius of 50 kms from the importers' stores. The margin allowed to importers/primary distributors for donor fertilizer distribution to rice planters is discussed further in this document.

For the cotton and the sugar markets, margins are reduced to around 5 percent because of the special financing made available to cotton and sugar planters and also because of reduced import costs.

6.4.13 Retailers' Margins

These margins vary considerably depending on the areas in which the retailers operate. However, we feel that 10 percent is a realistic average margin for the retailers and we have used this figure in our cost analysis. It includes transport offered by the retailers to planters within a radius of 30 kms from their store.

6.5 ALTERNATIVE SCENARIOS AFFECTING COST DATA

6.5.1 Effect of Volume Imported on Cost Data

Illustrated below in Table 6.2 are alternative analyses of costs under the following scenarios:

1) Order of 3,000 MT of urea in 50 kgs bags (ie the same as in table 1).

   Selling price - 582,000 FMg/MT

2) Order of 5,000 MT of urea in 50 kgs bags.

   As a result: FOB price is reduced by 10 percent, and freight by 12 percent.

   Selling price - 527,000 FMG/MT, ie a 9 percent reduction in selling price from (1) above.

3) Order of 10,000 MT of urea in 50 kgs bags.

   As a result: FOB price is reduced by 14 percent, freight by 15 percent, but transit charges increased by 9,000 FMg (56 percent).

Selling price - 524,000 FMG/MT, ie a 10 percent reduction in selling price from (1) above.

TABLE 6.2

	ORDER OF 3000 M T UREA IN BAGS OF 50 KG			ORDER OF 5000 M T UREA IN BAGS FOB REDUCED BY 10% FREIGHT REDUCED BY 12%			ORDER OF 10000 M T UREA IN BAGS FOB REDUCED BY 14% FREIGHT REDUCED BY 15% TRANSITAIRE INCREASED BY 9000 FMG		
Rate of exchange	1,670			1,670			1,670		
	US$	FMG		US$	FMG		US$	FMG	
FOB	145	242,150	42%	131	217,935	41%	125	208,750	40%
FREIGHT	63	105,210	18%	55	92,585	17%	54	90,180	17%
	208	347,360	60%	186	310,520	59%	178	298,930	57%
INSURANCE	3	5,210	1%	3	4,658	1%	3	4,484	1%
	211	352,570	61%	189	315,178	60%	181	303,414	58%
BANK CHARGES		10,421	2%		9,316	2%		8,968	2%
SGS		2,422	0%		2,179	0%		2,088	0%
IMPORT DUTY		17,629	3%		15,759	3%		15,171	3%
TRANSITAIRE		16,000	3%		16,000	3%		25,000	5%
TRANSPORT (ANTSIRABE)		52,000	9%		52,000	10%		52,000	10%
INTEREST		15,866	3%		14,183	3%		13,654	3%
LOSS		2,115	0%		1,891	0%		1,820	0%
STORAGE		0	0%		0	0%		0	0%
PROMOTION		0	0%		0	0%		0	0%
SUNDRIES		3,340	1%		3,340	1%		3,340	1%
		472,362	81%		429,845	81%		425,454	81%
MARGIN - IMPORTER/GROSSISTE (INCLUDES TRANSPORT UP TO 50 KMS FROM STORE)		56,683	10%		51,581	10%		51,054	10%
		529,046	91%		481,427	91%		476,509	91%
MARGIN - RETAILER (INCLUDES TRANSPORT UP TO 30 KMS FROM RET. STORE)		52,905	9%		48,143	9%		47,651	9%
		581,950	100%		529,570	100%		524,160	100%
PERCENTAGE OF COST OF ORDER OF 3000M T UREAIN BAGS OF 50 KGS					91%			90%	
CIF		352,570	61%		315,178	60%		303,414	58%
LOCAL COSTS BEFORE MARGINS		119,792	21%		114,668	22%		122,040	23%
MARGINS		109,588	19%		99,724	19%		98,705	19%
LOCAL COSTS INCLUDING MARGINS		229,380	39%		214,392	40%		220,746	42%

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6.5.2 Conclusions to Table 6.2

Unless transport facilities between Tamatave and the main towns are improved or alternatively storage charges are drastically reduced in the port area, it will not be beneficial to import 10,000 MT as opposed to 5,000 MT. The savings in FOB and freight will be offset by additional storage costs.

6.5.3 Bulk Imports

Illustrated below is the breakdown of costs if fertilizer imports were made in bulk.

Table 6.3: Cost data for an order of 10,000 MT of urea in bulk

FOB reduced by 20 percent
Freight reduced by 20 percent
Transitaire increased by 16,000 FMG

Rate of exchange	1,670	US$	FMG	
F.O.B.	*	114	190,380	38%
FREIGHT	*	50	83,500	17%
		164	273,880	55%
INSURANCE		2	4,108	1%
		166	277,988	56%
BANK CHARGES			8,216	2%
S.G.S.			1,904	0%
IMPORT DUTY			13,899	3%
TRANSITAIRE			32,000	3%
TRANSPORT (ANTSIRABE)			52,000	10%
INTEREST			12,509	3%
LOSS			1,668	0%
STORAGE			0	0%
PROMOTION			0	0%
SUNDRIES			3,340	1%
MARGIN - IMPORTER/MAIN DISTRIBUTOR			403,525	81%
(includes transport up to 50 kms from store)			48,423	10%
MARGIN - RETAILER			451,948	91%
(includes transport up to 30 kms from retail store)			45,195	9%
TOTAL			497,143	100%

NB: An accurate comparison of costs between fertilizer imported in bulk and bagged in-country, and fertilizer imported in bagged form cannot be made. This is because no serious study on bagging has been made up to now and reliable figures do not exist.

Imports of urea in bulk, for local bagging, cannot be recommended at present becasuse of the rainfall and humidity at the ports. Urea is hygroscopic and has to be imported in bagged form. The only bagging which now takes place is to handle quantities of broken bags. NPK could be imported as granulates in bulk, but only if installation is provided for safe handling, storage and bagging, protected from humidity.

TABLE 6.4

EFFECT OF DISTANCE AND DIFFERENT MEANS OF TRANSPORT ON COST DATA

RICE PLANTERS - In the example below, the cheapest route to FIANARANTSOA is by rail from Manakara. It costs around 74000 FMG less per tonne with a resultant of 12% in the selling price. However that route is never utilised because the volumes involved are too small. There are also not enough wagons. The normal route is from Tamatave via Antsirabe by lorry.

ORDER OF 3000 M T UREA IN BAGS OF 50 KG.

	DELIVERY ANTSIRABE			DELIVERY FIANARANTSOA BY LORRY (FROM TAMATAVE)			BY RAIL (FROM MANAKARA)		
Rate of exchange	1,670			1,670			1,670		
	US$	FMG		US$	FMG		US$	FMG	
FOB	145	242,150	42%	145	242,150	39%	145	242,150	45%
FREIGHT	63	105,210	18%	63	105,210	17%	63	105,210	19%
	208	347,360	60%	208	347,360	56%	208	347,360	64%
INSURANCE	3	5,210	1%	3	5,210	1%	3	5,210	1%
	211	352,570	61%	211	352,570	57%	211	352,570	65%
BANK CHARGES		10,421	2%		10,421	2%		10,421	2%
SGS		2,422	0%		2,422	0%		2,422	0%
IMPORT DUTY		17,629	3%		17,629	3%		17,629	3%
TRANSITAIRE		16,000	3%		16,000	3%		16,000	3%
TRANSPORT		52,000	9%		80,000	13%		18,000	3%
INTEREST		15,866	3%		15,866	3%		15,866	3%
LOSS		2,115	0%		2,115	0%		2,115	0%
STORAGE		0	0%		0	0%		0	0%
PROMOTION		0	0%		0	0%		0	0%
SUNDRIES		3,340	1%		3,340	1%		3,340	1%
		472,362	81%		500,362	81%		438,362	81%
MARGIN - IMPORTER/GROSSISTE (INCLUDES TRANSPORT UP TO 50 KMS FROM STORE)		56,683	10%		60,043	10%		52,603	10%
		529,046	91%		560,406	91%		490,966	91%
MARGIN - RETAILER (INCLUDES TRANSPORT UP TO 30 KMS FROM RET. STORE)		52,905	9%		56,041	9%		49,097	9%
		581,950	100%		616,446	100%		540,062	100%
CIF		352,570	61%		352,570	57%		352,570	65%
LOCAL COSTS BEFORE MARGINS		119,792	21%		147,792	24%		85,792	16%
MARGINS		109,588	19%		116,084	19%		101,700	19%
LOCAL COSTS INCLUDING MARGINS		229,380	39%		263,876	43%		187,492	35%

TABLE 8.5

EFFECT OF DISTANCE AND DIFFERENT MEANS OF TRANSPORT ON COST DATA (CONTINUED)

COTTON PLANTERS - The cheapest utilised routes are by coastal traffic for Morondava and Morombe.

ORDER OF 3000 M T UREA IN BAGS OF 50 KG.

	DELIVERY MORONDAVA BY RAIL FROM TAMATAVE (VIA ANTSIRABE)			DELIVERY MORONDAVA BY LORRY FROM TAMATAVE (VIA ANTSIRABE)			DELIVERY MOROMBE BY COASTAL TRAFFIC FROM TULEAR			DELIVERY MORONDAVA BY COASTAL TRAFFIC FROM TULEAR		
Rate of exchange	1,670			1,670			1,670			1670		
	US$	FMG		US$	FMG		US$	FMG		US$	FMG	
FOB												
FREIGHT	145	242,150	42%	145	242,150	42%	145	242,150	50%	145	242,150	50%
	63	105,210	18%	63	105,210	18%	63	105,210	22%	63	105,210	22%
	208	347,360	60%	208	347,360	60%	208	347,360	72%	208	347,360	72%
INSURANCE	3	5,210	1%	3	5,210	1%	3	5,210	1%	3	5,210	1%
	211	352,570	60%	211	352,570	61%	211	352,570	73%	211	352,570	73%
BANK CHARGES		10,421	2%		10,421	2%		10,421	2%		10,421	2%
SGS		2,422	0%		2,422	0%		2,422	1%		2,422	1%
IMPORT DUTY		17,629	3%		17,629	3%		17,629	4%		17,629	4%
TRANSITAIRE		16,000	3%		16,000	3%		16,000	3%		16,000	3%
TRANSPORT		135,000	23%		134,000	23%		40,000	8%		40,000	8%
INTEREST		15,866	3%		15,866	3%		15,866	3%		15,866	3%
LOSS		2,115	0%		2,115	0%		2,115	0%		2,115	0%
STORAGE		0	0%		0	0%		0	0%		0	0%
PROMOTION		0	0%		0	0%		0	0%		0	0%
SUNDRIES		3,340	1%		3,340	1%		3,340	1%		3,340	1%
		555,362	95%		554,362	95%		460,362	95%		460,362	95%
MARGIN - IMPORTER/GROSSISTE		27,768	5%		27,718	5%		23,018	5%		23,018	5%
		583,130	100%		582,080	100%		483,380	100%		483,380	100%
MARGIN - RETAILER		0	0%		0	0%		0	0%		0	0%
		583,130	100%		582,080	100%		483,380	100%		483,380	100%
PERCENTAGE OF COST OF RAIL ROUTE FROM TAMATAVE					100%				83%			
CIF												
LOCAL COSTS BEFORE MARGINS		352,570	60%		352,570	61%		352,570	73%		352,570	73%
MARGINS		202,792	35%		201,792	35%		107,792	22%		107,792	22%
LOCAL COSTS INCLUDING MARGINS		27,768	5%		27,718	5%		23,018	5%		23,018	5%
		230,560	40%		229,510	39%		130,810	27%		130,810	27%

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TABLE 6.6

EFFECT OF DISTANCE AND DIFFERENT MEANS OF TRANSPORT ON COST DATA (CONTINUED)

SUGAR PLANTERS - The cheapest utilised routes are shown below :

ORDER OF 3000 M T UREA IN BAGS OF 50 KG.

	SUGAR NOSY BE / AMBILOBE			SUGAR BRIKAVILLE			SUGAR MORONDAVA		
Rate of exchange	1670			1670			1670		
	US$	FMG		US$	FMG		US$	FMG	
FOB	145	242,150	56%	145	242,150	54%	145	242,150	44%
FREIGHT	63	105,210	24%	63	105,210	23%	63	105,210	19%
	208	347,360	80%	208	347,360	77%	208	347,360	63%
INSURANCE	3	5,210	1%	3	5,210	1%	3	5,210	1%
	211	352,570	81%	211	352,570	78%	211	352,570	64%
BANK CHARGES		10,421	2%		10,421	2%		10,421	2%
SGS		2,422	1%		2,422	1%		2,422	0%
IMPORT DUTY		17,629	4%		17,629	4%		17,629	3%
TRANSITAIRE		16,000	4%		16,000	4%		16,000	3%
TRANSPORT		5,000	1%		20,000	4%		114,000	21%
INTEREST		5,289	1%		5,289	1%		5,289	1%
LOSS		2,115	0%		2,115	0%		2,115	0%
STORAGE		0	0%		0	0%		0	0%
PROMOTION		0	0%		0	0%		0	0%
SUNDRIES		3,340	1%		3,340	1%		3,340	1%
		414,785	95%		429,785	95%		523,785	95%
MARGIN - IMPORTER/GROSSISTE		20,739	5%		21,489	5%		26,189	5%
		435,524	100%		451,274	100%		549,974	100%
MARGIN - RETAILER		0	0%		0	0%		0	0%
		435,524	100%		451,274	100%		549,974	100%
PERCENTAGE OF COST NOSY BE / AMBILOBE ROUTE					104%			126%	
CIF		352,570	81%		352,570	78%		352,570	64%
LOCAL COSTS BEFORE MARGINS		62,215	14%		77,215	17%		171,215	31%
MARGINS		20,739	5%		21,489	5%		26,189	5%
LOCAL COSTS INCLUDING MARGINS		82,954	19%		98,704	22%		197,404	36%

6.5.4 Effect of Different Rates of Exchange on Cost Data

Table 6.7 below shows the relationship between US$ and FMG since 1978.

Table 6.8 illustrates the impact of different rates of exchange on selling prices. Because of the weight of FOB and CIF on total costs, any fluctuations in the rate of exchange of the FMG will have a marked effect on selling prices.

Table 6.7: US$/FMG exchange rates since 1978.

	1 US$ = FMG
1978	226
1979	213
1980	211
1981	272
1982	350
1983	430
1984	576
1985	663
1986	676
1987	1,069 - 1380
1988	1,407
1989 (June)	1,670

TABLE 6.8

EFFECT OF DIFFERENT RATES OF EXCHANGE ON COST DATA

	ORDER OF 3000 M T UREA IN BAGS 1$ = 1670 FMG			ORDER OF 3000 M T UREA IN BAGS 1$=1400 FMG			ORDER OF 3000 M T UREA IN BAGS 1$=2000 FMG			ORDER OF 3000 T UREA IN BAGS 1$=2500FMG		
Rate of exchange	I,670			1,400			2,000			2500		
	US$	FMG		US$	FMG		US$	FMG		US$	FMG	
FOB	145	242,150	42%	145	203,000	40%	145	290,000	43%	145	362,500	45%
FREIGHT	63	105,210	18%	63	88,200	18%	63	126,000	19%	63	157,500	19%
	208	347,360	60%	208	291,200	58%	208	416,000	62%	208	520,000	64%
INSURANCE	3	5,210	1%	3	5,210	1%	3	5,210	1%	3	5,210	1%
	211	352,570	61%	211	296,410	59%	211	421,210	62%	211	525,210	64%
BANK CHARGES		10,421	2%		8,736	2%		12,480	2%		15,600	2%
SGS		2,422	0%		2,030	0%		2,900	0%		3,625	0%
IMPORT DUTY		17,629	3%		14,821	3%		21,061	3%		26,261	3%
TRANSITAIRE		16,000	3%		16,000	3%		16,000	2%		16,000	2%
TRANSPORT (ANTSIRABE)		52,000	9%		52,000	10%		52,000	8%		52,000	6%
INTEREST		15,866	3%		13,338	3%		15,866	2%		15,866	2%
LOSS		2,115	0%		1,778	0%		2,527	0%		3,151	0%
STORAGE		0	0%		0	0%		0	0%		0	0%
PROMOTION		0	0%		0	0%		0	0%		0	0%
SUNDRIES		3,340	1%		3,340	1%		3,340	0%		3,340	0%
		472,362	81%		408,453							

6.6 CONCLUSIONS

6.6.1 Pricing Policies

There has been no clear pricing policy for fertilizer. Rules and mechanisms of price determination have changed according to the donor and importer/distributor concerned. For paddy fertilizer, the only emerging common basis has been a cost/value ratio for paddy of 2 dictated by the demand side of the market. Fertilizer pricing for industrial crops, is based on the producer cost.

Problems created by the inconsistent pricing policy have been:

- accumulation of unsold stocks resulting in an unsatisfied demand for fertilizer
- different prices ruling for the same fertilizers - because recommended prices are not sustainable for private imports and hence not respected by the distributors
- accumulation of payment arrears of countervalue funds leading to uncertainty and confusion for both distributors/importers and consumers.

6.6.2 Import Costs

From the cost analyses on fertilizer imports, it emerged that import costs are high due to the small volumes involved. As a result, imports are not commercially viable. An action plan to reduce costs will have to be implemented if the private fertilizer marketing sector is to be profitable.

Costs of aid-in-kind at arrival at port are higher than for commercial imports. Coordination and agreement between the various fertilizer donors in this area would help to reduce these costs as well as be conducive to the setting of a uniform ex-port price for all Aid-in-Kind.

7 DONOR INVOLVEMENT IN FERTILIZER

Compared to some other African countries there has not been a great deal of donor involvement in fertilizer in Madagascar.

7.1 TYPES OF INVOLVEMENT

7.1.1 Policy Dialogue

The World Bank alone has been involved in policy dialogue and reform of the fertilizer sector in what was termed as agricultural sector adjustment operation - CASA.

7.1.2 Fertilizer-Specific Programs

The only programme that specifically addresses some fertilizer issues is the FAO's Programme d'Engrais Malgache, PEM.

7.1.3 Supply of Aid in-Kind

Norway is the only A-i-K donor country and has been supplying fertilizer for many years. Other donors such as Japan, Italy, and the EDF, have given occasional supplies. These donors have not been involved directly in policy dialogue or fertilizer-specific supporting activities, except for Norway which has supported the PEM. Donor supplies for the past 5 years are given below in Table 7.1.

Table 7.1: Donor Supplies 1985-1989

YEAR	FINANCE	TYPE	QUANTITY(MT)	SELLER
1989	NORAD	11:22:16	5000	AGRICO
1988	NORAD	UREA	5000	COROI
1988	FAO	15:15:15	500	ECOPLANTS
1987	FAO	15:15:15	350	
1987	NORAD	16:16:16	5822	COROI
1987	NORAD	11:22:16	8938	
1986	NORAD	16:16:16	6500	
1986	EDF	15:15:15	2000	SEIM
1986	ITALY	UREA	5755	OMNIUM
1985	NORAD	16:16:16	5400	

7.1.4 Credit for Fertilizer Imports

The principal supplier of fertilizer imports credit has been the CCCE. Additional credits for cotton inputs were also provided by the World Bank's Cotton project.

7.2 WORLD BANK

Since the early 1980's, the World Bank has implemented a credit and a cotton project for the agricultural sector. Cotton project credits were used to import fertilizer for cotton.

In 1987 there was an agricultural structural adjustment programme which also covered fertilizer supply issues. In the Credit Agreement for the CASA the government agreed that:

- Section 3.04 (a) : agricultural input subsidies should not exceed 7 percent of cif value, from CASA date of effectiveness
- Section 3.04 (b) : no agricultural input should be subsidized, except pesticides (up to 5%), from the date of second tranche release
- CASA credits would be made available for the commercial importation of fertilizer

These measures led to an increase in the commercial importation of fertilizer, while a major devaluation led to a sharp increase in fertilizer prices. This resulted in a drop in consumption and importers were left with unsalable fertilizer. Cheaper NORAD aid further exacerbated the situations. However, the main cause must be attributed to the price liberalization. It was ill-timed, coming at a time when producer prices could not yet sustain the full international price of fertilizer.

A tentative analysis indicates that the measures were premature. Being supply-oriented, they failed to appreciate that farmers had not yet benefited sufficiently from the policy changes to be able to afford the sharp price increases.

The Government was forced to default on its commitments to CASA and the IFAD programme, both of which required liberalized price regimes.

The World Bank is also indirectly involved in fertilizer use, through its Training and Visit extension programme, now in its initial stages. The programme will no longer emphasize the old fertilizer recommendations. The focus will be on improved cultural practices, such as better water management and use of improved varieties, to increase yields. Fertilizer use will be tackled later. The strategy is intended to minimize the farmers' financial risk.

7.3 INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT (IFAD)

IFAD's involvement was basically to support its Operation de Development Rizicole (ODR). Under the agreement with government, credits were made available for the purchase of fertilizer to be sold locally, mainly for foodcrops, at a cost plus margin. The proceeds from the sale were to be used by ODR to finance its activities.

The project was supervised by the World Bank while COROI was awarded the task of importing and selling the fertilizer and paying ODR. The fertilizer types chosen for import did not correspond to the types usually used by food crop farmers and did not arrive until January 1988 therefore missing the 1987/88 season. The preceding devaluations, the price conditionality, and the availability of cheaper fertilizer made it impossible to sell. The result was protracted negotiations between all parties concerned. Eventually, in June 1989, it was agreed to set the price of the fertilizer at below cost plus.

The IFAD import operation to generate funds for ODR was certainly fraught with problems. The implementation plan appears very unrealistic, especially:

- the mixed IFAD-CASA financing of imports,
- the procurement issue,
- the types imported,
- the imposition of a cost plus pricing structure, and
- the expected full reconstitution of funds,

7.4 NORWAY

Norway's involvement in fertilizer supplies stems from the long-term programme of the Lutheran church in Madagascar. The Norwegian government also supports agricultural development projects such as FIFAMANOR and ROMANOR.

The Norwegian aid-in-kind, under the terms of the bilateral agreement NORAD, undertakes to procure and ship the fertilizer. The Malagasy government undertakes to take charge of the consignment on arrival (by appointing a distributor), to sell it at a reasonable price to small farmers growing food crops, and to supply an amount (not exceeding 20 percent) free to NORAD-supported projects. Countervalue funds are to be paid to MPARA and used, in consultation with NORAD, for rural development programmes. NORAD is also supposed to be given a yearly report on the utilization of the funds, and a monthly situation report on the movement and distribution of the fertilizer.

7.4.1 Analysis

The Norwegian disbursement system disrupts commercial fertilizer marketing. Not only does the sale price of the fertilizer tend to be set lower, but some of the free fertilizer channelled through the Norwegian-supported organizations is marketed, especially by SAFAFI, at prices lower than that of commercial supplies.

7.5 FRANCE

Although France aid has not supplied any aid-in-kind, it has been an important source of foreign exchange credits used to import fertilizer. The following structural adjustment credits made available by the CCCE have been used for fertilizer imports:

(In Millions of French Francs)

Table 7.2: Structured Adjustment Credits made available by CCCE

USER	Description	1982	1983	1984	1985	1986	1987	TOTAL
MAMISOA	Supplier		0.3					.3
HOECHST	Supplier				0.4			.4
SEPCM	Supplier				1.0			1.0
SOAVOANIO	Coconut			1.6				1.6
SNBCE	Sugar cane	4.0	2.8			4.0		10.8
MPARA	Government	14.2						14.2
COROI	Supplier		9.6	7.5*	1.0		4.0	22.1
HASYMA	Cotton	11.3	19.8					31.1
SIRAMA	Sugar cane	12.0	5.2			14.0	8.7	39.9
TOTAL		39.5	37.6	9.1	2.4	18.0	12.7	119.3

* Included pesticides.

7.6 FOOD AND AGRICULTURAL ORGANIZATION (FAO)

FAO has been primarily involved in the PEM. The programme consists of the classical FAO fertilizer programme based on research, demonstration, and extension. Limited supplies of fertilizer were also supplied, their proceeds being used to help finance the project.

The programme is about to be substantially changed.

7.7 OTHER DONORS

Italy and Japan have once in a while supplied fertilizer aid-in-kind, with no specific conditions attached to the supply. The EDF has also supplied fertilizer once, again without specific conditions. Reportedly little of the countervalue funds from the Italian and EDF 1986 supplies have reached MPARA.

7.8 COORDINATION

Little evidence could be found of donor coordination in the fertilizer sector. The World Bank alone has been involved in fertilizer policy dialogue. The donors supplying aid-in-kind have not shown an interest in such dialogue. A World Bank sponsored donor meeting reportedly only highlighted the rift between the donors. There is also no coordination in supplies, as only Norway is a regular donor. Other donors seem to supply on an ad hoc basis.

7.9 COUNTERPART FUNDS

Conditions for the payment of counterpart funds vary, but in general appear very generous. Normally no bank guarantees or other such instruments are requested, and no interest is charged.

In most cases, MPARA is responsible for the payment of counterpart funds by the parties making use of aid facilities. MPARA, however, does not seem to have the powers to ensure such payment. The payment record is extremely poor. It is also very complex as MPARA offsets subsidies and other payments against outstanding debts.

7.9.1 Aid in-Kind

Payment terms vary for primary distributors and secondary distributors.

7.9.2 Credits

The CCCE system of the allocation of credits and payment of counterpart funds seem to work satisfactorily. The main difference is that the Treasury is responsible for payment of the funds, rather than MPARA, and has powers to freeze the bank accounts of the credit user if he fails to pay. Payment terms allow for 9 to 12 months interest-free.

7.10 CONCLUSION

Policy interventions have not led to the desired results.

The PEM has not addressed the key issue of appropriate policies. Only if these are in place will farmers respond to technical improvements and thus ensure attractive prices and markets.

The main issue, which is not limited to fertilizer aid, is the very poor payment record of counterpart funds to ..PARA. Essentially this means that aid does not reach the intended targets. In the case of fertilizer aid-in-kind, distributors seem to be the main beneficiaries. This not only takes away needed resources from the agricultural sector, but also skews fertilizer marketing because some of the distributors may distribute fertilizer aid for the wrong reasons. Abuses are more frequent in the use of funds from the sale of the fertilizer rather than in the narrow margins allowed. With a rapidly devaluing currency, the longer distributors hold on to these funds, the less the real value of the payment.

If assistance is to have a greater impact on the agricultural sector, the issue of counterpart funds must be urgently and thoroughly addressed. Mechanisms need to be put in place that will eliminate the current misuse of funds.

Furthermore, the expediency of channelling some of the aid to the agricultural sector in the most direct and effective way for a limited period, ie by using the aid to maintain low prices, should be investigated.

In order to develop fertilizer supply, it is also essential that all supplies be sold to distributors under the same conditions with no exceptions. A very detailed system needs to be designed to govern fertilizer aid supplies.

8 ECONOMICS AND PROJECTIONS OF FERTILIZER IMPORTS VERSUS RICE IMPORTS

8.1 DEPENDENCE ON RICE

Madagascar's economy depends on rice. This is the staple food and is produced by the vast majority of smallholders. At present imports of rice are small and amount to only 6 percent of domestic consumption. Most of the domestic rice is produced by inefficient traditional cultivation methods. However, smallholders cannot be effectively induced to improve their methods unless they can be convinced that doing so would be beneficial to them. Long and costly distances to markets for farm surpluses are a permanent constraint, reducing the incentives to smallholders of producing a surplus for off sale.

8.1.1 Input-Output Price Relationships and the Issue of Incentives

This study deals primarily with fertilizers. Demand is not a function only of fertilizer prices and availability, but of the relationship between all input and output prices at the farm level.

In the past, and until the structural adjustment policies had begun to be implemented, domestic prices for rice were often kept at low levels, for strong social reasons. Also, during recent years commercial imports of broken rice and rice of low quality, have been carried out for the purpose of maintaining a low affordable price of rice for the poorest sections of the community.

Commercial imports of rice tend to be executed at price levels which are little more than half of the costs of donor rice. Such commercial rice imports are desirable in the short run when the food security problem is overriding. But they also tend to create dis-incentives to domestic rice producers.

8.1.2 Historical Economic Returns to Paddy Farmers in Sample Years

The extract below from Table 8.5 shows why paddy producers have not had adequate incentives to embark on output expansion. The financial benefit/cost ratios have been very low during the whole period for the average paddy smallholders who practice traditional methods and have a low yield. While there are wide fluctuations around the average, it would not seem likely that the traditional farmers could have made sufficient earnings from their cultivations to make it tempting to improve cultivation methods. Farm gate prices were not attractive enough.

Financial benefit/cost ratios in paddy production 1984 - 1988. Estimated at farmgate level.

Year	ZERO OPTION	OPTION 1	OPTION 2	OPTION 3
1984	1.07	1.51	1.47	1.67
1985	1.01	1.43	1.40	1.59
1986	1.38	1.99	2.11	2.42
1987	1.10	1.59	1.69	1.93
1988	1.14	1.66	1.66	1.93

Four different output options are analyzed. The ZERO OPTION represents traditional farming methods without fertilizer. All four scenarios show very low benefit-cost ratios, except for 1986. The significant fluctuations from year to year in all options reflect largely the variations in paddy price at farmgate level.

Traditional method smallholders who might have ventured into IMPROVED methods (OPTION 1), with higher yields without the use of fertilizers, would seem to have earned considerably more in relation to the value of their input (mainly labor).

OPTION 2 represents the same improved technology as in OPTION 1 plus the use of 300 kgs of NPK 11-22-16 or equivalent. The cost-benefit ratios are generally slightly lower than in OPTION 1, which is to be expected, since there are now the expenses for insecticides and fertilizers.

Benefit-cost ratios which are below 2 do not encourage investors to take risks in new ventures. The same applies to farmers, even when the risk period is as short as 6 months.

Larger output on the same area

The attractiveness of OPTION 2 does not lie in higher benefit-cost ratios, but in the fact that for a given area of land the farmer will now have a considerably larger output. The earnings per hectare will then be proportionately larger. But the ratios were not high enough to make ordinary smallholders take the financial risks involved.

OPTION 3 is the same as OPTION 2 with an additional input of 66 kilo of UREA (46 percent). From 1986 onwards the farmers would have been attracted to this option if it were not for the fact that it only applies to farmers who have already reached a rather advanced technology and who have access to the advice and services of extension workers. The drop in actual paddy prices between 1986 and 1987 would also have discouraged any experiments.

8.1.3 Historical Benefit-Cost Ratios

The lack of incentives to rice growers is illustrated by Table 8.5 which shows benefit-cost ratios in paddy production during 1984 - 1988. Four different output options are analysed:

ZERO OPTION	-	traditional farming methods without fertilizer
OPTION 1	-	improved methods without fertilizer
OPTION 2	-	improved methods and the use of 300 kg of NPK or equivalent fertilizer per hectare per planting cycle
OPTION 3	-	as in OPTION 2 but with the additional use of 66 kg of UREA.

All four scenarios show very low benefit-cost ratios, except for 1986. The significant fluctuations from year to year in the different options largely reflect the variations in paddy price at farmgate level.

Benefit-cost ratios which are below 2 do not encourage investors to take risks in new ventures. The same applies to farmers, even when the risk period is as short as 6 months.

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8.1.4 Minimal Amounts of Purchased Inputs but a high Labor Content

For the overwhelming majority of rice farmers, the inputs consist of his or her own labor and that of other family members. The Agricultural Census of 1985 shows that farmers buy a minimal amount of material inputs, and hire very little labor. On the other hand, there are considerable community self-help efforts for work of a collective nature, which is inevitable in a river valley where each farmer's irrigation efforts have to harmonize with those of their neighbors. The individual plots, separated by small retaining walls of soil and mud, are often as small as one-tenth of one hectare or less, and a farmer will usually have many such plots, depending upon the lay of the land.

8.1.5 Labor Costs per Hectare

Below are estimates of present costs of labor inputs in producing rice under different farming systems.

Labor inputs and costs in different Farming Systems

LABOR cost/day 1,000 FMG

EXCHANGE RATE FMG 1620/$

	Labor in days per hectare	Cost/hectare FMG'000	All inputs FMG'000
ZERO OPT.	235	235	264
OPTION 1	221	221	258
OPTION 2	221	221	418
OPTION 3	222	222	455

It can be seen that for the traditional farmer labor accounts for nearly 90 percent of his costs. In advanced farming systems, represented by OPTIONS 1, 2 and 3, labor remains the largest component of cost. This assumes that the agricultural smallholder farmer takes into account the cost of his or her work in the fields. They do not pay themselves wages, but they certainly have a feeling for when it pays to work more and earn more, or for when market conditions discourage the production of a farm surplus.

8.1.6 A Social Problem

Keeping rice prices down for the consumer is a real problem which cannot be dismissed in the context of a structural adjustment policy, but must form an important part of a long-term strategy. Reference was made in Chapter 1 to estimates of widespread under-nutrition. Madagascar has a growing urban population which on the margin consists of growing numbers of extremely poor persons. These have to be provided with affordable rice and other basic foodstuffs if the social fabric is not to be disrupted.

The analysis which follows indicates that, at import parity prices, the Madagascar economy benefits if it imports fertilizers rather than rice. The problem is how to arrive at import parity price relationships without causing a social crisis. During an adjustment process, the authorities will have to intervene in the market mechanism, but it should gradually become possible to operate a policy of absolute non-intervention.

8.1.7 A Gradual Adjustment Process

With free rice imports, as is the case at present, there is a danger that dumped rice, broken rice or rice of low quality will at times depress domestic market prices. Observers do not expect that Madagascar's rice farmers would be stimulated to increase production, if their market prices for rice are determined by whatever marginal quantities of low quality or dumped rice that become available in the world market. Government itself will be tempted at times because of financial constraints, to save public funds by buying internationally dumped supplies.

The policy of stimulating the farmers would, in the long run become effective if the Government restricted itself to domestic supplies when buying rice for distribution to the under-privileged. Donor rice import programs should be implemented gradually so as to avoid sudden shocks to the market; it is not merely a question of price but also of stability in the supply-demand situation.

Analysis of input-output price relationships indicate that the benefit-cost ratios for paddy production would be generally favorable for rice farmers if both inputs and outputs were traded at import parity prices.

8.1.8 Cross-Subsidization Problems

Rice growers have to be paid promptly, when they deliver their marketable surpluses, and they have to be paid at world market import parity prices. These conditions are not likely to be met if the bulk buying of rice from growers is carried out by government or its agencies, because of chronic financial constraints and budgetary delays. Parastatal agencies are generally expected to pay for themselves; if they sell subsidized rice at a loss they will be expected to sell ordinary rice at a profit.

Experience in other countries indicates that such a policy will not work; if the growers are to be paid at the equivalent of import parity prices, and if imports are free, in accordance with the trade liberalization policy, the parastatal agencies cannot charge more than normal trade margins when selling domestic rice to ordinary consumers or traders.

If the state agencies attempt to sell to normal consumers at higher than normal margins, so as to cross-subsidize the consumers of cheap rice, they will be landed with an unsalable surplus, because imports will be cheaper to the trade. Therefore, rice for subsidized distribution should only be bought at market prices from the trade, and not from the growers.

8.2 SCENARIO ANALYSIS

The analysis which follows is based on a comparison between three strategies for dealing with Madagascar's foreseeable demand for rice between now and year 2000.

8.2.1 ZERO OPTION Scenario

Table 8.1 sets out the ZERO OPTION scenario which assumes that Madagascar will proceed towards the year 2000 without any modernization of its smallholder agriculture. Yields per hectare will remain at present levels, and agricultural methods will not change.

With the population increase, we assume that there will be a modest annual increase in areas cultivated. The assumption that the yields from marginal land will be at the same level as average yields from land now under cultivation, is perhaps overly optimistic.

Some improvements will undoubtedly be carried out by good farmers and on good land. But there will be a steady growth of new, poor, farmers on marginal land. Experience in Madagascar also indicates that the population density will increase on the smallholdings.

As a minimum target, the Government will aim at maintaining consumption per capita at present levels. We have not assumed any increase in consumption per capita, although this would be desirable.

Assumptions underlying this scenario are set out in the NOTES to Table 8.1.

This model assumes that rice will be imported below world market prices for average rice of good quality, such as is produced by the Malgache farmer. The rice might be financed by donors, but it will be costed at full free market import prices. The costs and benefits of such imports, versus imports of fertilizers, apply to donors as well as to the Madagascar economy. If the economy saves foreign exchange on importing fertilizers, rather than rice, so would the donors, if they see the options in those terms. Thus, it does not matter in the analysis, whether we assume commercial imports or donor imports as long as the resources are properly costed.

8.2.2 The OPTION 1 Scenario

The OPTION 1 scenario is quite effective, and very cheap, since it does not use fertilizers but only improved methods. The net foreign exchange savings are dramatic and virtually equal to the cost of the rice that it saves. The background to the scenario is assumed to be that domestic production would have to increase so as to eliminate the imports which arise in the ZERO OPTION scenario.

The NOTES TO TABLE 8.2 explain the assumptions. Basically, a large and growing number of hectares have to be converted each year from ZERO to OPTION 1 conditions. A successful program requires that 73 percent of all paddy land would be under improved culture by the year 2000.

This program cannot be realized unless there are very drastic improvements in the extension services and in all supporting activities.

8.2.3 The OPTION 2 Scenario

The OPTION 2 scenario in Table 8.3 shows that the same rice supply will be achieved at a higher cost, compared to OPTION 1. But the savings in foreign exchange, although a little smaller than in the previous scenario, are still dramatic, rising to $150 million dollars per year by the year 2000.

The implementation of this scenario is also going to put an enormous strain on the extension services. But, because of the higher yields per hectare of land converted to OPTION 2 methods, there will be no need for a very large number of farmers to be counselled and instructed every year. By the year 2000 the amount of land brought in under the OPTION 2 methods, will have to reach 33 percent of all land under rice. But that is at least rather more attainable than the 73 percent which would have to be converted under the OPTION 1 scenario alone.

It must be remembered that farmers will not be encouraged to use fertilizers unless they at the same time improve their general agricultural methods. Thus, the smallholders must go to OPTION 2 via OPTION 1. Otherwise the yield benefits are going to be dismal in relation to costs.

Again, NOTES to TABLE 8.3 set out basic assumptions.

8.2.4 Comparisons of Net Foreign Exchange Costs

Table 8.4 is self-explanatory and summarizes in a few columns foreign exchange implications of the three scenarios. We have not in this analysis brought in the OPTION 3 scenario, although this undoubtedly is much more profitable, because of the massive output increases which can be gained by a very small UREA application of 66 kg per hectare, in addition to the 300 kgs of NPK implied in OPTION 2.

The reason for not including OPTION 3 in the broad projection model is that it will for technical reasons have a limited application. Only under very well controlled conditions will the farmer reap the full benefit of the urea, which otherwise is likely to run away with the irrigation water.

8.3 ESTIMATED RICE PADDY YIELDS PER HECTARE

Tables 8.7 to 8.7d show the "yields-per-hectare" implications of the different scenarios in this chapter. Thus a change from traditional methods to improved methods, without the use of fertilizers, will result in a very substantial increase in output, on average about 800 kgs of paddy per hectare or more than 500 kgs of rice equivalent.

To recapitulate:

ZERO OPTION:	traditional husbandry without use of fertilizers
OPTION 1:	improved husbandry, without use of fertilizers
OPTION 2	improved husbandry PLUS 300 kg of NPK 11-22-16
OPTION 3	same as OPTION 2 PLUS 66 kg of UREA 46 percent.

The farming systems show considerable average yield difference (paddy kilo/hectare):

	Average total yields paddy kg/ha	Average marginal yields paddy kg/ha
ZERO OPTION:	1880	
OPTION 1:	2680	800
OPTION 2	3680	1000
OPTION 3	4430	750

These are estimates of yield impacts under actual field conditions, which are different, and lower, than those arrived at in selected projects. They represent the consultant's estimates of what ordinary farmers can achieve when they move from the ZERO option, when they have the benefit of agricultural advice from extension officers, and the requisite supply of timely inputs.

Of considerable interest is, the improvement in OUTPUT which a traditional farmer can achieve when moving from the ZERO OPTION to OPTION 1. The latter does not imply any use of fertilizers, but of improved methods of planting and cultivation.

As shown in the following, the move from ZERO to OPTION 1 actually implies reduced costs to the farmer.

8.3.1 Realistic transformation requirements during the 1990's

The transformation of Madagascar's rice culture from traditional methods to improved methods will, under all circumstances, have to become very vigorous. Our conclusion is, however, that a "fertilizer-free" modernization of rice culture cannot achieve the minimum requirements for food security set out above.

8.3.2 Needs for Extension Services

All improvements, with or without fertilizers, will require a vastly expanded and more penetrating agricultural extension service. There is a lack of extension officers to show the farmers what to do, and to monitor their performance. The relative improvement in output from traditional methods to OPTION 1 is equal to 43 percent. The National Agricultural Census which was carried out during 1984 and 1985 indicated by its data that very few farmers applied improved methods of cultivation of any kind.

8.3.3 Minimal use of Fertilizers

The minimal use of fertilizers in production of the national food staple is illustrated by the fact that current fertilizer use in the paddy fields is so small, that at the very most only 33,000 hectares or about 3 percent of the cultivated hectarage could conceivably receive a recommended dosage of about 300 kgs per year. The additional yield from this fertilizer dosage would, at most, amount to little more than 1.5 percent of national rice output!

8.3.4 Yield Differences Within Farming Systems

Estimates of average output indicated considerable yield differences between different regions of Madagascar and between different districts in each region. These differences are documented in the Agricultural Census data which were based on a sample of 4,300 rice farmers all over the country.

There are also, inevitably, considerable yield differences between farmers within each district, depending upon the quality of their land, and upon their own characteristics as farmers.

Taking into account both inter-regional, inter-district and intra-district differences in yields within each farming system, yields per hectare can be classified into four groups:

ZERO OPTION	PERCENTAGE OF AVERAGE YIELDS
lowest quartile	69 percent
second quartile	91 percent
third quartile	112 percent
highest quartile	128 percent
AVERAGE ZERO OPTION YIELD	100 percent

Table 8.7d sets out in detail our assumed yield differences between farmers within each system. Relative yield differences of this order have a strong bearing on the efficiency of farm improvement programs, including the use of fertilizers. A concentration on the upper quartiles will give approximately 20 percent better than average results.

8.3.5 Informed Guesses

It must be emphasized that the yield distributions which have been applied in this analysis are the result of informed agronomic guesses but not of actual sampling. A spread of +/- 30 percent around a yield average of 100 percent would, a priori, be expected even in a rather homogenous agricultural environment. This is, approximately, the spread applied for the highest and lowest quartiles, respectively.

Considering the sharp differences in agricultural environments between valleys and deltas, and along valleys with different water regimes, it could well be that the differences are larger than here assumed. Also, rice is produced in three different regimes, with irrigation, on natural flood lands and using rainfed methods. The yield differences between these three systems are large, as shown in the agronomic ANNEX 1 to this report.

8.4 SUMMARY OF OPTION RESULTS

Our scenario analysis has been carried out using world market prices for both inputs and outputs, in order to determine the economics of fertilizer imports versus rice imports. The results of the analysis for the four options are summarized in Table 8.8.

It should be pointed out that the benefit-cost ratios referred to in this analysis are NOT the same thing as the well known concept of value-cost ratios. The value-cost ratios generally indicate the impact of increased fertilizer use only. We have in our analysis regarded labor as a cost to the farmer as an entrepreneur, even if he is paying himself a very low minimum wage.

The benefit-cost ratios at current import parity prices at farmgate level are high enough to expect that the farmers would respond, if they were offered such farmgate prices. These ratios are however considerably better than those which have resulted from price management in the recent past.

The benefit-cost ratios have been subject to provisional sensitivity testing in TABLE 8.6 with parameter variables for paddy prices and for NPK. The actual values are shown in the upper left hand corner of the Table, with an import parity price for paddy of 331 FMG/kg and NPK at 519 FMG/kg at farmgate. Urea was held constant at a price of FMG 547/kg and labor at FMG 1,000/day. Also, the rather negligible input of insecticides in Options 2 and 3 was held at constant costs.

Appendix Tables A4.1 to A4.10 provide detailed listings of data, estimates and summaries relating to the analysis. Import content coefficients have been assigned to different cost elements on the basis of informed guesses. In most cases they reflect commonly encountered input/output ratios in other countries, since there is no input/output table for Madagascar.

These coefficients are used as an attempt to catch indirect foreign exchange costs in local transport and handling operations from port to up-country depots to farmers, and from farmers to depots.

8.5 OTHER CROPS

Total fertilizer use in Madagascar in 1988 was approximately 22,000 MT, down from 35,000 MT in 1987 when imports were excessive in relation to demand and to input/output ratios. For the time being it would seem reasonable to apply a benchmark figure of, say, 25,000 MT as a theoretical normal 1988 consumption.

The data that we have reviewed indicate that producers of industrial crops are able to live with present ratios between input and output prices, and that the constraints they experience have more to do with logistics of supply than with price ratios.

Assuming that 7,000 MT - 10,000 MT would be the normal usage in the rice sector, the other crops would then at present be using approximately 15,000 tons - 18,000 tons.

Because of the logistics and the processing constraints in the case of some crops (for example the need to rehabilitate the sugar mills before a conservative projection throughput can substantially increase), it would also seem reasonable to of the an average growth rate in output of all the other crops can be given at 5 percent per year. Without any change in fertilizing practices, their demand for fertilizers would then increase from present, levels of 15,000 MT - 18,000 MT (in 1988) by a factor of 1.8 to the year 2000.

Thus, demand for fertilizer by the year 2000 would be in the range of 27,000 tons to 32,400 tons. Taking the mid range of the estimates the aggregate demand scenario for fertilizers would be of the following order of magnitude

	Year 2000
Rice basic	8,750
Rice increased use	135,000
Other crops	29,700
TOTAL	173,450

It must be remembered that projections do not constitute demand. The major item in the picture given above is the massive rice sector demand for fertilizers, which will not materialize unless a great number of conditions are first satisfied. It would therefore be dangerously misleading to suggest that this is definately going to be the demand picture by the year 2,000 . A more likely assumption is that a livelier commercial crop development will come about, using modern methods and logistics, while the smallholders will continue largely in their traditional ways. In such a case it is possible that fertilizer imports would weigh heavily at the commercial use end.

8.6 THE AGRICULTURAL CENSUS 1985

The Census showed, among other things, that nearly half the farmers were illiterate, which implies that they have difficulties in applying modern methods, or in reading simple instructions on packets of fertilizers or chemicals.

It also indicated that the area under cultivation had undergone negligible change during the preceding 10-year period, while the population had increased by at least 30 percent. The Census findings were that agricultural population density per hectare under cultivation had increased by approximately 20 percent. This finding emphasizes the strong need for an improvement in yields per hectare.

The Agricultural Census samples were stratified so that they would cover each district in a reasonably representative manner. Also, they attempted to cover agricultural inputs and outputs for different periods of the year, depending upon when farmers would plant and harvest their crops. About 90 percent of the data relate to irrigated rice. Dryland rice yields are considerably lower per hectare, and also considerably more vulnerable to climatic fluctuations.

In addition, a special detailed investigation was carried out on the basis of a sample of nearly 1,600 rice farmers regarding their production costs and methods of production. The analysis showed that modern methods in general, and fertilizers and chemicals in particular, were rarely used.

8.7 CONSTRAINTS

The following constraints hold down production volumes in the smallholder sector:

8.7.1 Input-Output Price Relationships

A great number of constraints have operated in Madagascar, including in particular a pricing system which has for social reasons tended to keep down the price of basic food stuffs, while fertilizers have been comparatively expensive. This system has reduced the attractiveness of surplus production by subsistence farmers, for off-sale to urban markets.

8.7.2 Imports and Distribution

As indicated elsewhere in this report, the system of importing and distributing fertilizers has been characterized by parastatal operations and administrative interventions.

8.7.3 Smallholder Credits

The smallholder credit system is ineffectual, as shown in Chapter 4 of this report. Farmers will need cash income rather than credit.

8.7.4 Extension Services

Extension services are inadequate in staffing and means of operation.

8.7.5 Physical Infrastructure

The physical infrastructure and logistics of the transport system has deteriorated. Studies of the transport system indicate that some of the main roads are or have been impassable except by four-wheel-drive vehicles, and that numerous bridges and culverts have collapsed. For a more detailed analysis of the transport system refer to a World Bank Document (No.4057-MAG) "MADAGASCAR TRANSPORT SECTOR MEMORANDUM" of 1983. Also, the field visits carried out in the present study have shown up massive transport and infrastructure bottlenecks in roads, railways and harbour installations.

8.7.6 Availability of Inputs at Farm Level

Agricultural producers in general and smallholders in particular, experience high transport costs, or a virtual lack of transport possibilities both for their excess produce and for their agricultural inputs. Inevitably, these conditions have resulted in low levels of farm production for sale in domestic markets or for exports, and of very small quantities of fertilizers reaching the smallholders.

8.8 CONCLUSIONS REGARDING FERTILIZER STRATEGY

The OPTION 2 strategy is the only feasible one in the medium term, including both improved general farming methods AND the use of fertilizer, a forecast can be made that the rice sector will need fertilizer imports rising from about 33,000 MT in 1989 to 137,000 MT in the year 2000. These are requirements in addition to the approximate amounts of 7,000 - 10,000 MT which at present go to the rice sector.

9 RECOMMENDATIONS

9.1 PERSPECTIVE

Madagascar is a country in transition. Far-reaching policy changes have taken place in the last few years and the country is slowly adjusting. The adjustment period is likely to be long and difficult as changes do not always yield the expected results.

The fertilizer sector forms but a small part of this reform process but its position in the economy must be kept in perspective.

9.1.1 Output Prices and Inflation Rates

The prices of some agricultural products are managed in a manner which creates dis-incentives to the producers. For example, the price management on imports of cheap broken rice has a negative effect on producer incentives.

One can, however, foresee a strong policy resistance in agriculture to any short-term price adjustments making the market economy more effective. One of the elements in that general process is reflected in very optimistic forecasts that indicate that the annual inflation rate can be reduced to 8.5 percent between 1989 and 1990 and to an annual rate of 7 percent after 1991.

According to preliminary data the inflation rate was 27 percent between 1987 and 1988, and has been optimistically scheduled to be brought down to 9.5 percent this year (1989). This seems to be a very fragile scenario, which is likely to collapse with any substantial price shocks.

9.1.2 Adjustments of Agricultural Output and Input Prices

The adjustment of producer prices to import parity price levels based on world market prices, cannot be made in a vacuum and will have to take some time. Meanwhile compromise solutions will have to be found. One such solution, which is far from satisfactory but is applicable within the current economic framework, is that prices for agricultural imputs generally, and for fertilizers in particular, be kept affordable during a transition period in order to lessen the shock to the economic system.

9.2 THE DEVELOPMENTAL ASPECT

The role of fertilizer use as an instrument of national development is the most pertinent in the context of this study. The fertilizer sector cannot be reviewed and recommendations made on it in a vacuum. A global approach is needed whereby the fertilizer sector is percieved in the context of Madagascar's:

- agricultural sector
- socio-economy, and
- political structure

All these sections are inter-linked and intra-influencing and thus have to be considered collectively, if any feasible and far-reaching policies are to be developed in the fertilizer sector.

9.2.1 The Demand Constraint

External interventions to boost fertilizer supply have not had the desired effect because of the demand constraints that have limited the absorption of the increased supply. Addressing the demand constraints may provide the key to recovery.

9.2.2 Increasing Rice Production

The agricultural sector dimension comes to light when the area of rice production is reviewed. Madagascar's immediate priority is to boost agrucultural production. But this issue of increasing rice production presents a paradox: boosting the farmers' purchasing power will require an increase in rice yields; but a short term increase in rice yeilds can only be achieved by boosting fertilizer use in the first place.

Under conditions of minimal fertilizer use and inadequate food production, fertilizer marketing is relegated to a lower priority as the need to increase rice production becomes a more immediate objective. Despite a move to deregulate rice prices the liberalization process is not yet in force, and in actual fact will take time. Only when rice prices are decontrolled can any open fertilizer market be sustained.

9.2.3 Maintaining Reasonable Fertilizer Prices

In the long-term it will be essential for crop prices to rise to allow the profitable use of fertilizer. Until then, the short to medium-term aim should be to maintain fertilizer prices at a level that will ensure profitability to the farmer at existing producer prices. It is expected that such action will:

- create timely conditions condusive to fertilizer use on rice and other food crops for the first time
- stimulate additional fertilizer use, lead to increased marketable supplies and, therefore affect the majority of the population: There should be less need to import, considering the increased food production
- give a monetary incentive to farmers and boost their purchasing power
- boost sales and margins for the supply sector, thereby laying the foundations for a sustainable fertilizer marketing systems
- make better use of aid which will benefit the farmers more than the distributors (who currently tend to retian counterpart funds)
- direct the benefits to the field where they are needed most rather than being kept in Antananrivo

- enable the country to absorb more aid faster

It is recommended that in order to maintain reasonable fertilizer prices, an expedient system would be to use grant aid fertilizer.

9.3 FERTILIZER USE

Madagascar is endowed with resources, but is practising a very undeveloped form of agriculture, uses extremely little fertilizer and imports food. There is clearly a need to intensify agriculture and make it more productive.

The short-term aim should be to create conditions that will stimulate the use of fertilizer on rice and other food crops. Only under such conditions will extension efforts bear fruit. The most practical means to stimulate consumption is a decrease in fertilizer prices. Such intervention should stimulate production and, for the first time, test real demand for fertilizer.

Real fertilizer demand will constitute the basis for a sustainable fertilizer marketing system.

9.4 FERTILIZER SUPPLY POLICY

The policy for fertilizer supply should continue to move towards privatization and liberalization. The key factor, however, will be time. Within the sector development plan, realistic targets ought to be set to arrive at the goal of a fully liberalized and privatized marketing system, as well as at its intermediate stages. Above all, the policy must be consonant with adjustments in the rest of the economy and evaluate realistically the constraints to reaching the desired goals, such as:

- the limited amount of fertilizer used
- foreign exchange constraints
- the banking system and the limited availability of credit
- the very limited number of companies with the capability to import.

As most of these constraints affect principally importation, it may be expedient to pursue a policy that will concentrate on building up domestic distribution and retailing. Progress on

importation should be deferred until conditions are ripe, ie until increased fertilizer use and a healthier supply system, as well as producer prices, will make it attractive. In fact, a properly formulated and implemented policy will lead to this condition with little intervention.

The low priority given to commercial fertilizer importation at the moment, and the need to keep fertilizer prices affordable, as well as the need to absorb external funds quickly; all lead to the possibility of increasing the use of fertilizer aid-in-kind made available by donors.

9.4.1 Donor Support

In view of the arguments put forward it is recommended that donors should support a government sectoral development plan formulated along these lines by supplying the necessary aid-in-kind. For the time being it is expected that such intervention would constitute the most effective way of rapidly reaching the target. At the same time it will eliminate the need for the government to apply an overt subsidy and go back on its liberalization process.

The sectoral development plan should contain guidelines for the donors on all aspects of supplying aid-in-kind. This would not only ensure that the aid is well integrated within the marketing system operating in the country, but also ensure a uniform system of aid supply.

In essence, the current agricultural and fertilizer situation calls for bilateral support rather than structural adjustment of fertilizer supply.

9.4.2 Design of the Intervention

The key factor in a successful intervention will be its design. Each detail needs to be specified to ensure adequate mechanisms for the disbursement of the aid. Once the rules are laid down, no exemptions or deviations should be allowed. Monitoring and reporting should constitute an integral part of the exercise. Both the government and donors should ensure adherence to the rules.

The aid should be channelled through the private sector and the system should be modelled on a commercial basis. There should be no allocation of supplies by the government. Counterpart funds should to the extent possible be handled by the banks and the Treasury.

Commercial importation should continue to be available to interested parties.

9.5 STRATEGY TO INCREASE FERTILIZER USE

The most effective incentive to farmers is profit. So long as rice-growing or other crops do not yield the necessary returns, extension services are unlikely to have the desired effect. Besides, the extension effort, per se, is not cheap.

As the country cannot afford an overt fertilizer subsidy, it will be up to the donors to support such an initiative.

9.6 REALISTIC PUBLIC AND PRIVATE SECTOR ROLES

9.6.1 Public sector

There has been excessive public sector involvement in the past. Current policies are fast diminishing such involvement. MPARA's role has been drastically reduced, and state-related enterprises have lost their supply monopoly position. More disengagement is needed in the following areas:

Allocation of Aid Supplies

In particular, MPARA needs to develop more open systems for the allocation of aid supplies. There is a need to develop systems that are based not on decisions within the ministry but, on the ability of distributors to buy and sell. MPARA should disengage itself from the allocation of supplies to distributors.

Fertilizer Pricing

So long as it is continued, steps need to be taken to improve it. Furthermore, such steps should ensure participation of professional bodies outside the government that will be able to give figures based on sound economic basis. This is likely to require a considerable amount of expertise and information, well beyond the current capabilities of the private or public sectors.

Payment of Counterpart Funds

MPARA should also disengage from the responsibility of monitoring and ensuring payment of these funds. Payment will need to become the responsibility of banks and the Ministry of Finance.

Supply

The remaining MPARA involvement in fertilizer supply should be phased out. A plan of specific private sector-run, initiatives should be prepared by MPARA as part of its sectoral development plan. A similar but probably slower disengagement ought to take place for cotton and sugarcane.

Data Gathering and Processing

MPARA should step up data gathering, and information processing in order to keep abreast of the fertilizer situation throughout the country; also in order to more accurately project future fertilizer requirements.

9.6.2 Private Sector

The private sector role in fertilizer supply should increase if conditions conducive to its growth are put in place. The process is slow and will take time. Involvement will have to grow not only according to disengagement by the public sector, but also according to the capabilities of the private sector. These are different at each supply level. The goal should be to build from the bottom, ie retail, distribution, and finally importation. To ensure all this, adequate supplies of fertilizer have to be available.

Retail

Capabilities are good at the retail level, and providing margins are adequate, fertilizer should be adequately channelled throughout the areas where it is in demand. Remote areas may not attract fertilizer suppliers. Special development arrangements may have to be made to ensure that the private sector can profitably supply such areas. These could take the form of a transport subsidy.

Distribution

Currently there is considerable weakness at distribution level. By making the purchase of fertilizer aid more competitive, the most efficient and able distributors (and those with adequate resources) will emerge above the others.

Importation

The greatest weakness exists at importation level. Only two companies (not including the marketing boards) have been importing, and they have done so mainly on non-commercial terms, ie using aid credits, which allowed generous payment delays.

To conclude, supplies will have to be maintained through generous donor support in the transition period. However, all aspects of distribution of these supplies should be carried out on a commercial system based on commercial capability. Commercial importation should continue to be freely allowed. Thus for cotton and sugarcane, importation can continue according to the present system.

9.7 AN APPROPRIATE COMMERCIAL MARKETING SYSTEM

Madagascar is emerging from a period of limited private sector activity. As a consequence it is going to take time for the private sector to build up what is required to provide all the required marketing services. Policies must be put in place to enable the private sector to respond. Action must be taken to give the necessary incentives even though the process will be slow.

Not all marketing functions are equally manageable by the private sector at this moment. Therefore each marketing function should be handed over according to the sector's capacity to handle it, and the possibilities of the economy.

As noted above, the import function is the one most affected by the limited financial possibilities of the private sector and other constraints and therefore needs considerable help. It does not yet lead to the cost effectiveness that ought to be the deciding factor determining the appropriate import system to be adopted by the country. On the basis of cost effectiveness, this function will be the least sustainable by the private sector, because it is only after economies of scale have been achieved that it will make sense to have a fully commercial import system.

In the current Madagascar situation, imports need to be consolidated in order to minimize purchase prices and freight charges.

9.8 IMPROVED LOGISTICS OF FERTILIZER SUPPLY

Consultative mechanisms should be established for programming ship traffic to Toamasina port so as to avoid simultaneous arrivals of large shipments of fertilizer; both donors and importers should participate in such mechanisms.

Consideration should be given to investment in special railway sidings to appropriately located existing large fertilizer storage facilities in the central highlands region in order to enhance railway participation in fertilizer transport. Consideration should be given to investment in a barge with bagging facilities at Toamasina port which could be used to receive immediately fertilizer unloaded from ships as soon as they dock. The barge would then move to a harbour anchorage and bag the fertilizer and later return to pier to unload to railway wagons and/or lorries as and when they are available to be positioned on or near the pier. Approximately 100,000 tons per year of bulk fertilizer imports would probably be needed to make such an operation viable.

Training of importers in better management of import logistics should be organized, perhaps through Chambers of Commerce or similar groupings in Madagascar (e.g. FIV.MPA.MA, GEM) in concert with SEPT, in order for large importers to dispense with clearing agents' services and be capable of achieving higher port evacuation rates. This training should include coordination and appropriate advance negotiating positions (e.g. for demurrage) vis a vis SEPT.

Consideration should be given to eliminating SGS inspections eventually for purely commercial fertilizer imports when pricing becomes highly competitive amongst several importers.

The Central Bank should be encouraged to eliminate/simplify its procedures for approving import requisitions ("FSI") and for confirming documentary credits; at a minimum a procedure for processing these 2 requirements simultaneously should be instituted in order to reduce the time required therefor from up to 1 month to, say, 1 week.

Trucking companies and importer/merchants should be encouraged to negotiate round trip arrangements with grouped loads of merchandise outbound for the ports and fertilizer inbound for the central plateau regions.

Fertilizer importers should be encouraged to negotiate with the railways to obtain favorable conditions for transport on the

Manakara/Fianarantsoa line which currently needs more traffic to remain viable.

9.9 FERTILIZER AID

For the foreseeable future, fertilizer aid will need to be heavily increased in order to attain developmental goals. The aid should be used as a precision instrument to boost agricultural production thereby supporting the policy reforms already undertaken and consolidating gains. Through proper planning the aid could be used to bring about the conditions necessary for the establishment of a sustainable private sector marketing system in the country.

The first requirement will be to standardize fertilizer aid. Thus, Aid-in-Kind or credit for fertilizer imports should have the same conditions attached. If possible all aid should be in grant form. Access to the aid should, similarly, be standardized.

Fertilizer aid supplies will however be confined to those types that are used for rice production. For other crops, imports should continue under commercial importation.

9.10 A SUPPLY SYSTEM FOR THE FERTILIZER MARKET

The current fertilizer supply system is heavily distorted by government and donor intervention. The uncommercial practices that have developed from this must be eliminated and be replaced with a supply system that works along commercial lines, in which fertilizer aid is fully integrated.

The first issue that needs to be addressed is the relative preference to distributing fertilizer aid as opposed to importing caused by the attractive payment terms for both fertilizer Aid-in-Kind and credits for fertilizer imports.

Commercial credit is reportedly a constraint to commercial fertilizer importation, hence, this is where measures need to start being taken. Credit lines ought to be available for importation on request and with the necessary guarantees to the companies requiring them. This will tend to ensure that fertilizer imports or purchases of fertilizer aid are only made by the organizations with the financial capabilities to do so. This will also tend to resolve the payment of counterpart funds issue. As clear regulations are laid down for the payment of aid fertilizer purchases, the failure by buyers to pay the government should be eliminated.

MPARA should no longer be the administrator of the funds. This function should go either to a Ministry with the necessary instruments to ensure payment, or through the banks themselves. The instruments and mechanism' to ensure that distributors pay the counterpart funds and that importers pay for their credit use should be clearly defined. In some countries, distributors buying government fertilizer have to submit Banker's Guarantees at 90 or 120 days so that, in essence their bank guarantees payment to the government within the time specified. Furthermore, interest may be payable on the outstanding amount to approximate commercial practice. It is only by eliminating the special aid conditions that streamlining is made possible and a gradual return to commercial practice and a sustainable import system is effected.

9.11 IMPROVEMENT OF PRIVATE SECTOR MARKETING

Improvement of private sector marketing will first of all require the right incentives, in the form of assured supplies and adequate margins. As increased margins for the suppliers mean decrease in profitability for the farmers, a liberalized price system for the time being is unlikely to be advantageous to either party. Besides, the current government pricing intervention, not only limits margins, but also makes them unpredictable.

A short-term price subsidy on donor fertilizers could serve as a tool to develop the supply sector. The aid-in-kind supplies used to maintain fertilizer prices affordable could be sold to distributors at a price that allows them suitable profits. As no fixed retail prices are envisaged, at least initially, the system should ensure adequate margins and active competition. This, in turn, should sort out the viable distributors from the rest.

To put an equitable system for the allocation of aid supplies into place will require an efficient banking system and streamlined credit facilities. Improvements in the banking sector will therefore be necessary.

9.12 TECHNICAL RECOMMENDATIONS

The study could not go into the technical issues. However, the following was noted:

- Madagascar uses very little fertilizer. Inevitably this must lead to depletion of nutrients in the soil, particularly in the intensively cultivated areas. The

issue of sustainable agriculture through a more balanced soil management needs to be addressed. Even with the use of farmyard manure, it is likely that greater use of fertilizer will be required. This may be even more important for the tanetys.

- Despite involvement by various agencies, there appears to be no clear guideline as to the fertilizer type(s) and application rates best suited to rice growing under current conditions. A decision needs to be made, and clear recommendations issued as soon as possible to replace the old and reportedly outdated ones.

- The need for Potassium on certain soils has not been conclusively proven. Yet the country seems to be importing a relatively large proportion of this nutrient, which is relatively expensive. The issue should be investigated with a view to optimize the use of the limited foreign exchange available to import as closely as possible, the optimal mix of nutrients.

9.13 SMALLHOLDER CREDIT

The principal lesson that the World Bank draws from its experience is that no viable means has as yet been found for delivering financial services to the smallholders. But the project has made it possible to define some conditions which have to be fulfilled for even..ual success. The Bank emphasizes institutional aspects such as :

- a favorable political framework
- the existence of other, complementary, services
- the necessity of basing future interventions on a complete financial circuit, which also will have to encourage private savings side by side with lending.

In more specific terms, the Bank draws the conclusion that the farmers have to form savings and loan associations, which would be guided by BTM and drawn into the formal financial system, once they have reached a certain level of viability.

The rural credit system would have to concentrate on the more productive regions.

The World Bank states that the support services must be regarded as essential. This means to our mind a particularly improved

effectiveness of the extension services, combined with advice, guidance and training in credit operations.

To the World Bank view as summarized above, must be added that it is unlikely that an improved agricultural credit delivery system can solve the problems unless other conditions are also fulfilled, in addition to those listed above. The most vital of these conditions is that costs of inputs and outputs must be such that the farmer can risk some of his present or future income on fertilizers and be reasonably convinced that he will make a profit. Another condition is that even without fertilizers, a diligent farmer should be able to save some money, so that he can join a savings association, or pay cash for inputs.

The chief issue to the farmer is, at present, that he does not earn enough from his agricultural output, such as it is, so as to be able to pay cash. It is only when farmers reach a level of income which enables them to go to a local distributor an pay cash for fertilizers, that usage will begin to reach economic levels. Therefore, any smallholder credit scheme, must, in order to be successful, work with farmers who can begin to pay in cash.

9.14 COSTS

FOB and freight costs represent around 60 percent of selling price and therefore constitute the most important consideration regarding the reduction of costs.

The largest cost savings would result with orders of around 10,000 MT in bulk. This, however, would necessitate a bulk handling facility, which climatic conditions in Tamatave make tricky. The quality of stores in the port area could also be improved and the rent surcharge applicable when fertilizers are stored for more than 4 days, reduced. Alternatively the railway system should be improved and fertilizer importers should be allocated more than their present daily quota of 6 wagons (180 Tonnes).

Under the present state of the fertilizer market individual imports of 10,000 tonnes cannot be achieved except for donor supplies. Private importers should be encouraged to group their orders and shipments with those of Reunion and Mauritius.

9.14.1 New Supply Sources

New sources of supplies should be investigated. For example, if the freight costs between Mauritius and Madagascar could be reduced, Mauritius could become a very competitive and complementary source of supply. Freight from Mauritius is US$40 per tonne - this is high. Port Louis is an expensive port: the quantities involved are low (between 100 and 1000 MT) and there is not much competition on that route. However, in view of the competitive FOB prices offered by the Mauritius Fertilizer Plant - a chemical blending plant, some thought should be given on how to reduce freight costs. Once a month a vessel with a 2,000 tonnes capacity leaves Mauritius for VOEMAR empty. It comes back with cattle purchased by Mauritius from Madagascar. Freight could be reduced to lower than US$20 per tonne should the negotiation between the Mauritius Fertilizer Plant and the ship owners come to fruition. There is ample room for the Mauritius Government to reduce its port charges. Special rates could be obtained for exports to Madagascar via "La Commission de l'Ocean Indien".

Donor countries should ensure that freight is on a Liner Term basis and not on FIOS. Importers should be encouraged to pay for the insurance overseas as already described before. Bank charges and bank interest are high, and should be investigated. Import duties of 5 percent should be removed altogether. The opportunity of removing the SGS inspection should be studied.

9.14.2 Transport Costs

Transport costs represent the highest component of local costs for the average rice market - 9 percent of selling price. However its weight can be considerably increased depending on the remoteness of the users. There is not much which can be done to reduce transport costs in the short term. Long term action should include improvements of the railway system and road network. Transport cost is negligible for the sugar market which accounts for only 1 percent to 4 percent of selling price. The exception being the MORANDAVA Plantation where it can go up to 21 percent of selling price. Transport cost for the cotton market fluctuates considerably from 8 percent to 23 percent of selling price depending on the route and the method of transport (eg coastal shipping against rail or lorry).

There is no hard and fast rule concerning costs differential between transport by rail or by road. Rail costs are slightly lower on a tonne per mile basis than those of lorries. However some routes are not entirely serviced by rail and in other

instances distances from port to final destination are shorter by road than they are by rail (distance from port to final destination).

Private importers are making best use of the routes and methods despite the present constraints, and potential savings with the present system which are not great.

9.15 INFORMATION SYSTEMS

9.15.1 Data Collection and Dissemination Methods

Obscurity as to the nature of some information and the methods of collecting, calculating or estimating data would make it difficult for any government agency to plan its resource use. But, even more so, the private sector has a functional need for better market information, so as to avoid over-ordering or under-ordering of supplies. A market mechanism cannot operate effectively in the absence of reliable (if any at all) statistical data.

9.15.2 Need for Computerized Data Units

Data, which normally would be accessed through a computerized system, are still handled in handwritten or typed file notes or tables. Such a system becomes unmanageable today, when private sector investors and operators, developers, importers and exporters need virtually instant information in order to operate effectively in an international environment.

Differences and contradictions in information content emerging from different government and parastatal agencies indicate that the information system is not functioning well within the Government itself.

APPENDICES

APPENDIX I

TERMS OF REFERENCE

I

Purpose of the Study

A.I.D/Madagascar is coordinating with other donors to institute measures to further strengthen GDRM policies regarding liberalization. One area where AID can make an important contribution and impact is by revitalizing the agricultural input delivery system. Fertilizer, because of its critical role in increasing rice production, is one of the key inputs. Additional policy changes and refinements are needed to rationalise the current importation and distribution system so that fertilizers can be delivered to farmers of the appropriate type, at the right time and place, in sufficient quantities and at competitive prices. By financing the fertilizer study, AID, will be helping to re-establish a private sector delivery apparatus for one critical input. Moreover, once a working private sector marketing system is in place for fertilizer, the same organization will be better equipped to market other agricultural inputs. A study of the fertilizer sector in Madagascar is needed at this time to enable the Mission and other donors to better understand how the sector works, the reasons for low use and availability of fertilizer, and to recommend ways to address the problems. The results of the study will prepare AID to take a lead role in coordinating donor efforts to work with the GOM to address constraints to increased use and availability of fertilizer. The study will also guide the donors and the GDRM to design appropriate policies to liberalize the agricultural input supply sector, and to strengthen private sector performance.

The study will focus on the role of the private sector in increasing the use and availability of fertilizer, particularly for smallholder farmers. Since Madagascar is moving from a highly administered farm economy with an acute shortage of inputs and control of input supply and prices, to a more liberalized system in which input supply and prices are determined by the marketplaces, AID needs to make sure that such supply will be effective in leading to substantial increase in farm production. This is a basic goal of the AID program in Madagascar. To support this goal adequately requires more knowledge about input supply than is currently the case.

The report will be of primary use and value to AID and other donors interested in promoting further GDRM efforts in import liberalization. It will also be a valuable resource for the Government in planning and analyzing policy decisions, and will assist importers, distributors and other operators in the input supply system to enhance their participation in the near future. The study recommendations, when implemented, will support the AID funded IRRI Rice Research Project in Madagascar by enhancing the impact of that project on increasing the production of rice by smallholder farmers. Farmers benefiting from greater availability of fertilizer will be able to reap the full benefits of the results of the IRRI research now underway.

II Objectives of the Study

AID and the other donors want to assist the GDRM to increase agricultural production through liberalized input distribution policies. To help make this possible, AID will carry out the study with the objectives to:

1. Better understand the role and importance of fertilizer in the agricultural sector of Madagascar - its present contribution to agricultural production, and its potential to contribute to future growth in the sector;

2. Better understand how the fertilizer sector in Madagascar functions - its strengths and weaknesses, who is involved and their roles, and the constraints to more efficient and increased use;

3. Better understand the role of the private sector in promoting fertilizer use, and how it can become more effectively involved in integrated marketing systems, and to reduce marketing costs;

4. Formulate long-term goals, and short to medium-term objectives for improved marketing of fertilizer for increased agricultural production with a focus on the role of the private sector; and

5. Draft a general strategy to achieve the stated goals and objectives of the fertilizer sector.

III Scope of Work

A contractor shall address each of the following issues and produce a written report as described in Section VI. The study shall have three parts. In all three parts, the contractor shall maintain a focus on integrated marketing systems and the role of the private sector.

The first part shall describe the general state of the fertilizer sector in Madagascar. The focus of this part shall be to identify how the sector functions, its problems, and the constraints to increased use and availability of fertilizer in the country. The first part shall also describe the current role of the government, private sector and donors in importing, distributing, pricing and promoting fertilizer use.

The second part of the study shall develop workable recommendations which address the constraints identified in Part I, and which define the appropriate roles of the private sector, the Government and the donors in promoting efficient fertilizer marketing and use in Madagascar. This part shall focus on the private sector, and how it can best promote efficient importation, distribution, pricing and promotion of fertilizer use in the country, particularly for smallholder farmers in areas outside major market centers. The third part of the study shall develop a strategy to implement the recommendations described in Part II. The strategy shall include recommended Government policy changes which can be supported by donor programs, including the use of counterpart, to bring about a fertilizer marketing system in which the quantities and types imported and the prices sold in Madagascar are determined by the marketplace. The strategy shall include a suggested timeframe for actions to be taken by the Government and donors in the short (1-2 years), medium (3-5 years) and long-terms.

The contractor shall develop Parts II and III of the study in close collaboration with Government, private sector and donor counterparts so that the recommendations and strategy developed are realistic and implementable.

Part I - Analysis of the Existing System

In order to provide the necessary background for Parts II and III of the study, relevant data on past performance of the fertilizer sector, and the potential for growth must be collected and analyzed. This will include but is not limited to the following specific issues which the contractor shall address:

1 Using such agricultural data that exists and is available from research and sector reports prepared by the Government of Madagascar, AID and other donors, analyze, evaluate, and describe present and past fertilizer usage, including:

   (a) supply from domestic production and fertilizer imports during the past 10 years (including sources, prices, donor or commercial financed, and the procurement, import and distribution procedures); and

   (b) fertilizer consumption for the past 10 years by area, by crop, by product, by nutrient, and by type of consumer.

2 Determine the economic optimum level of fertilizer use on major crops to the extent date is available. Based on this information and known area under production by major crops, determine the optimal fertilizer requirements in the country by type and crop. Compare and analyze this data against actual consumption.

3 Identify types of consumers (i.e. cooperatives, large farms, small farms, parastatals, estates, etc.) and their major sources of fertilizer and information on fertilizer use. Examine the potential for increased domestic production of fertilizers, and in particular the exploitation of Madagascar's substantial deposits of dolomite/limestones. Identify constraints at the farm level to increased fertilizer use.

4 Prepare projections of fertilizer demand assuming present consumption, constraints, and policies to encourage increased fertilizer use, and considering the projected growth of population and the need to provide sufficient food. Compare these projections to estimated fertilizer requirements, specifying the assumptions used. Such projections should be for 10 years, by product, by nutrients, by area, and by crop.

5 Determine the current financial and economic returns to fertilizer use over the past 10 years on major crops based on current fertilizer prices and farmgate prices to the extent data is available.

6 Collect and analyze cost data on fertilizer marketing; ie., c.i.f. costs, financing costs, in-country transport costs, handling and storage costs, retail marketing (including promotion) costs, profit margins, etc. Analyze and evaluate the results against Government pricing policies to identify to what extent there are constraints to effective marketing, distribution, and consumption of fertilizers due to pricing policies.

7 Describe and analyze the impact of relevant past and present governmental policies and actions affecting fertilizer usage including domestic production, procurement, distribution, prices (of inputs and outputs), subsidies, transportation, storage, promotion and delivery to the farm. Also, evaluate the impact of current fertilizer research efforts, including the work of the FAO - Supported Program D'Engrais Malgache and Field Level Research under crop-specific programs. Describe the impact of each intervention and identify the constraints to efficient marketing, distribution and use of fertilizers. Include earlier systems of private and public sector involvement, parastatal or joint venture operation in fertilizer production.

8 Describe the past and present roles of the public and private sector in importation, distribution and marketing of fertilizer. Analyze the effect of each intervention on fertilizer availability and use, and the constraints to continued involvement.

9 For all types of imports, whether donor or commercially financed, describe how selling prices and quantities imported are determined.

10 Describe the role, impact and availability of credit in financing fertilizer imports, marketing and consumption.

11 Describe and compare the use and availability of alternative fertilizers as a substitute for imported chemical fertilizers.

12 Present a profile of private sector organi involved in the fertilizer trade. Identify their primary line of business (i.e. agriculture, trading, general import-export business); their primary mode of business (i.e. wholesale or retail); their distribution network (i.e. number and location of primary and secondary retail outlets and agents); services provided to farmers (e.g. soil testing, extension); previous experience with fertilizer importation/distribution; and plans to expand their business, etc. List the constraints to expansion, as described from the point of view of the organi, and their recommendations for needed incentives to expand.

13 Assess the adequacy of the physical infrastructure to handle fertilizer, i.e., port facilities, transport for bagged and bulk fertilizer, bagging facilities, etc. Determine to what extend present facilities are used efficiently: if underused, estimate capacity which would be available for distribution and circulation of additional fertilizer quantities.

14 Compare and analyze, as relevant, the different donor policies and preferences with regard to importation, pricing and distribution of fertilizer financed for the GDRM.

15 Describe the programs of other donors which affect the fertilizer sector and their impact on fertilizer use and availability.

16 Describe the extent of and impact of donor coordination in the fertilizer sector.

17 Review the procedures for counterpart programming and management, and availability of counterpart to support private sector fertilizer marketing.

Based on the data collected and analysis of the issues above, the contractor shall prepare a summary of Part I which describes current and projected fertilizer use, identifies the constraints to increased fertilizer use and availability in Madagascar, and assesses the potential for future growth and efficiency in the sector. The summary shall also identify the appropriateness of the current programs and interventions of the Government, donors and the private sector to increase the use and availability of fertilizer in Madagascar.

Part II - Recommendations For More Effective Private Sector Involvement In Fertilizer Marketing

Based on the analysis of Part I, the contractor shall prepare recommendations for an integrated marketing system driven by the private sector which will make fertilizers available to farmers that most efficiently meet their needs at the least cost. The recommendations shall address the appropriate roles of the Government, the donors and the private sector. The recommendations must be workable in the context of Madagascar and support Government efforts in liberalization of the input supply system. In developing the recommendations, the contractor shall address the following issues:

1 Assess the capabilities and incentives of commercial firms to import, distribute and promote the use of fertilizers, and the nature and extent of Government versus private intervention. Consider the need to distribute fertilizer into rural areas outside major marketing centers.

2 Develop recommendations, based on comparative cost analysis, to reduce landed CIF costs of fertilizer in Madagascar, and in-country transportation and handling costs. Consider the possibilities of bulk blending, in-country bagging group purchasing, and various modes of transport.

3 Assess the potential and availability of alternatives to chemical fertilizers such as organic materials and lime to increase production.

4 Consider the appropriate bag size and packaging. Provide recommendation as to the size, type of package, material specifications and comparative costs and benefits of various alternatives.

5 Consider possibilities of a workable fertilizer credit program including methods of extending credit, methods and procedures for advising farmers of their obligation and responsibilities as a borrower and the type of controls to be employed. Consideration should be given to the possible institutions and/or agencies which could handle the credit program.

6 Make a recommendation on the need and/or desirability of a fertilizer promotion policy, and if recommended, how it should be effected. Should fertilizer subsidies be a component of such a policy?

7 Identify implementable private sector interventions in fertilizer marketing in Madagascar. Describe commercial fertilizer marketing systems that are applicable to the Madagascar situation.

8 Outline an organizational structure and all components required for the efficient operation of the recommended fertilizer marketing system. Recommend institutional linkages and training that are required for efficient operation of the marketing system.

9 Make recommendations on policy implications and government actions, and donor initiatives needed to achieve the objective for improved private sector marketing.

10 Make recommendations on how grant fertilizer should be handled, and in particular, how it should enter the marketing system.

11 Identify information gaps to better understand the sector, and to develop a prioritized list of studies to be undertaken. Identify needed areas of detailed data collection, research and analysis for the short, medium and long-terms.

APPENDIX II

LIST OF ACRONYMS

LIST OF ACRONYMS

1 CROP AND REGIONAL DEVELOPMENT PROJECTS

AFAFI	-	Rice Development
FAFIFAMA	-	Livestock Development
FANALAMANGA	-	Forestry Development
FIFABE	-	Regional Development (Rice mainly) (Maravoay Irrigation)
FIFAMANOR	-	Rice, Food Crops and Cattle Development
FIFATO	-	Regional Development (South)
FOFIFA	-	Agricultural Research (Parastatal)
HASYMA	-	Parastatal for Cotton Production and Marketing
NAMISOA	-	Soya Bean Production and Marketing
NAMAKIA	-	Rice Development
OCPG	-	Development of Coffee, Pepper, Cloves, Vanilla
ODR	-	Extension Services Project for Rice and Smallholder Food Crops (Highlands)
OFMATA	-	Tobacco Marketing (Parastatal)
SAMBAVAVA VOANIO	-	Rice Development
SIRAMA	-	Sugarcane Production, Refining and Marketing (Parastatal)
SIRANALA	-	Sugarcane Production Refinery and Marketing
SOAMA	-	Regional Development (Andapa irrigation)
SOAVOANIO	-	Coconut Development

LIST OF ACRONYMS (CONTD.)

SODEMO	-	Regional Development (Moroadavo Irrigation)
SOMALAC	-	Regional Development (Lac Alaotra Irrigation)
SOMAPALM	-	Palm Oil Plantation and Refinery
SORIFEMA	-	Manioc and Tapioca Development

2 MAIN COMMERCIAL FERTILIZER DISTRIBUTORS

AFAFI	-	Regional distributor based in Fiarantsoe. Agent for Hoechst products
AGRICO	-	New private company. Distributes fertilizer aid.
COROI	-	Nationalized company. Main importer and distributor with largest country-wide network of 17 branches.
ECOPLANT	-	New private company representing overseas suppliers.
OCM	-	A private company. It only distributes fertilizer aid. It has stores in Antananarivo and 27 selling points (ex-MPARA) around the country.
SAFAFI	-	Created in 1982 for the coordination of Lutheran Church projects in Madagascar. Receives some free fertilizer from NORAD.
SEIM	-	Mainly a producer of cooking oil. It only sells fertilizers and other inputs to its contract farmers and on direct orders.
SEPCM	-	A private company, and the oldest fertilizer supplier in Madagascar. Caters mainly for cotton and sugarcane needs.

LIST OF ACRONYMS (CONTD.)

3 OTHER

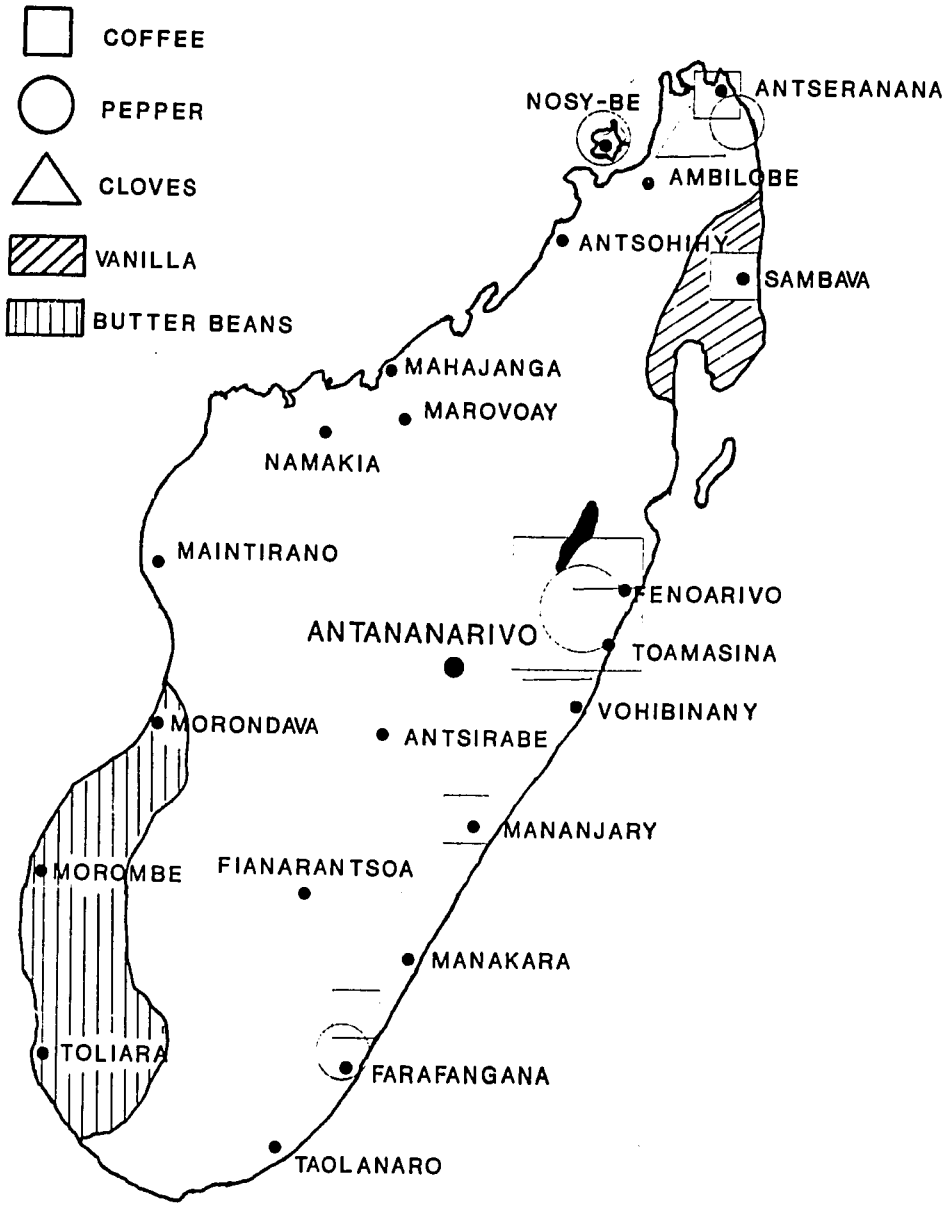
BNI	-	Bank (Industry)
BTM	-	Bank (Agriculture)
COMADEX	-	Mining Enterprise
CCCE	-	Bilateral Credit Institution (France)
CMC	-	Coastal Shipping Company
CMN	-	Coastal Shipping Company
DVA	-	Direction de la Vulgerisation Agricole
FMG	-	Malagasy Franc FMG 1,620 - 1,670 = 1US$ (June 1988)
MPARA	-	Ministry of Agriculture
PFP	-	Policy Framework Paper
SMTM	-	International Shipping
ZEMA	-	Organic Fertilizer Enterprise
ZTE - REN	-	Urea Plant Project (Defunct)

APPENDIX III

MAPS

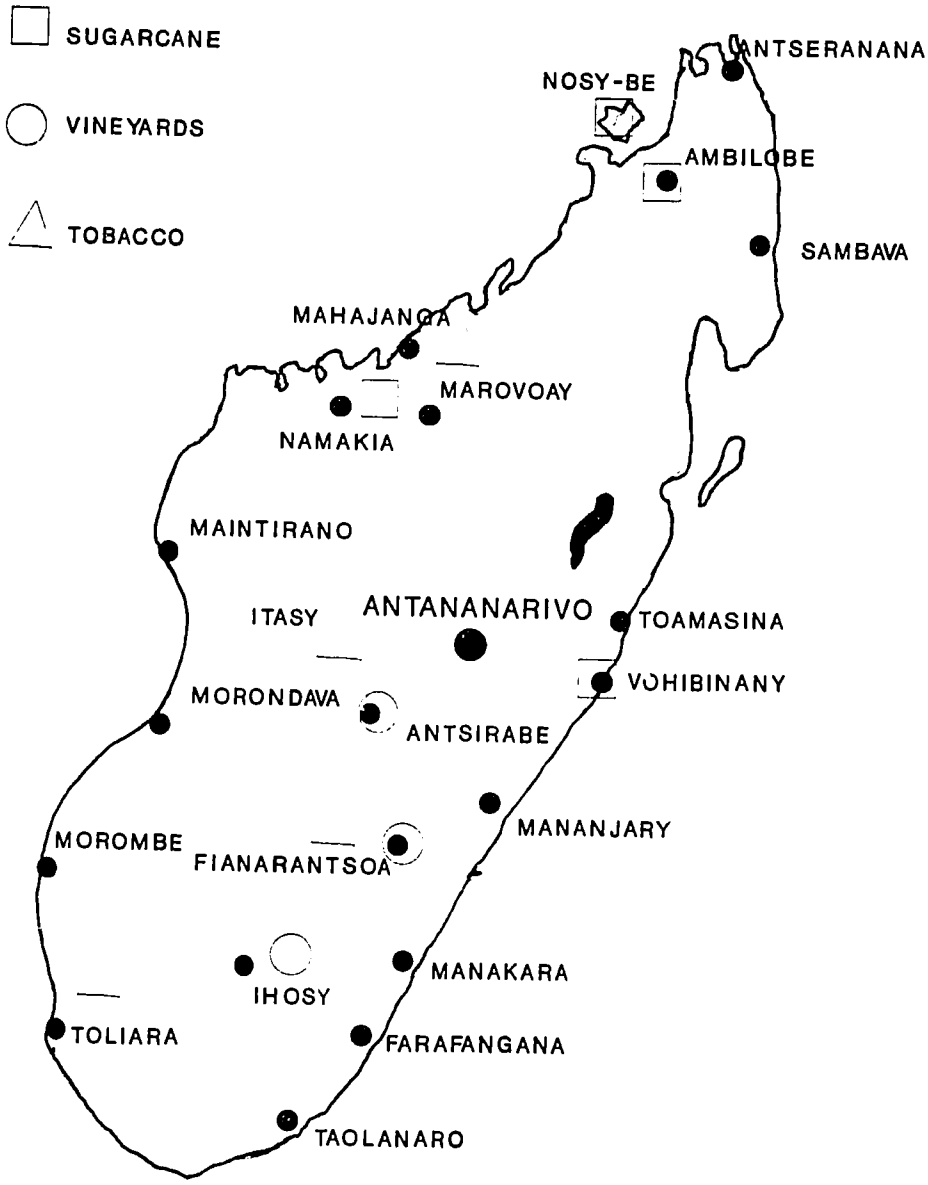
MADAGASCAR

CROP PRODUCTION



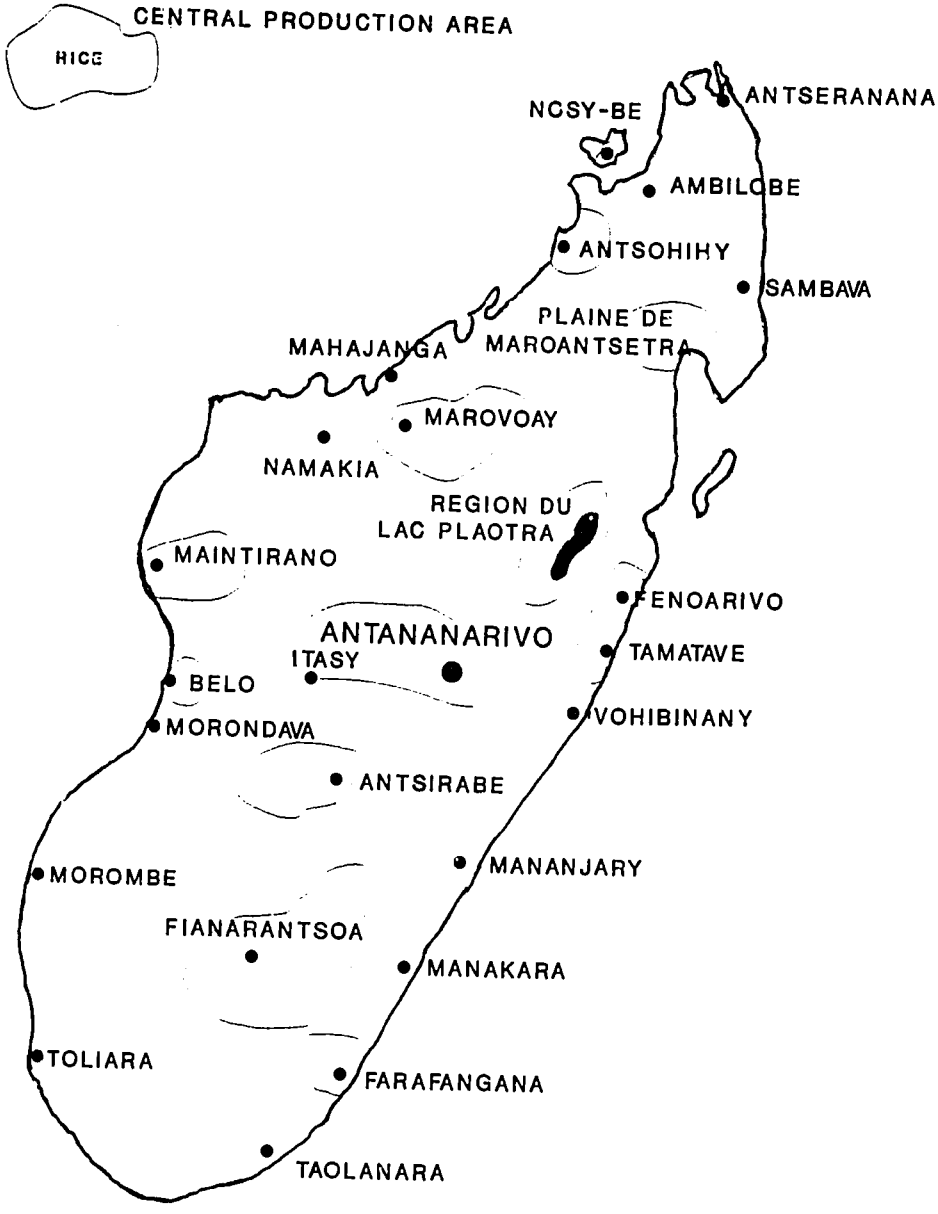
MADAGASCAR

CROP PRODUCTION



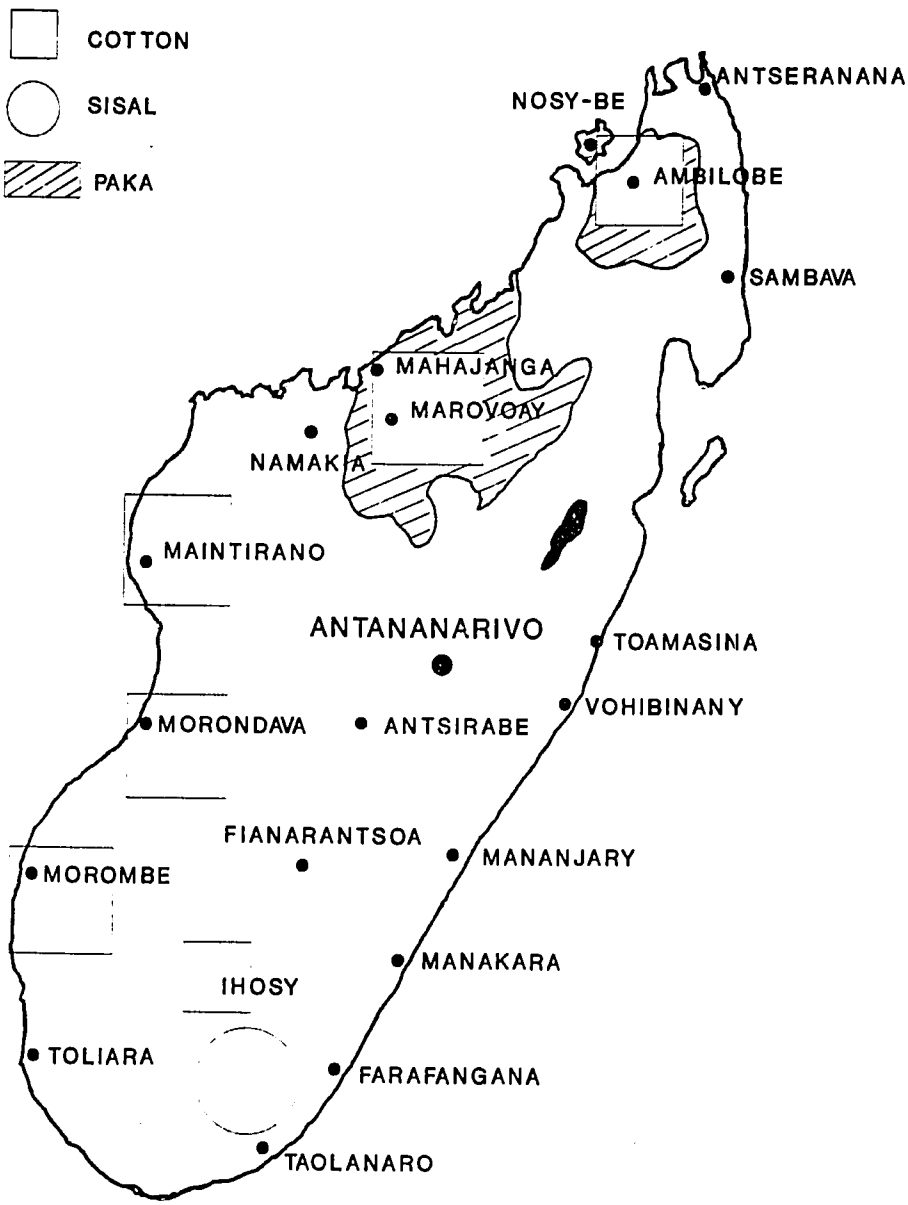
MADAGASCAR

RICE PRODUCTION



MADAGASCAR

FIBRES



APPENDIX III

TABLES ON FERTILIZER USE

Table 2.1: Technical recommended levels of fertilizer application per crop, per Hectare.

Crops	Technical recommended levels			Recommended types and quantities	
	N	P	K	Types	Kg/Ha
Rice	60	60	45	11.22.16	300
				Urea	66
Manioc	20	10	50	20.10.10	100
				KCL	66
Maize	150	160	120	11.22.16	300
				Urea	250
				KCL	175
Coffee	175	85	85	20.10.10	840
Sugar Cane	100	75	150	S.A.	500
				TSP	165
				KCL	250
Cotton	140	0	0	Urea	300
Tobacco	30	30	50	16.16.16	200
				SO4K2	40
Pepper	200	50	100	20.10.10	500
				Urea	200
				KCL	80

Table 2.2: Hectarage cultivated, crop production and yields for paddy.

CULTIVATED AREA in HECTARES

Province	1985	1986	1987	1988	1989 estimates
Antananarivo	228,310	227,795	227,575	229,365	n.a.
Fianarantsoa	278,765	279,420	285,725	280,055	n.a.
Toamasina	302,640	301,530	311,770	304,050	n.a.
Mahajanga	171,010	173,945	179,085	171,800	n.a.
Toliary	107,200	107,835	109,800	107,695	n.a.
Antsirana	95,595	97,040	99,970	96,035	n.a.
MADAGASCAR	1,183,520	1,187,565	1,213,925	1,189,000	1,221,000

PRODUCTION in MT

Province	1985	1986	1987	1988	1989 estimates
Antananarivo	424,550	439,755	452,755	435,760	n.a.
Fianarantsoa	553,105	565,425	582,645	567,715	n.a.
Toamasina	573,375	561,210	578,290	588,520	n.a.
Mahajanga	308,9D5	330,415	340,695	317,065	n.a.
Toliary	165,965	173,960	177,590	170,350	n.a.
Antsirana	151,780	159,44D	164,155	155,790	n.a.
MADAGASCAR	2,177,680	2,230,205	2,296,130	2,235,200	2,293,000

YIELD in TONS/Ha

Province	1985	1986	1987	1988	1989 estimates
Antananarivo	1.860	1.930	1.989	1.900	-
Fianarantsoa	1.984	2.024	2.039	2.027	-
Toamasina	1.895	1.861	1.855	1.936	-
Mahajanga	1.806	1.900	1.902	1.846	-
Toliary	1.548	1.613	1.617	1.582	-
Antsirana	1.588	1.643	1.642	1.622	-
MADAGASCAR	1.840	1.878	1.891	1.880	1.878

SOURCES:

* For 1985 and 1986 : MPARA Agricultural Statistics, November 1987 (Annuaire de Statistiques Agricoles)
* For 1986, 1987, 1988: MPARA (Centre de Documentation, Anosy), December 1988 (fiches FMI).

Table 2.3: Area cultivated, production and yields for cotton.

Province	1985 Area	1985 Prod	1985 Yield	1986 Area	1986 Prod	1986 Yield
Type of cult.	Ha	MT	k/ha	Ha	MT	k/ha
Antananarivo	237	307	1.295	514	496	0.965
- decrue	0	0	-	0	0	-
- irriguee	0	0	-	0	0	-
- pluviale	237	307	1.295	514	496	0.965
Fianarantsoa	704	871	1.237	1,019	754	0.740
- decrue	0	0	-	0	0	-
- irriguee	0	0	-	0	0	-
- pluviale	704	871	1.237	1,019	754	0.740
Mahajanga	10,700	21,177	1.979	9,315	20,933	2.247
- decrue	10,685	21,173	1.982	9,315	20,933	2.247
- irriguee	0	0	-	0	0	-
- pluviale	15	4	0.267	0	0	-
Toliary	20,189	19,142	0.948	30,748	17,460	0.568
- decrue	137	171	1.248	70	70	1.000
- irriguee	7,231	7,715	1.067	4,480	2,899	0.647
- pluviale	12,821	11,256	0.878	26,198	14,491	0.553
Antsirana	1,124	1,374	1.222	1,254	1,367	1.090
- decrue	1,124	1,374	1.222	1,254	1,367	1.090
- irriguee	0	0	-	0	0	-
- pluviale	0	0	-	0	0	-
MADAGASCAR	32,954	42,871	1.301	42,850	41,010	0.957
- decrue	11,946	22,718	1.902	10,639	22,370	2.103
- irriguee	7,231	7,715	1.067	4,480	2,899	0.647
- pluviale	13,777	12,438	0.903	27,731	15,741	0.568

Summary:

	1985			1986		
Antananarivo	237	307	1.295	514	496	0.965
Fianarantsoa	704	871	1.237	1,019	754	0.740
Mahajanga	10,700	21,177	1.979	9,315	20,933	2.247
Toliary	20,189	19,142	0.948	30,748	17,460	0.568
Antsirana	1,124	1,374	1.222	1,254	1,367	1.090
MADAGASCAR	32,954	42,871	1.301	42,850	41,010	0.957

Summary by type of farmer:

	1985			1986		
Private	15345	24,165	1.575	16887	24,895	1.474
Hasyma	1603	1,618	1.009	508	282	0.555
smallholders	16006	17,088	1.068	25455	15,833	0.622
TOTAL	32,954	42,871	1.301	42,850	41,010	0.957

Source: Hasyma, January 1989.

Table 2.4: Cultivated area, production and yields for sugar cane.

CULTIVATED AREA in HECTARES

Province	1985	1986	1987	1988	1989 estimates
Antananarivo	2,680	2,465	2,935	n.a.	n.a.
Fianarantsoa	7,965	9,155	10,065	n.a.	n.a.
Toamasina	9,245	9,600	10,080	n.a.	n.a.
Mahajanga	18,690	16,070	11,880	n.a.	n.a.
Toliary	7,685	5,750	9,670	n.a.	n.a.
Antsirana	12,735	15,960	14,870	n.a.	n.a.
MADAGASCAR	59,000	59,000	59,500	60,000	59,890

PRODUCTION (in MT)

Province	1985	1986	1987	1988	1989 estimates
Antananarivo	20,755	66,050	67,085	n a.	n.a.
Fianarantsoa	148,950	294,225	298,845	n.a.	n.a.
Toamasina	286,215	319,960	324,980	n.a.	n.a.
Mahajanga	415,980	405,270	411,630	n.a.	n.a.
Toliary	175,110	364,365	370,085	n.a.	n.a.
Antsirana	697,140	500,130	507,975	n.a.	n.a.
MADAGASCAR	1,744,150	1,950,000	1,980,600	1,990,000	1,990,000

YIELDS (in T/Ha)

Province	1985	1986	1987	1988	1989 estimates
Antananarivo	8.420	26.795	22.857	-	-
Fianarantsoa	16.270	32.138	29.692	-	-
Toamasina	29.814	33.329	32.240	-	-
Mahajanga	25.886	25.219	34.649	-	-
Toliary	30.454	63.368	38.271	-	-
Antsirana	43.680	31.336	34.161	-	-
MADAGASCAR	29.562	33.051	33.287	33.167	33.228

SOURCE:

* For 1985, 1986, 1987: Centre de Documentation de la MPARA (ANOSY), Febr.1988.
* For 1989 estimates: Centre de Documentation de la MPARA (Anosy), Jan.1989.

Tables 2.5: Minor crops, areas cultivated and production.

1. COFFEE

CULTIVATED AREA in HECTARES

Province	1985	1986	1987	1988	1989 estimates
Antananarivo	980	985	880	n.a.	n.a.
Fianarantsoa	99,950	100,410	100,290	n.a.	n.a.
Toamasina	69,100	69,420	69,585	n.a.	n.a.
Mahajanga	5,000	5,020	5,115	n.a.	n.a.
Toliary	2,815	2,825	2,830	n.a.	n.a.
Antsirana	45,355	45,575	45,295	n.a.	n.a.
MADAGASCAR	223,200	224,235	223,995	225,000	225,000

PRODUCTION in MT

Province	1985	1986	1987	1988	1989 estimates
Antananarivo	340	355	350	n.a.	n.a.
Fianarantsoa	34,620	36,255	35,600	n.a.	n.a.
Toamasina	25,660	26,870	26,385	n.a.	n.a.
Mahajanga	1,625	1,700	1,670	n.a.	n.a.
Toliary	830	875	860	n.a.	n.a.
Antsirana	15,425	16,155	15,860	n.a.	n.a.
MADAGASCAR	78,500	82,210	80,725	83,500	85,000

YIELD (K/Ha)

Province	1985	1986	1987	1988	1989 estimates
Antananarivo	347	360	398	-	-
Fianarantsoa	346	361	355	-	-
Toamasina	371	387	379	-	-
Mahajanga	325	339	326	-	-
Toliary	295	310	304	-	-
Antsirana	340	354	350	-	-
MADAGASCAR	352	367	360	371	378

SOURCES:

- for 1985, 1986, 1987: MPARA, Centre de Documentation (Anosy), Febr.1988.
- for 1988 and 1989 estimates: MPARA, Centre de Documentation (Anosy), Jan.1989.

Table 2.5 (continued): Minor crops.

2.TOBACCO CULTIVATED AREA in Ha

Province	1985	1986	1987
Antananarivo	1,455	1,656	947
Fianarantsoa	202	152	162
Toamasina	120	57	60
Mahajanga	1,470	1,174	1,366
Toliary	450	290	131
Antsirana	106	87	136
MADAGASCAR	3,803	3,416	2,802

PRODUCTION in MT

Province	1985	1986	1987
Antananarivo	1,458	1,659	947
Fianarantsoa	205	154	162
Toamasina	120	57	60
Mahajanga	1,475	1,180	1,367
Toliary	455	293	132
Antsirana	107	88	136
MADAGASCAR	3,820	3,431	2,804

NOTE: Hectarages are calculated by OFMATA using the assumption that all yields equal on average 1Ton/Ha.
SOURCE: OFMATA, June 1989.

3. MANIOC	1985	1986	1987
Hectarage	350,570	359,245	311,200
Prod.(MT)	2,142,000	2,190,000	2,178,400
Yields (T/Ha)	6.110	6.096	7.000

4. MAIZE	1985	1986	1987
Hectarage	140,000	148,000	139,975
Prod.(MT)	140,200	152,890	158,100
Yields (T/Ha)	1.001	1.033	1.129

5. PEPPER	1985	1986	1987
Hectarage	6,200	6,100	6,250
Prod.(MT)	2,800	2,880	300
Yields (T/Ha)	0.452	0.472	0.048

Sources: MPARA, Statistiques Agricoles.

Table 2.6: Total theoretical technical fertilizer requirements by crop and fertilizer type.

Crop	Fertilizer Type required	Dosage K/Ha	Cultivated Area Ha	Requirements by crop and fertilizer type in MT per year 11.22.16	Urea	KCL	TSP	S.A.	Total
Rice	11.22.16	300	1,183,520	355,056					433,168
	Urea	66			78,112				
Sugar Cane	S.A.	500	60,100					30,050	
	TSP	165					9,917		54,992
	KCL	250				15,025			
Cotton	Urea	300	32,954		9,886				9,886

Crop	Fertilizer Type	Dosage K/Ha	Cultivated Area Ha	Requirements by crop and fertilizer type in MT per year 16.16.16.	SO4K2	20.10.10	Urea	KCL	Total
Tobacco	16.16.16.	200	3,803	761					913
	SO4K2	40			152				
Coffee	20.10.10.	840	223,200			187,488			187,488
Pepper	20.10.10.	500	6,200			3,100			
	Urea	200					1,240		4,836
	KCL	80						496	

Crop	Fertilizer Type	Dosage K/Ha	Cultivated Area Ha	Requirements by crop and fertilizer type in MT per year 11.22.16	Urea	20.10.10	KCL	Total
Manioc	20.10.10.	100	350,570			35,057		58,195
	KCL	66					23,138	
Maize	11.22.16	300	140,000	42,000				
	Urea	250			35,000			101,500
	KCL	175					24,500	

Total fertilizer required in MT:

11.22.16	397,056
Urea	124,238
20.10.10.	225,645
KCL	63,159
TSP	9,917
16.16.16.	761
S.A.	30,050
SO4K2	152
Total	850,978

Table 2.7: Fertilizer donor imports by fertilizer type and by donor, 1985-1989 (in MT).

DONOR	Fertilizer Type	1985	1986	1987	1988	1989
NORWAY	Urea				5,000	100
	main distributor				COROI	Ecoplants
	NPK 16.16.16	5,400	6,500	5,822		
	main distributor	COROI	COROI	COROI		
	NPK 11.22.16			9,000		5,000
	main distributor			COROI		COROI
EDF	NPK 15.15.15		2,000			
	main distributor		SEIM			
ITALY	Urea		5,755			
	main distributor		OCM			
FAO	KCL		30			
	main distributor		SEPCM			
	NPK 15.15.15			350		
	main distributor			SEIM		
	NPK 16.16.16				500	
	main distributor				Ecoplants	
Sub-Total	Urea	0	5,755	0	5,000	100
	KCL	0	30	0	0	0
	NPK 15.15.15	0	2,000	350	0	0
	NPK 16.16.16	5,400	6,500	5,822	500	0
	NPK 11.22.16	0	0	9,000	0	5,000
Total		5,400	14,285	15,172	5,500	5,100

Table 2.8: Fertilizer imports by users and distributors, 1985 (in MT).

	COROI		HASYMA	TOTAL
	aid	own	own	
Urea Pearl		600	3,965	4,565
Urea s		100		100
16.16.16.	5,400	1,000		6,400
P.A.			1,110	1,110
Sulf.Pot.		100	3,060	3,160
Hyper Reno		100		100
Boracine			140	140
Solubor			35	35
Total	5,400	1,900	8,310	15,610

Table 2.9: Fertilizer imports by users and distributors, 1986 (in MT).

Fertilizer	COROI		OCM	SEPCM		HASYMA	SEIM	TOTAL
Type	aid	own	aid*	aid*	own**	own	aid	
Urea		6,790	5,755			6,000		18,545
8.20.20.		200						200
16.16.16.	6,500	2,200						8,700
15.15.15.		1,000					2,000	3,000
KCL				30	550			580
P.A.						700		700
Phosp.naturel					100			100
Phosp.Bic.					50			50
Sulf.Pot.					50			50
TSP					70			70
Boracine						76		76
Solubor						30		30
Total	6,500	10,190	5,755	30	820	6,806	2,000	32,101

Note: ** These are all SEPCM commercial imports for SIRAMA

Table 2.10: Fertilizer imports by users and distributors, 1987 (in MT).

Fertilizer Type	COROI aid	COROI own	SEPCM own**	SEPCM own	HOECHST own	SEIM aid	HASYMA	TOTAL
Urea Pearl		3,000	1,100				4,900	9,000
8.20.20.		150						150
10.20.20.				800	100			900
10.26.26.				140				140
11.22.16	9,000				989			9,989
15.15.15.		1,500				350		1,850
16.16.16.	5,822							5,822
KCL		2,250		100				2,350
P.A.				100			2,200	2,300
Phosp.Bic.				100				100
S.A.		1,000						1,000
Sulf.Pot.			350				1,000	1,350
SSP				300				300
TSP			110		10			120
Fertibor				50				50
BLAUKORN					20			20
Nitrate Ammon				54				54
Total	14,822	7,900	1,560	1,644	1,119	350	8,100	35,495

Table 2.11: Fertilizer imports by users and distributors, 1988 (in MT).

Fertilizer Type	COROI aid	COROI own	SEPCM own**	ECOPLANTS aid	HASYMA own	SIRAMA (COROI)	OCM own	TOTAL
Urea Pearl	5,000	1,500						6,500
8.20.20		3,000						3,000
11.22.16							1,000	1,000
15.15.15.				500				500
16.16.16		4,000						4,000
KCL			695					695
P.A.			42			135		177
Phos.Bic.			490					490
Phos.Tric.			500					500
Sulf.Pot.			2,880					2,880
TSP			80					80
Sultr.Ammon.			680					680
Boracine					100			100
Solubor					20			20
Total	5,000	8,500	5,367	500	120	135	1,000	20,622

Table 2.12: Fertilizer imports by users and distributors, 1989 (in MT).

Fertilizer Type	COROI own	SEPCM own	HOECHST own	ECOPLANTS aid	AGRICO aid*	TOTAL
Urea Pearl	1,000			100		1,100
11.22.16					5,000	5,000
P.A.		100				100
Phosp.Bic.		15				15
TSP			5			5
BLAUKORN			10			10
Total	1,000	115	15	100	5,000	6,230

Table 2.13: Summary of fertilizer imports by fertilizer type, 1985-1989 (in MT).

Fertilizer type	1985	1986	1987	1988	1989
Urea	4,665	18,545	9,000	6,500	1,100
8.20.20		200	150	3,000	
10.20.20			900		
10.26.26			140		
11.22.16			9,989	1,000	5,000
15.15.15		3,000	1,850	500	
16.16.16	6,400	8,700	5,822	4,000	
KCL		580	2,350	695	
P.A.	1,110	700	2,300	177	100
Phosp.naturel		100			
Phosp.Bic.		50	100	490	15
Phosp.Tric.				500	
S.A.			1,000		
Sulf.Pot.	3,160	50	1,350	2,880	
SSP			300		
TSP		70	120	80	5
Sultr.Ammon.				680	
Nitr.Ammon.			54		
Hyper Reno	100				
Boracine	140	76		100	
Solubor	35	30		20	
Fertibor			50		
BLAUKORN			20		10
Total	15,610	32,101	35,495	20,622	6,230

Source for tables 2.7 to 2.13: data collected among users and distributors of fertilizer (Imports per shipment of fertilizer)

NOTE: * Data extracted from MPARA files "Dons d'engrais au MPARA"

Table 2.14: Fertilizer sales by fertilizer type and by crop, 1985 (in MT).

Fertilizer Type	RICE	SUGAR	COTTON	TOBACCO	MANIOC	FOREST	
Urea	700	1,166	5,259	29	33		
10.10.20	0	807					
11.22.16	2,335	0		327			
15.15.15.	104	14		290			
16.16.16	6,094	0		0			
20.10.10.	0	0		40			
Other NPK	1,719	0	0	0	0	624	
KCL	870	400		0			
Phosp.Ammo	0	164	1,168	0			
Sulf.Ammon	1,137	0		0			
Sulf.Pot.	58	720	1,869	0			
SSP	149	0					
TSP	15	31		0			
Sultr.Pot	0	810		0			
Dolomie	26	0		0			
Hyper Reno	176	0		0			
Other	139	333	118	0	0	0	
Total:	13,521	4,446	8,413	685	33	624	
Grand Total:							27,722

Table 2.15: Fertilizer sales by fertilizer type and by crop, 1986 (in MT).

Fertilizer Type	RICE	SUGAR	COTTON	OIL PALM	FOREST	
Urea	558	1,037	5,266	160	90	
8.16.24	0	0			1,439	
8.20.20.	43	0				
10.10.20.	0	657				
11.22.16	596	0		0	0	
15.15.15.	59	69		0	0	
16.16.16.	3,078	0		0	9	
KCL	9	400		130	0	
Phosp.Ammo	15	237	1,655			
S.A.	2	0				
Sulf.Potas	15	410	1,824			
TSP		110				
Hyper Reno	30	0		0	0	
Other	38	0	164	0	8	
Total by region	4,444	2,920	8,908	290	1,546	
Grand Total:						18,108

Table 2.16: Fertilizer sales by fertilizer type and by crop, 1987 (in MT).

Fertilizer Type	RICE	SUGAR	COTTON	OCPG	FOREST	
Urea	6,331	1,139	2,603	2,864	0	
8.20.20.	112					
10.10.20.	0	330				
11.22.16	7,897	0				
15.15.15.	1,063	0		0	0	
16.16.16.	6,388	0		0	46	
Other NPK	954	0	0	0	165	
KCL	2,502	690		0	0	
Phosp.Ammo	8	0	86			
Phosp.Bica	1	0		716	0	
Sulf.Ammon	793	0				
Sulf.Potas	2	350	641	2,204	0	
SSP	23	0				
TSP	0	111		105	0	
Sultr.Ammon.		1,270				
Hyper Reno	42	0		0	0	
Other	303	17	92	0	0	
Total by crop:	26,419	3,907	3,421	5,889	211	
Grand Total:						39,846

Table 2.17: Fertilizer sales by fertilizer type and by crop, 1988 (in MT).

Fertilizer Type	RICE	SUGAR	COTTON	OIL PALM	OCPG	
Urea 46%	2,792	4,515	2,663	43	50	
8.20.20.	26	0	0	0	0	
10.10.20	0	1	0	0	6	
11.22.16	1,272	0	0	0	0	
15.15.15.	398	0	0	0	38	
16.16.16.	1,173	0	0	3	0	
20.10.10.	199	0	0	0	81	
Other NPK	20	0	0	0	3	
KCL	394	695	0	132	1	
Phosp.Ammo	0	135	991	0	2	
Phosp.Bica	0	570	0	0	0	
Phosp.Tric	38	500	0	0	0	
Sulf.Ammon	320	50	0	0	0	
Sulf.Pot.	0	2,880	1,089	0	0	
TSP	252	80	0	0	0	
Sultr.Ammo	0	680	0	0	0	
Hyper Reno	47	0	0	2	0	
Other	341	0	72	0	2	
Total by crop:	7,272	10,106	4,816	180	183	
Grand Total:						22,375

Table 2.18: Fertilizer sales by fertilizer type and by region, 1985 (in MT).

Fertilizer Type	ANTANANARIVO	FIANARANTSOA	TOAMASINA	MAHAJANGA	TOLIARA	ANTSIRANANA	TOTAL
Urea	6,581	71	103	1	380	51	7,187
10.10.20					807		807
11.22.16	1,496	1,068	65	1	4	27	2,661
15.15.15	313	81	0	0	14		408
16.16.16	5,818	277					6,094
20.10.10.	40						40
Other NPK	1,970	0	665	0	41	0	2,676
KCL	402	4	0			863	1,270
Phosp.Ammon.	1,332						1,332
S.A.	987	1	0			149	1,137
Sulf.Pot.	2,589				58		2,647
SSP						149	149
TSP	31					15	46
Sultr.Pot.	810						810
Hyper Reno	135	4	35	1			176
Other	120	4	20	0	0	139	282
Total by region:	22,623	1,510	888	3	1,305	1,393	
Grand Total:							27,722

Table 2.19: Fertilizer sales by fertilizer type and by region, 1986 (in MT).

Fertilizer Type	ANTANANARIVO	FIANARANTSOA	TOAMASINA	MAHAJANGA	TOLIARA	ANTSERANANA	TOTAL
Urea	6,459	77	361	4	132	77	7,806
8.16.24			1,439				1,439
8.20.20.	43						43
10.10.20.					657		657
11.22.16	149	104	186	16	30	111	597
15.15.15.	11	34	1		69	14	2,118
16.16.16.	1,365	856	9			856	10,750
KCL	406	1	131		0	1	539
Phosp.Ammon	1,655				252		1,907
Sulf.Ammon.	0	1			0	1	327
Sulf.Potass.	2,234				15	0	2,249
TSP	110						110
Hyper Reno	15	2	11	2	0		39
Other	167	0	40	0	1	0	210
Total by region	12,616	1,076	2,177	22	1,157	1,061	
Grand Total:							18,108

Table 2.20: Fertilizer sales by fertilizer type and by region, 1987 (in MT).

Fertilizer Type	ANTANANARIVO	FIANARANTSOA	TOAMASINA	MAHAJANGA	TOLIARA	ANTSIRANANA	TOTAL
Urea 46%	9,840		2,893	0	203	1	12,936
8.20.20.	112						112
10.10.20.					330		330
11.22.16	7,892					5	7,897
15.15.15.	1,061		2				1,063
16.16.16.	6,382		52				6,434
Other NPK	954		165	0	0	0	1,119
KCL	2,997		0			195	3,192
Phosp.Amma	86				8		94
Phosp.Bica	1		716			0	717
Sulf.Ammon	742					51	793
Sulf.Potas	991		2,204		2		3,197
SSP						23	23
TSP	111		105				216
Sultr.Amma	1,270						1,270
Hyper Reno	41		0				42
Other	328		1	0	17	66	411
Total by region:	32,807	0	6,138	0	559	342	
Grand Total:							39,846

Table 2.21: Fertilizer sales by fertilizer type and by region, 1988 (in MT).

Fertilizer Type	ANTANANARIVO	FIANARANTSOA	TOAMASINA	MAHAJANGA	TOLIARA	ANTSIRANANA	TOTAL
Urea 46%	9,951		61	0	0	51	10,063
8.20.20.	26		0				26
10.10.20	0			0	1		1
11.22.16	1,266		4	0	0	3	1,272
15.15.15.	397		1	0	0	38	437
16.16.16.	1,166		10	0	0	0	1,176
20.10.10.	0			199	0	81	280
Other NPK	20		9	0	2	0	32
KCL	738		132	0	0	352	1,222
Phosp.Ammo	1,126		0	0	0	2	1,128
Phosp.Bica	570		0	0	0	0	570
Phosp.Tric	500		0	0	0	38	538
Sulf.Ammon	313		0	0	0	56	370
Sulf.Potas	3,969		0	0	0	0	3,969
TSP	85		0	0	0	247	332
Sultr.Ammo	680		0	0	0	0	680
Hyper Reno	47		2	0	0	0	49
Other	289		2	0	0	123	413
Total by region:	21,143	0	222	199	4	991	
Grand Total:							22,558

Table 2.22: Fertilizer sales for rice, by fertilizer type and by region, 1985 (in MT).

Fertilizer Type	ANTANANARIVO	FIANARANTSOA	TOAMASINA	MAHAJANGA	TOLIARA	ANTSIRANANA	TOTAL
Urea	244	71	70	1	264	51	700
10.10.20					0		0
11.22.16	1,169	1,068	65	1	4	27	2,335
15.15.15.	23	81	0	0	0		104
16.16.16	5,818	277					6,094
20.10.10.	0						0
Other NPK	877	0	4	0	0	0	881
KCL	2	4	0			863	870
Phosp.Ammon	0						0
Sulf.Ammon.	987	1	0			149	1,137
Sulf.Pot.	0				58		58
SSP						149	149
TSP	0					15	15
Sultr.Pot	0						0
Hyper Reno	135	4	35	1			176
Other	803	4	57	0	0	139	1,002
Total by region:	10,058	1,510	232	3	326	1,393	
Grand Total:							13,521

Table 2.23: Fertilizer sales for rice, by fertilizer type and by region, 1986 (in MT).

Fertilizer Type	ANTANANARIVO	FIANARANTSOA	TOAMASINA	MAHAJANGA	TOLIARA	ANTSERANANA	TOTAL
Urea	234	77	111	4	56	77	559
8.16.24			0				0
8.20.20.	43						43
10.10.20.					0		0
11.22.16	149	104	186	16	30	111	596
15.15.15.	11	34	1		0	14	59
16.16.16.	1,365	856	0			856	3,078
KCL	6	1	0		0	1	9
Phosp.Ammon.					15		15
S.A.	0	1			0	1	2
Sulf.Potass.					15	0	15
Hyper Reno	15	2	11	2	0		30
Other	3	0	32	0	1	0	36
Total by region	1,827	1,076	341	22	117	1,061	
Grand Total:							4,442

Table 2.24: Fertilizer sales for rice, by fertilizer type and by region, 1987 (in MT)

Fertilizer Type	ANTANANARIVO	TOAMASINA	MAHAJANGA	TOLIARA	ANTSERANANA	TOTAL
Urea	6,137	29	0	164	1	6,331
8.20.20.	112					112
10.10.20.						0
11.22.16	7,892				5	7,897
15.15.15.	1,061	2				1,063
16.16.16.	6,382	6				6,388
Other NPK	954				5	959
KCL	2,307	0			195	2,502
Phosp.Ammo	0			8		8
Phosp.Bica	1	0			0	1
Sulf.Ammon	742				51	793
Sulf.Pot.	0	0		2		2
SSP					23	23
Hyper Reno	41	0				42
Other	237	1	0	0	61	298
Total by region:	25,865	38	0	174	342	
Grand Total:						26,419

Table 2.25: Fertilizer sales for rice, by fertilizer type and by region, 1988 (in MT).

Fertilizer Type	ANTANANARIVO	TOAMASINA	MAHAJANGA	TOLIARA	ANTSIRANANA	TOTAL
Urea 46%	2,773	18	0	0	2	2,792
8.20.20.	26	0				26
10.10.10.	3	0				3
11.22.16	1,266	4			3	1,272
15.15.15.	397	1			0	398
16.16.16.	1,166	7				1,173
20.10.10.		0	199		0	199
Other NPK	17	0		2		19
KCL	43	0			351	394
Phosp.Tric	0	0			38	38
Sulf.Ammon	263	0			56	320
TSP	5	0	0	0	247	252
Hyper Reno	47	0				47
Other	216	0	0	0	122	339
Total by region:	6,221	30	199	2	820	
Grand Total:						7,272

Table 2.26: Fertilizer use by Hasyma for cotton, by fertilizer type and by region, 1985-1988 (in MT).

	1,985	1,986	1,987	1,988
ANTSERANANA				
Urea	108	97	39	56
Sulf.Pot.	71	64	25	33
Solubor	0	0	0	0
P.A	9	5	2	2
Neobor	0	0	0	0
Boracine	2	1	1	1
MAHAJANGA				
Urea	3,444	3,206	2,091	1,903
Sulf.Pot.	1,418	1,244	604	1,017
Solubor	23	21	22	25
P.A	30	16	0	0
Neobor	2	0	0	0
Boracine	79	78	67	47
TOLIARA				
Urea	1,682	1,905	473	704
Sulf.Pot.	369	491	12	40
Solubor	4	15	0	0
P.A	1,104	1,579	84	989
Neobor	0	0	0	0
Boracine	7	46	1	0
ANTANANARIVO				
Urea	25	57	0	0
Sulf.Pot.	11	25	0	0
Solubor	0	0	0	0
P.A	25	54	0	0
Neobor	0	0	0	0
Boracine	1	3	0	0
TOTAL				
Urea	5,259	5,266	2,603	2,663
Sulf.Pot.	1,869	1,824	641	1,089
Solubor	27	37	23	25
P.A.	1,168	1,655	86	991
Neobor	2	0	0	0
Boracine	89	127	69	47
GRAND TOTAL	8,413	8,908	3,421	4,816

Table 2.27: Fertilizer use by SIRAMA for sugar cane, by fertilizer type and by region, 1986-1989 (in MT).

	1986	1987	1988	1989
ANTSERANANA				
KCL	400	690	695	1,220
P.A.	0	0	0	0
Phosp.Bicalc.	0	0	0	0
Phosp.Tricalc.	0	0	500	0
Sulf.Pot.	0	0	1,950	625
Sulfonitr.Ammo	0	1,270	0	0
TSP	40	41	0	265
Urea 46%	550	730	2,735	2,235
S.A.	0	0	50	0
Carbon.Calc.	0	0	0	150
MAHAJANGA				
KCL	0	0	0	540
P.A.	0	0	135	100
Phosp.Bicalc.	0	0	570	175
Phosp.Tricalc.	0	0	0	0
Sulf.Pot.	0	0	570	0
Sulfonitr.Ammo	0	0	680	600
TSP	0	0	0	600
Urea 46%	0	0	1,400	1,000
S.A.	0	0	0	0
Carbon.Calc.	0	0	0	0
TOAMASINA				
KCL	0	0	0	300
P.A.	0	0	0	0
Phosp.Bicalc.	0	0	0	0
Phosp.Tricalc.	0	0	0	0
Sulf.Pot.	410	350	360	0
Sulfonitr.Ammo	0	0	0	0
TSP	70	70	80	80
Urea 46%	410	370	380	380
S.A.	0	0	0	0
Carbon.Calc.	0	0	0	0
TOTAL				
KCL	400	690	695	2,060
P.A.	0	0	135	100
Phosp.Bicalc.	0	0	570	175
Phosp.Tricalc.	0	0	500	0
Sulf.Pot.	410	350	2,880	625
Sulfonitr.Ammo	0	1,270	680	600
TSP	110	111	80	945
Urea 46%	960	1,100	4,515	3,615
S.A.	0	0	50	0
Carbon.Calc.	0	0	0	150
GRAND TOTAL	1,880	3,521	10,105	8,270

Table 2.28: Fertilizer sales by type and by NPK nutrient, 1985 to 1988 (in tons)

Fertiliser Type	1985 TOTAL	Nutrient content N	P	K	1986 TOTAL	Nutrient content N	P	K
Urea	7,187	3,306	0	0	7,806	3,591	0	0
8.16.24		0	0	0	1,439	115	230	345
8.20.20.		0	0	0	43	3	9	9
10.10.20	807	81	81	161	657	66	66	131
11.22.16	2,661	293	585	426	597	66	131	96
15.15.15	408	61	61	61	2,118	318	318	318
16.16.16	6,094	975	975	975	10,750	1,720	1,720	1,720
20.10.10.	40	8	4	4	492	98	49	49
Other NPK	2,256				15			
KCL	1,270	0	0	762	539	0	0	323
P.A.	1,332	266	133	133	1,907	381	191	191
Phosp.Bic.		0	0	0		0	0	0
Phosp.Tric.		0	0	0		0	0	0
S.A.	1,137	523	0	0	327	150	0	0
Sulf.Pot.	2,647	0	0	1,271	2,249	0	0	1,080
S.S.P.	149	0	21	0	110	0	15	0
T.S.P.	46	0	21	0		0	0	0
Sultr.Pot.	810							
Sultr.Ammon.								
Hyper Reno	176	0	53	0	39	0	12	0
Other	703				210			
Total	27,723	5,513	1,934	3,793	29,298	6,509	2,741	4,261

Fertiliser Type	1987 TOTAL	Nutrient content N	P	K	1988 TOTAL	Nutrient content N	P	K
Urea	12,936	5,951	0	0	10,063	4,629	0	0
8.16.24		0	0	0		0	0	0
8.20.20.	112	9	22	22	26	2	5	5
10.10.20	330	33	33	66	1	0	0	0
11.22.16	7,897	869	1,737	1,264	1,272	140	280	204
15.15.15	1,063	159	159	159	437	66	66	66
16.16.16	6,434	1,029	1,029	1,029	1,176	188	188	188
20.10.10.		0	0	0	280	56	28	28
Other NPK	1,119				32			
KCL	3,192	0	0	1,915	1,222	0	0	733
P.A.	94	19	9	9	1,128	226	113	113
Phosp.Bic.	717	0	280	0	570	0	222	0
Phosp.Tric.		0	0	0	538	0	135	0
S.A.	793	365	0	0	370	170	0	0
Sulf.Pot.	3,197	0	0	1,535	3,969	0	0	1,905
S.S.P.	23	0	3	0	273	0	38	0
T.S.P.	216	0	97	0	59	0	27	0
Sultr.Pot.	1,270							
Sultr.Ammon.					680			
Hyper Reno	42	0	12	0	49	0	15	0
Other	412				414			
Total	39,846	8,434	3,384	6,000	22,558	5,477	1,116	3,242

Table 2.29: Fertilizer sales by type 1985 to 1988 (in MT).

Fertiliser Type	1985 TOTAL	% of Total	1986 TOTAL	% of Total	1987 TOTAL	% of Total	1988 TOTAL	% of Total
Urea	7,187	25.9	7,806	26.6	12,936	32.5	10,063	44.6
8.16.24		0.0	1,439	4.9		0.0		0.0
8.20.20.		0.0	43	0.1	112	0.3	26	0.1
10.10.20	807	2.9	657	2.2	330	0.8	1	0.0
11.22.16	2,661	9.6	597	2.0	7,897	19.8	1,272	5.6
15.15.15	408	1.5	2,118	7.2	1,063	2.7	437	1.9
16.16.16	6,094	22.0	10,750	36.7	6,434	16.1	1,176	5.2
20.10.10.	40	0.1	492	1.7		0.0	280	1.2
Other NPK	2,256	8.1	15	0.1	1,119	2.8	32	0.1
All NPK	19,454	70.2	23,917	81.6	29,891	75.0	13,286	58.9
KCL	1,270	4.6	539	1.8	3,192	8.0	1,222	5.4
P.A.	1,332	4.8	1,907	6.5	94	0.2	1,128	5.0
Phosp.Bic.		0.0		0.0	717	1.8	570	2.5
Phosp.Tric.		0.0		0.0		0.0	538	2.4
S.A.	1,137	4.1	327	1.1	793	2.0	370	1.6
Sulf.Pot.	2,647	9.5	2,249	7.7	3,197	8.0	3,969	17.6
S.S.P.	149	0.5	110	0.4	23	0.1	273	1.2
T.S.P.	46	0.2		0.0	216	0.5	59	0.3
Sultr.Pot.	810	2.9		0.0	1,270	3.2		0.0
Sultr.Ammon.		0.0		0.0		0.0	680	3.0
Hyper Reno	176	0.6	39	0.1	42	0.1	49	0.2
Other	703	2.5	210	0.7	412	1.0	414	1.8
Total	27,723	100.0	29,298	100.0	39,846	100.0	22,558	100.0

Table 2.30: Costs of recommended fertilizers over 1984-1988.

A. Prices of fertilizer (FMG/kg), 1984-1988.

Fertilizer type	1,984	1,985	1,986	1,987	1,988
Urea	180	180	210	210	210
11.22.16	180	180	180	180	300
20.10.10	180	180	210	210	350
KCL	170	170	170	170	370
S.A.	120	120	120	120	310
TSP	140	140	140	140	300

B. Total fertilizer costs per hectare (in FMG).

Crop	Fertilizer Type	Dosage K/Ha	Total costs per hectare in FMG				
			1,984	1,985	1,986	1,987	1,988
Rice	11.22.16	300	65,880	65,880	74,880	74,880	128,760
	Urea	66					
Manioc	20.10.10.	100	29,220	29,220	32,220	32,220	59,420
	KCL	66					
Maize	11.22.16	300					
	Urea	250	128,750	128,750	137,750	137,750	257,900
	KCL	175					
Coffee	20.10.10.	840	151,200	151,200	176,400	176,400	294,000
Sugar Cane	S.A.	500					
	TSP	165	125,600	125,600	125,600	125,600	297,000
	KCL	250					
Cotton	Urea	300	54,000	54,000	54,000	54,000	108,000
Pepper	20.10.10.	500					
	Urea	300	139,600	139,000	154,600	154,600	276,600
	KCL	80					

Table 2.31: Costs of surplus production obtained with the use of recommended quantities of fertilizer.

A. Farmers prices for produce(FMG/kg), 1984-1988.

Produce	1984	1985	1986	1987	1988
Paddy	80.6	76.7	149	119	160
Manioc	93	92	110	-	-
Maize	126	150	182	-	-
Coffee	332	427	495	716	881
Sugar cane	10	10	12	14	14
Cotton	155	155	155	320	320
Pepper	175	336	362	432	1235

B. Total fertilizer costs per hectare (in FMG).

Crop	Average Yield in K/Ha		Increase in yields K/Ha	Total costs per hectare in '000 FMG				
	Traditional without fertilizer	Improved with fertilizer		1984	1985	1986	1987	1988
Rice	1,860	3,610	1,750	141	134	261	208	280
Manioc	6,300	16,300	10,000	930	920	1,100	-	-
Maize	1,000	6,000	5,000	630	750	910	-	-
Coffee	360	2,360	2,000	664	854	990	1,432	1,762
Sugar cane	20,000	90,000	70,000	700	700	840	980	980
Cotton	1,240	3,240	200	310	310	310	640	1,040
Pepper	443	2,943	2,500	438	840	905	1,230	3,088

Table 2.32: Financial Value Cost Ratios for Madagascar's main crops, from 1984 to 1988.

Crop	1984	1985	1986	1987	1988
Paddy	2.14	2.03	3.48	2.78	2.17
Manioc	31.82	31.50	34.37	34.16	18.51
Maize	4.89	5.82	6.60	6.60	3.52
Coffee	4.39	5.64	5.61	8.11	5.99
Sugar Cane	5.57	5.57	6.68	7.80	3.29
Cotton	5.74	5.74	5.74	11.85	9.62
Pepper	3.15	6.06	5.87	8.48	11.18

Note: the producer price for manioc and maize have been assumed to remain unchanged from 1986 onwards for lack of information.

Table based on the farmgate fertilizer prices and the farmgate producer prices indicated in tables 2.30 and 2.31.

MADAGASCAR FERTILIZER SECTOR STUDY

FINAL REPORT

VOLUME III

ANNEXES

NOVEMBER 1989

UNITED STATES OF AMERICA

Price Waterhouse

ANNEX

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ANNEX 1 - PART 1

SITUATION SUR L'UTILISATION DES ENGRAIS A MADAGASCAR

par

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Consultant

Juin 1989

AGRICULTURAL SECTOR OVERVIEW

Nous allons considérer cette situation au point de vue sols, principales plantes cultivées et mode de culture.

1.1 LES SOLS DE MADAGASCAR

Meme si les 10 classes de sols de la classification française des sols sont représentés à Madagascar, d'une façon pratique, on peut distinguer principalement trois types de sols : les tanety, les sols hydromorphes des bas fonds et des plaines et les baiboho.

1.1.1 Les tanety

Ce sont les terres de collines ou de plateaux, toujours pauvres en P2O5 et qui manquent aussi de K2O s'ils ne présentent pas des micas en surface à la suite d'un rajeunissement de leur profil. Leur teneur en N varie avec leur teneur en matière organique. Ils représentent plus de 75% des sols malgaches et sont en principe cultivables mais très peu cultivés. Seule, une infime partie autour des villages est exploitée prouvant ainsi qu'ils peuvent l'etre, notamment pour les cultures sèches (manioc, mais, riz pluvial, café).

1.1.2 Les sols hydromorphes des bas fonds et des plaines

Ils sont reconnaissables par

- leur topographie : une plaine ou des bas fonds des vallées
- leur engorgement temporaire ou permanent de leur profil et leur couleur bleue ou tacheté de rouille
- leur texture souvent argileuse.

Ils sont aussi toujours pauvres en P2O5 et la plupart du temps en K2O. Ils peuvent etre riches en azote mais sous forme organique dont il faut amorcer la minéralisation par un apport d'azote minéral assimilable.

Ils sont exploités principalement sous forme de rizières.

1.1.3 Les baiboho

Ils sont reconnaissables par

- leur localisation sur les bourrelets de berge des Haut-Plateaux, sur les terrasses non inondables de la Cote Est et sur les grandes plaines alluviales de la Cote Ouest (MAMPIKONY, PORT-BERGER, AMBILOBE....).

- leur texture limoneuse et leur couleur beige à l'état sec.

- leurs horizons micacés dès la surface : ils sont riches en K2O mais manquent en général de N et de P2O5.

Ce sont les sols les plus fertiles de Madagascar et ont un grand intéret économique et agricole. Sur les Hauts-Plateaux, ils portent des cultures maraichères ou fruitières, du tabac, de la canne à sucre, du bananier, du manioc.

Sur la Cote Est, quand ils ne sont pas inondables, ils portent des caféiers, palmiers à huile, bananiers.

Sur la Cote Ouest, ils sont cultivés en décrue avec du coton, du tabac, de la canne à sucre.

1.2 LES PRINCIPALES PLANTES CULTIVEES

Trois plantes : le riz,le coton et la canne à sucre, sont les principales utilisatrices d'engrais à Madagascar.

1.2.1 Le riz : C'est la principale et la plus importante culture malgache au point de vue tonnage et superficie avec 2.235.200 tonnes et 1.189.000 ha en 1988 avec un rendement moyen de 1,88 t/ha.

Il est produit essentiellement en milieu paysannal, sur des petites parcelles de 0.5 are à 50 ares. Il est cultivé dans tout Madagascar mais de façon intensive sur les Haut-Plateaux et moins intensive sur les Cotes, sur les sols hydromorphes principalement et dans une mesure moindre, sur les tanety.

1.2.2 Le coton

La production de coton en 1986 était de 42.850 t sur 40.866 ha avec un rendement moyen de 0,95 tonnes par ha de coton-graine.

Par suite du parasitisme élevé, la culture du cotonnier dans une région nécessite une discipline stricte de la part des paysans. Souvent, celle-ci est réalisée par l'association entre un organisme de développement (SAMANGOKY, HASIMA) et les cultivateurs.

Suivant l'origine de son alimentation en eau, la culture du cotonnier est classée en

- culture pluviale
- culture irriguée
- culture de décrue.

Le cotonnier est principalement cultivé sur baiboho dans le Nord-Ouest et le Sud de Madagascar et ne nécessite qu'un apport unique de 300 kg d'urée/ha jusqu'à maintenant.

1.2.3 La canne à sucre

La production de cannes en 1986 était de 1.950.000 tonnes dont 978.180 t en exploitations traditionnelles à raison de 1 à 2 ares par exploitation, pour la consommation de bouche et la fabrication de vin de canne. Cette production paysannale n'utilise pas généralement de fertilisants.

Par contre, les 5 sucreries existant à Madagascar, pour une production totale de 971.820 t en 1986 adoptent une fertilisation minérale intensive variable suivant les sucreries.

1.3 LES MODES DE CULTURE

En milieu paysannal, la culture est la plupart du temps, manuelle, avec une beche traditionnelle, l'angady. Cela fait que la taille moyenne des exploitations n'est que de 1,14 ha, car la productivité de travail du paysan est très faible. Sur les Haut-Plateaux, notamment autour des agglomérations pratiquement tous les bas fonds sont exploités d'une façon intensive. Par contre, seule une infime partie des tanety est cultivée en manioc, mais .... avec de temps en temps des reboisements d'eucalyptus et de pins.

L'impression générale est que Madagascar dispose de beaucoup de terres mais seule une petite partie est exploitée.

2 FERTILIZER RESEARCH

2.1 THE IMPACT OF CURRENT FERTILIZER RESEARCH EFFORTS

En plus du FOFIFA, le Programme Engrais Malagasy et certains organismes chargés du développement ou de la production directe d'une culture donnée (riz, coton, canne à sucre, tabac ...) incluent dans leurs programmes de recherche les problèmes de fertilisation.

2.1.1 La Fofifa

A Activités de la FOFIFA

C'est la principale institution qui s'occupe de recherches agronomiques à Madagascar. Ces activités sont très vastes et concernent de nombreux domaines et de nombreuses cultures. Pratiquement, pour chaque production, elle travaille :

- sur les variétés (comparaison, comportement, sélection de celles qui sont les mieux adaptées à chaque région)
- sur les ennemis des plantes : insectes et maladies
- sur la physiologie de la plante (cycle, fumure)
- sur les techniques culturales : densité de semis ou de plantation,lutte contre les mauvaises herbes ...

Devant cette multiplicité des thèmes de recherches, la fumure minérale n'a pas toujours été une préoccupation prioritaire de la FOFIFA, si bien que

a) les dernières expérimentations sur la fumure dans certaines régions (MANAKARA) datent de 1970,

b) que les thèmes sur la fumure préconisés par les vulgarisateurs actuels datent de plus de 15 ans et sont ceux résultant des recherches de 1965-1970.

Vers 1984, ARRIVETS et Al à la FOFIFA ont essayé, par différentes expérimentations de remettre en cause la formule classique de 30-62-45 pour les rizières en montrant que la réponse de K2O est marginale. Leurs efforts n'ont pas encore convaincu tout le monde.

B **Les stations de Recherche de FOFIFA:**

Sont, pour le

- Riz : Lac Alaotra, Marovoay, Tananarive
- Mais : Lac Alaotra
- Manioc : Lac Alaotra
- Café : Ilaka, Kianjavato
- Coton : Tuléar, Tanandava, Manjuga
- Poivre : Tamatave.

C **Relations de la FOFIFA avec :**

1 **Les sucreries, HASIMA, OFMATA OPERATION CAFE, ODR, ODASE.**

Il peut y avoir des conventions sur des recherches ponctuelles entre ces organismes et la FOFIFA. Il ne peut pas y avoir double emploi car ces recherches sont effectuées dans les zones d'interventions de ces organismes: aussi les services expérimentations de ces derniers y sont associés.

a) Avec les sucreries : la FOFIFA effectue, non des conventions qui sont plus importantes mais de simples prestations de service notamment en matière de défense des cultures.

b) Avec HASIMA. HASIMA confie à FOFIFA sous forme de convention les recherches sur les variétés de cotonnier. Aucune convention en matière de fertilisation.

c) Avec OFMATA : Meme comportement qu'avec HASIMA.

d) Avec ODASE et ODR. Les programmes établis par leurs services experimentations avec FOFIFA sont réalisés en commun aussi, avec une convention de financement par l'organisme de développement demandeur.

e) Avec l'opération Café

Cette opération n'a pas de service expérimentation spécifique. Elle confie toutes les recherches dont elle a besoin à FOFIFA, avec des conventions de financement payées par la Caisse café.

2) Le PEM

Le PEM pendant trois ans a un programme de 77 essais de 16 parcelles chacun. La FOFIFA avec l'IRRI était associée à l'établissement des protocoles.

Dans la réalisation:

- La FOFIFA devait réaliser une partie des essais : elle l'a fait uniquement la 1ère année et pratiquement un ou deux essais à partir de la 2ème année, faute de moyens ;

- Le PEM réalise tous les autres essais et s'occupe de toutes les analyses de sol.

- L'IRRI s'occupe des analyses végétales par diagnostic foliaire, auprès de GERDAT, MONTPELLIER.

D Role de la Direction de la Recherche et Développement(DRD) de la FOFIFA

La FOFIFA comprend actuellement une branche Recherche-Développement dont les activités consistent à tester auprès des paysans d'une zone, les résultats des recherches thématiques de la Direction de la Recherche Agronomique de la FOFIFA, à recueillir les opinions et les réactions des paysans.

La procédure à suivre est la suivante :

La DRD fait en premier lieu un diagnostic agro-socio-économique de la zone à étudier. Elle fait actuellement cette étude de base fondamentale pour 3 zones :

- Nord-Ouest = MAROVOAY
- Moyen-Ouest = TSIROANOMANDIDY
- Haut-Plateaux = MANJAKANDRIANA.

La DRA de la FOFIFA lui donne un thème (variété, formule d'engrais, défense de cultures, techniques culturales ...) à tester.

La DRD peut refuser de faire le test. Si elle trouve que le thème n'est pas vulgarisable pour des raisons économiques, sociologiques, culturelles.

Si elle fait le test, elle recueille toutes les réactions des paysans et peut proposer à la DRA-FOFIFA d'en modifier certains aspects.

Ce n'est qu'une fois que la DRA et la DRD de la FOFIFA sont d'accord que le thème prévulgarisé dans une zone de la DRD peut etre vulgarisé ailleurs.

2.1.2 Programme FOFIFA-IRRI

L'IRRI a commencé à travailler à Madagascar il y a 5 ans en 1984.

Le programme de l'IRRI porte sur

1) l'amélioration variétale du riz par sélection
2) l'agronomie (techniques culturales, systèmes de culture, fertilisation).

En matière de fertilisation, l'IRRI travaille avec la FOFIFA. Le programme est défini en commun avec les 2 experts de l'IRRI, la FOFIFA et les organismes de vulgarisation.

L'IRRI et la FOFIFA trouvent que la formule classique 60-60-45 préconisée pour le riz n'est pas valable partout et constitue dans beaucoup de cas, un gaspillage.

Leur programme consiste a trouver la meilleure formule exacte pour chaque zone des rizières. Les résultats obtenus diffèrent parfois de 60-60-45 mais ne sont valables qu'au niveau de la station de recherches ou au niveau des zones des opérations, mais pas ailleurs, ni au niveau national.

2.1.3 Le Programme Engrais Malagasy (PEM)

Le PEM, exécuté par la FAO, sur financement norvégien, a mis en place un réseau d'essais de fertilisation (20 environ) et une centaine d'essais de démonstrations, en milieu paysannal, principalement sur les Hauts-Plateaux. Il s'agissait

- d'identifier l'ensemble des contraintes qui ont provoqué la baisse de la consommation d'engrais après la cessation des activités des Grandes Opérations de Productivité Rizicole (GOPR) en 1975, et

- de relancer l'utilisation des engrais, surtout pour la riziculture.

Les résultats des efforts du PEM sont actuellement les suivants:

1) La preuve est faite auprès des paysans, du bien fondé de la formule classique d'engrais 30-60-45 avec un apport supplémentaire de 30 U d'azote en couverture, formule qui a été remise en question par certaines personnes (FOFIFA, Banque mondiale ....). Elle n'est pas la meilleure dans tous les cas, mais les paysans se sont aperçus qu'elle offre en moyenne les meilleurs accroissements de rendements.

2) La tentative d'introduction à Madagascar par le PEM, depuis quelques années, de l'engrais ternaire 15-15-15 moins cher que le 11-22-16; a plus ou moins échoué. Cet engrais, moins connu des paysans a été moins demandé. Ce fait suppose que chaque fois qu'on introduit un nouvel engrais, il faut reprendre dès le début les actions nécessaires pour convaincre les paysans de son intéret.

3) Les paysans ont été convaincus de l'efficacité et de l'intéret plus grands du supergranulé (boulette d'urée conditionnée avec des substances diverses) par rapport au perlurée. Ils l'ont adopté.

4) Les nombreux essais de démonstration effectués par le PEM, ont remis en mémoire auprès des paysans les bienfaits de la fertilisation qu'ils avaient tendance à oublier un peu, depuis l'action du GOPR.

2.1.4 Field level research under crop-specific programs

Certains organismes de développement ou de production spécifique à une culture donnée (toutes les sucreries pour la canne à sucre, l'ODASE (riz), HASIMA (coton) OFMATA (tabac) trouvent que la FOFIFA ne se penche pas suffisamment assez sur leurs problèmes locaux spécifiques. Aussi ces organismes ont créé leurs propres "services experimentations" qui travaillent sur les variétés, la protection des plantes, les techniques culturales et également sur la fertilisation qu'ils doivent adopter.

En matière de fertilisation, ils trouvent que les recommendations actuelles qui sont les résultats des recherches de l'IRAM avant 1972 sur la mise en valeur des tanety ou des rizières, ont une application trop générale.

Il leur faut trouver des formules plus précises et adaptées à leurs sols, à leurs pratiques culturales, aux disponibilités locales en fertilisants.

Donnons à titre d'exemples, quelques impacts des efforts de ces organismes :

- les sucreries ont chacune leurs propres formules de fertilisation qui diffèrent les unes des autres et qui tiennent compte des éléments dont leurs sols sont les plus carencés, des restitutions sous forme d'écumes, du brulage ou non de la canne avant récolte, etc.

- la Sucrerie d'AMBILOBE vers 1972 a fait augmenter sa production de 20% (10.000 t de sucre en plus) en remplaçant uniquement l'urée qu'elle utilisait depuis des années, par du $SO_4(NH_4)_2$. Son Service Expérimentation a en effet décelé, par diagnostique foliaire, une carence en soufre de ses sols au bout de cette longue utilisation d'urée qui était moins cher.

- HASIMA expérimente actuellement l'apport de K_2O sur le cotonnier des baiboho. Le K_2O de ce type de sol, après des années d'exploitation commence à s'épuiser.

2.1.5 Efficacité du mécanisme utilisé pour diffuser les résultats des recherches sur les engrais

Les problèmes entre le passage des résultats de recherches à la vulgarisation.

Il faut faire remarquer que :

1) les résultats de recherches sur la fertilisation vulgarisés actuellement par les organismes de vulgarisation sont encore ceux de l'IRAM d'avant 1974.

2) Depuis 1974 jusqu'à maintenant, il n'y a eu pratiquement aucun résultat sur, venant du FOFIFA en matière de fertilisation qu'on doit faire passer à la vulgarisation.

3) Le MPARA avait un service spécial intitulé : Service d'Appui à la vulgarisation et de Liaison avec la Recherche (SALIAR) qui a été supprimé récemment, parce qu'on a jugé qu'il était trop peu efficace.

En effet, quand le MPARA présentait au FOFIFA ses problèmes à résoudre, la FOFIFA établissait un protocole d'essais et présentait une convention de financement à signer, au MPARA Or, les fonds n'étaient pas disponibles et les problèmes restaient en suspens.

Par contre, l'ODR, l'ODASE, qui avaient suffisamment de moyens, signaient des conventions semblables avec la FOFIFA.

4) Le Service de Vulgarisation du MPARA, actuellement teste, avec la méthode Training and Visits, les thèmes (y compris les thèmes de fertilisation éventuels) qu'il voudrait diffuser, en utilisant trois CIRVA pilotes : MORAMANGA, TANANARIVE, MIARINARIVO, en vue d'une extension de la vulgarisation des thèmes testés.

5) Il arrive aussi à ce service du MPARA ci-dessus de passer une convention avec la Direction de la Recherche-Développement du MRSTD pour tester un thème donné dans une des zones d'études de cette DRD.

3 FERTILIZER TYPES USED AND ASSOCIATED CROP

Les principaux types d'engrais importés et utilisés à Madagascar sont :

3.1 ENGRAIS AZOTES

- Sulfate d'ammoniac SO4 (NH4)2 à 46% de N sous forme de perlurée et de supergranulé : pour la canne à sucre et pour les sols carencés en soufre.

- Urée : pour le coton et en complément à d'autres engrais composés pour le riz, le mais, le poivre ...

Les nitrates sont d'une façon générale, écartés car, malgré leur action rapide, ils sont facilement lessivés sur la Cote Est et ils sont nocifs pour les rizières.

3.2 ENGRAIS PHOSPHATES

- Hyper Reno : (PO4)2Ca3, un phosphate naturel tricalcique finement moulu et titrant 30% de P2O5 : pour les cultures sur sols acides des tanety : arbres fruitiers, reboisements industriels, divers, ...

- Supertriple : (PO4H)2Ca, titrant 45% P2O5 sous forme monocalcique pour la canne à sucre.

- Phosphate bicalcique, PO4Ca, titrant 40% environ de P2O5 : pour les pépinières de riz.

3.3 ENGRAIS POTASSIQUES

- Chlorure de potassium, Clk, titrant 60% de K2O en complément des engrais composés utilisés pour le manioc, mais, canne à sucre, poivre...

- Sulfate de potasse, SO4K2, titrant 48% de K2O et 18% de soufre, réservé au tabac et aux cultures maraichères et fruitières.

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3.4 ENGRAIS COMPLEXES

- **NPK (diverses formules) dont principalement**

  11-22-16 pour le riz, le mais ...
  20-10-10 pour le café, le manioc.
  16-16-16, 15-15-15 et 8-20-20 quand il n'y a pas suffisamment de 11-22-16 sur le marché.

3.5 REMARQUES

Ce sont les grandes exploitations privées ou nationalisées qui utilisent les engrais simples tandis que les organismes de vulgarisation (MPARA, ODR) préfèrent les engrais complexes, souvent en granulé, facilement manipulables par les paysans utilisateurs.

4 PRESENT RECOMMENDATIONS ON FERTILIZER TYPES

4.1 LES ENGRAIS AZOTES

a) Le SO4(NH4)2 (21% de N) est un excellent engrais pour les rizièrs meme si on lui reproche son action acidifiante peu importante mais réelle. Il est aussi à préconiser dans les sols calcaires à pH élevé et dans les sols de canne à sucre carencés en soufre.

b) L'urée (46% de N) : cette concentration élevée en fait diminuer le prix du transport à l'unité fertilisante. Elle est facilement lessivée par les fortes pluies. Aussi une forte fumure en urée doit etre fractionnée en plusieurs apports pour éviter son lessivage. Elle est recommandée pour les tanety acides car elle est alcalinisante et pour les rizières où elle peut etre apportée en couverture.

c) Les nitrates ont une action rapide mais ils sont facilement lessivés et sont absolument à proscrire dans les rizières inondées. Aussi on n'en trouve que rarement à Madagascar (NO3K pour les arbres fruitiers, les fleurs ...).

4.2 LES ENGRAIS PHOSPHATES

Les engrais phosphatés peuvent etre utilisés en fumure de fond pour redresser une carence du sol en cet élément.

a) Sur tanety ou rizières acides on recommande l'utilisation de phosphate tricalcique Hyper Reno (30% de P205).

b) En pépinière de riz, on recommande le phosphate bicalcique (quand il est disponible) plus soluble que le tricalcique.

c) Le Super-Triple (45% de P2O5) est déconseillé sur les tanety riches en fer et aluminium solubilisés, mais il est utilisé sur les alluvions jeunes (canne à sucre).

4.3 LES ENGRAIS POTASSIQUES

a) Le chlorure de potassium (48% de K2O).

Il coute moins cher que les autres types d'engrais potassiques. Aussi on le recommande pour tous les sols et pour toutes les cultures sauf pour le tabac (le chlore nuit à la combustibilité des feuilles) et pour certains arbres fruitiers (avocatier).

b) Le sulfate de potassium (48% de K2O)

Il convient à tous les sols et toutes les plantes mais il est plus cher à l'unité fertilisante que le ClK et on le réserve en général au tabac et aux cultures maraichères et fruitières.

4.4 Les engrais complexés NPK

Ils sont recommandés pour etre vulgarisés auprès des paysans car

- très riches en UF, ils sont moins chers par unité fertilisantes car ils permettent une économie de transport et de sacherie ;

- et surtout, il est plus facile de conseiller aux paysans d'apporter un seul engrais que trois : dans ce dernier cas il a tendance à n'en apporter qu'un ou deux, pensant qu'il en a fait suffisamment. Or c'est une catastrophe !

5 TECHNICAL FERTILIZER REQUIREMENTS

Les besoins théoriques de Madagascar en engrais peuvent se calculer à partir des surfaces totales cultivées pour chaque principale culture et les quantités de fertilisants préconisées par ha pour chacune de ces cultures.

Toutefois, la détermination des surfaces cultivées par culture pose les problèmes suivants :

1) Sauf pour le riz, les chiffres disponibles les plus récents datent de 1986 ou 1987.

2) Les chiffres relevés sur les "fiches FMI" du Service de Statistique Agricole du MPARA à ANOSY diffèrent de ceux, sortis de l'ordinateur du meme service mais à MANJAKARAY.

Nous avons estimé que les "chiffres FMI" d'ANOSY sont plus fiables. MANJAKARAY estimait, à titre d'exemple la surface et la production du riz en 1975 à 1.962.000 tonnes sur 1.078.000 ha, et 13 ans plus tard à 1.978.000 tonnes sur 1.058.000 ha c'est- à- dire , pratiquement stable. Etant donné l'augmentation de la population en 13 ans et considérant l'importation du riz l'année dernière, les chiffres du FMI semblent plus réalistes.

5.1 - Recommended technical levels

Les doses d'engrais préconisés par les organismes vulgarisateurs actuels sont portées sur le tableau ci-dessous :

Cultures	Quantités préconisées en UF/ha	Types d'engrais préconisés et quantités correspondantes	
		Types	Quantité en kg/ha
Riz	60-60-45	11-22-16 Urée	300 66
Manioc	20-10-50	20-10-10 ClK	100 66
Maïs	150-160-120	11-22-16 Urée ClK	300 250 175
Café	170-85-85	20-10-10	840
Canne à sucre	100-75-150	S.A Super-triple ClK	500 165 250
Coton	140-0-0	Urée	300
Tabac	30-30-50	16-16-16 SO_4K_2	200 40
Poivre	200-50-100	20-10-10 Urée ClK	500 200 80

Tableau n°1 : *Quantités et types d'engrais recommandés pour chaque culture.*

5.2 - Areas under production

Le tableau ci-dessous nous montre les superficies cultivées pour chaque culture depuis ces dernières années. Ce sont les derniers chiffres disponibles (ND = non disponible).

Culture / Année	Riz en ha	Manioc en ha	Maïs en ha	Café en ha	Canne à sucre en ha	Coton en ha	Tabac en ha	Poivre en ha
1985	1.183.520	350.570	140.000	223.100	60.100	32.929	4.100	6.200
1986	1.187.565	359.245	148.000	224.235	59.000	42.850	ND	6.100
1987	1.123.925	311.200	139.975	223.995	59.500	ND	ND	6.250
1988	1.189.000	ND	ND	ND	ND	ND	ND	ND

Tableau n°2 : *Superficies cultivées des principales cultures à Madagascar.*
(Source : Fiches FMI du Service de la Statistique Agricole du MPARA-ANOSY).

5.3 - Total theorical requirement

Les besoins théoriques totaux de Madagascar en engrais, pour une année sont calculés de la façon suivante :

Culture	Types d'engrais	Doses kg/ha	Superficies concernées	Besoins par culture et par type d'engrais en tonnes par an							Totaux par culture en tonnes
				11-22-16	Urée	20-10-10	ClK	Super T	16-16-16	S.A.	SO_4K_2	
Riz	11-22-16	300	1.189.000 ha	356.700								435.174
	Urée	66			78.474							
Manioc	20-10-10	100	311.200 ha			31.120						
	ClK	66					20.539					51.659
Maïs	11-22-16	300	139.975 ha	41.992								
	Urée	250			34.993							101.480
	ClK	175					24.495					
Café	20-10-10	840	223.995 ha			188.155						189.155
Canne à sucre	S.A	500	59.500 ha							29.750		
	Super T	165						9.817				54.442
	ClK	250					14.875					
Coton	Urée	300	42.850 ha		12.855							12.855
Tabac	16-16-16	200	4.100 ha						820			984
	SO_4K_2	40									164	
Poivre	20-10-10	500	6.100 ha			3.050						
	Urée	200			1.200							4.758
	ClK	80					488					
Besoins totaux par types d'engrais				398.692	127.542	222.325	60.397	9.817	820	29.750	164	849.507

Tableau n° 3 : *Besoins théoriques totaux de Madagascar par culture et par type d'engrais et par an.*

N.B. : Ces besoins ont été calculés à partir des plus récentes évaluations des superficies cultivées du tableau n° 2.

6 PROFITABILITY OF FERTILIZER USE

6.1 FINANCIAL VCR FOR 5 YEARS

Les éléments de base nécessaires aux calculs des VCR correspondants aux principales cultures de Madagascar pendant ces cinq dernières années sont :

a) Couts des doses d'engrais préconisées par ha, depuis 5 ans, (tableau n' 4 ci-dessous).

b) Couts des surplus de production obtenus par ha, depuis 5 ans, (tableau n' 5 ci-dessous).

A partir de ces 2 tableaux n' 4 et n' 5, le VCR :

Cout du surplus de produit peut se calculer pour chaque culture et Cout des engrais utilisés chaque année. On obtient alors, les valeurs portées sur le tableau n' 6.

Remarques :

D'après ce tableau n' 6, il faut noter que :

1) Le VCR du riz par rapport à celui des autres spéculations est nettement plus faible, et dépasse à peine la valeur 2 admis comme minimum acceptable.

2) Les valeurs élevées des VCR des autres cultures expliquent pourquoi les grandes exploitations qui font ces cultures utilisent toujours des engrais, car elles savent que cette utilisation est hautement rentable. C'est le cas de la féculerie de MAROVITSIKA (Manioc) de toutes les sucreries de Madagascar (canne à sucre), la CIM (coton), SAMA (café), FIFAMANOR (mais).

3) L'augmentation du prix des engrais en 1987 a fortement affecté les VCR de toutes les cultures en 1988, sauf pour le coton et le poivre qui ont vu leur prix aux producteurs augmenter sensiblement.

4) Rappelons que le VCR (Value Cost Ratio) mesure l'importance du surplus de production obtenu par rapport aux dépenses engagées en utilisant les engrais.

Tableau n° 4 : *Coûts des engrais recommandés par ha depuis 5 ans*

Cultures	Nature de l'engrais	Doses en kg	Prix du kg en FMG en 1984	1985	1986	1987	1988	Coût total par ha de la fertilisation en FMG en 1984	1985	1986	1987	1988
Riz	11-22-16	300	180	180	210	210	350	65.880	65.880	74.880	74.880	128.760
	Urée	66	180	180	180	180	300					
Manioc	20-10-10	100	180	180	210	210	350	29.220	29.220	32.220	32.220	59.420
	ClK	66	170	170	170	170	370					
Maïs	11-22-16	300	180	180	210	210	350	128.750	128.750	137.750	137.750	257.900
	Urée	250	170	170	180	180	360					
	ClK	175	170	170	170	170	370					
Café	20-10-10	840	180	180	210	210	350	151.200	151.200	176.400	176.400	294.000
Canne à sucre	S.A	500	120	120	120	120	310	125.600	125.600	125.600	125.600	297.000
	Super triple	165	140	140	140	140	300					
	ClK	250	170	170	170	170	370					
Coton	Urée	300	180	180	180	180	360	54.000	54.000	54.000	54.000	108.000
Poivre	20-10-10	500	180	180	210	210	350	139.000	139.000	154.000	145.000	276.000
	Urée	300	180	180	180	180	360					
	ClK	80	170	170	170	170	370					

Tableau n° 5 : *Coûts des surplus de production obtenus en utilisant les engrais recommandés.*

Cultures	Rendement moyen en kg par ha		Accroissement du rendement en kg/ha	Prix réels par kg de produit en FMG					Coût total de l'accroissement de rendements en FMG				
	Traditionnel sans engrais	Amélioré avec engrais		1984	1985	1986	1987	1988	1984	1985	1986	1987	1988
Riz (Paddy)	1.860	3.610	1.750	80,6	76,7	149	119	160	141.050	134.225	260.750	208.250	280.000
Manioc	6.300	16.300	10.000	93	92	110	-	-	930.000	920.000	1.100.000	-	-
Maïs	1.000	60.000	5.000	126	150	182	-	-	630.000	750.000	910.000	-	-
Café	360	2.360	2.000	332	427	495	716	881	664.000	854.000	990.000	1.432.000	1.762.000
Canne à sucre	20.000	90.000	70.000	10	10	12	14	14	700.000	700.000	840.000	980.000	980.000
Coton	1.240	3.240	2.000	155	155	155	320	520	310.000	310.000	310.000	640.000	1.040.000
Poivre	443	2.943	2.500	175	336	362	492	1.235	437.500	840.000	905.000	1.230.000	3.087.500

Tableau n° 6 : *VCR des principales cultures à MADAGASCAR.*

Cultures \ Années	1984	1985	1986	1987	1988
RIZ	$\frac{141.050}{65.830} = 2,14$	$\frac{134.225}{65.830} = 2,03$	$\frac{260.750}{74.880} = 3,48$	$\frac{208.250}{74.880} = 2,78$	$\frac{280.000}{128.760} = 2,17$
MANIOC	$\frac{930.000}{29.220} = 31,8$	$\frac{920.000}{29.200} = 31,5$	$\frac{1.100.000}{32.000} = 34,1$	$\frac{1.100.000^{(+)}}{32.200} = 34,1$	$\frac{1.100.000^{(+)}}{59.420} = 18,5$
MAIS	$\frac{630.000}{128.750} = 4,9$	$\frac{750.000}{128.750} = 5,8$	$\frac{910.000}{137.750} = 6,6$	$\frac{910.000^{(+)}}{137.750} = 6,6$	$\frac{910.000^{(+)}}{257.900} = 3,5$
CAFE	$\frac{664.000}{151.200} = 4,4$	$\frac{854.000}{151.200} = 5,6$	$\frac{990.000}{176.400} = 5,6$	$\frac{1.432.000}{176.400} = 8,1$	$\frac{1.762.000}{294.000} =$ [illegible]
CANNE A SUCRE	$\frac{700.000}{125.600} = 5,6$	$\frac{700.000}{125.600} = 5,6$	$\frac{840.000}{125.600} = 6,7$	$\frac{980.000}{125.600} = 7,8$	$\frac{980.000}{297.000} = 3,3$
COTON	$\frac{310.000}{54.000} = 5,7$	$\frac{310.000}{54.000} = 5,7$	$\frac{310.000}{54.000} = 5,7$	$\frac{640.000}{54.000} = 11,8$	$\frac{1.040.000}{108.000} = 9,6$
POIVRE	$\frac{437.500}{139.000} = 3,1$	$\frac{840.000}{139.000} = 6,0$	$\frac{905.000}{154.000} = 5,9$	$\frac{1.230.000}{145.000} = 8,5$	$\frac{3.087.500}{276.000} = 11,2$

(+) - Prix du produit en 1986 seul disponible et supposé stable jusqu'en 1988.

7 ALTERNATIVE FERTILIZERS

Les fertilisants alternatifs disponibles à Madagascar sont essentiellement organiques. On peut les classer en :

7.1 FERTILISANTS ORGANIQUES D'ORIGINE PUREMENT VEGETALE

Ce sont:

a) Les résidus de récolte.

Elles comprennent : les fanes d'arachide, les feuilles et stipes de bananiers, les feuilles et bouts blancs des cannes à sucre, les tiges du cotonnier, du mais, du manioc, du tabac, la paille de riz. Leur quantité et leur disponibilité précises restent à determiner. Mais en tout cas pour la plupart des plantes cultivées, ils sont quantitativement plus importants que la récolte elle-meme, et il faut les récupérer pour fertiliser les sols.

b) Les déchets de transformation de produits alimentaires.

Ce sor.. les enveloppes et les coques de divers produits, les résidus de sucrerie ... Sur le plan national, leur role peut etre modeste, mais ils peuvent jouer localement des roles très importants pour fertiliser l'humus des sols qui se trouvent autour des usines de transformation.

c) Les plantes de couverture

C'est une technique très intéressante qui consiste à couvrir les interlignes des plantes pérennes (cocotier, palmier à huile ...) par une légumineuse rampante.

Elle apporte de l'azote et de la matière organique aux sols et permet de lutter contre l'érosion et les mauvaises herbes.

7.2 FERTILISANTS ORGANIQES D'ORIGINE PUREMENT ANIMALE

a) Ce sont Principalement: Les déchets d'abattoirs (résidus des panses des ruminants, sabots ...) utilisés par les maraichers des environs.

b) Les phosphates d'os produits il y a quelques années par PROCHIMAD à partir des os de zébus dont la viande désossée est exportée. La quantité d'os récoltée variait autour de 3.000 tonnes par an.

La composition en était de 5% d'azote organique, 26-29% de phosphate bicalcique et tricalcique, 34% de CaO.

7.3 FERTILISANTS ORGANIQUES D'ORIGINE MULTIPLE

A) <u>Les fumiers</u>

Il y a lieu de distinguer :

a) le fumier de ferme : un mélange de déjections animales et de litière végétale. On en utilise environ 1,2 millions de tonnes par an à Madagascar sur une potentialité de dizaines de millions de tonnes.

b) le fumier de parc ou poudrette:

ce sont des déjections bovines déposées, piétinées dans les divers enclos où les animaux passent la nuit. Il n'y a pas d'apport de litières. Leur disponibilité est importante dans le Sud et le Sud-Ouest de Madagascar, mais elles ne sont pas utilisées par l'agriculture pour diverses raisons.

c) le fumier artificiel obtenu par décomposition de divers refus organique après adjonction d'azote minérale. On le trouve dans quelques exploitations agricoles évoluées.

B) Les ordures ménagères

Elles contiennent des substances organiques et minérales qui sont quantitativement loin d'etre négligeables. Certains paysans les font décomposer dans un trou et les déterrent au bout d'un temps plus ou moins long pour fumer les cultures autour des cases.

La municipalité de TANANARIVE gère une usine de transformation des ordures ménagères en compost. Celle-ci a des problèmes concernant le cout du produit fini : celui-ci est trop élevé pour du fumier.

C) L'engrais organico-biologique de ZE.MA

C'est une tentative effectuée par l'Etat pour produire industriellement un engrais organico-biologique (EOB) à partir des déchets de sisal et divers ingrédients (déchets de poisson, algues, dolomie). Elle a échoué car le produit commercialisé était trop cher pour les quantités d'unités fertilisants qu'il contenait.

7.4 FERTILISANTS MINERAUX D'ORIGINE LOCALE

On peut citer parmi eux :

a) Les guano des grottes

Les guano des grottes à chauve-souris de la Cote, comme celle d'ANDOHARANO qui aurait une réserve de 10.000 tonnes de guano à 15% de P2O5 et 4% de N. Leurs exploitations ne sont pas faites mais peuvent etre envisagées avec les Fokontany environnants.

b) Les guano de l'ile de Juan de Nova (titrant 25-30% de P2O5).

Il y aurait une réserve de 4.000.000 tonnes, mais le statut juridique de l'ile de Juan de Nova n'est pas encore fixé définitivement.

c) Les nodules phosphatés dans le bassin de MAHAJANGA.

Titrant 36 à 50% de phosphate de chaux. Leur importance n'est pas évaluée.

d) La dolomie : les possibilités pour augmenter son utilisation.

La SOMADEX a des débouchés auprès des industriels (PROCHIMAD et SOVEMA)(+) mais jusqu'à maintenant, les principaux utilisateurs de dolomie agricole se concentrent dans le Faritany de FIANARANTSOA (Isorana, Ambalavao) et d'ANTANANARIVO (Antsirabe).

Ces clients agricoles, principalement les viticulteurs FIFAMANOR, TOMBONTSOA et quelques riziculteurs encadrés utilisent la dolomie pour corriger des carences en Ca et Mg des sols de tanety et remédier aux actions néfastes de l'acidité de ces derniers.

Nous avons remarqué, que malgré le prix incitatif, 12 FMG/kg en 1980, (subventionné à 50%) de la dolomie, son utilisation en milieu paysannal était très faible et loin d'etre en rapport avec la superficie de tanety mise en culture.

Les raisons de cette faible utilisation sont à notre avis les suivantes :

- La majorité des paysans connaissent mieux les engrais NPK dont la vulgarisation est plus ancienne.

- Il leur est difficile d'admettre la dose de 1 t/ha préconisée, qu'il faut en plus épandre manuellement et uniformement, demandant beaucoup de travail.

- Ils ne comprennent pas qu'un tel apport ne peut etre amorti qu'au bout d'une rotation quinquennale : ils demandent un résultat immédiatement rentable la 1ère année.

  (+) - PROCHIMAD = Produit chimique de Madagascar.
  SOVEMA = Société de Verrerie de Madagascar.

- Ils se sont aperçus que la dolomie est un destructeur de matière organique, et que s'ils n'apportent pas suffisamment de fumier, leurs sols durcissent.

Il y a eu des malentendus : certains paysans ayant pris la dolomie comme engrais, l'avaient utilisée seul et se trouvaient en face de résultats decevants.

Pour relancer l'utilisation de la dolomie, à notre avis, il faut:

a Sur les Haut-Plateaux

1 Préconiser 300-500 kg/ha d'apport pour les paysans et non une tonne et éventuellement renouveler l'apport au bout de 2 ou 3 ans.

2 Commencer la vulgarisation, l'utilisation de la dolomie.

a) auprès des grandes exploitations : les paysans autour profiteront de leur savoir faire et de leurs résultats.

b) sur les cultures riches : cultures maraichères, florales et ornementales.

c) sur les cultures perennes : arboricultures, viticultures, bananeraies ... qui assure largement la rentabilité d'une fumure de redressement dès la première année.

b Sur la Cote Est

Les sols tourbeux, acides de cette partie de Madagascar profiteront beaucoup d'un apport massif de dolomie qui va en élever le pH, diminuer le taux de M.O en excès et libérer ainsi du N,P et K de ces matières organiques au profit du riz. Une telle action sera certainement rentable dès la 1ère ou la 2ème saison de culture.

Actuellement cependant aucune action sérieuse pour promouvoir l'apport de dolomie sur ces sols n'a été faite. Or, elle permettrait certainement d'utiliser plus de dolomie à Madagascar.

7.5 IMPORTANCE DE L'UTILISATION DES PRINCIPAUX FERTILISANTS ORGANIQUES

Par ordre décroissant d'importance, les fertilisants organiques les plus utilisés sont : le fumier de ferme, les déchets de transformation des produits alimentaires, les plantes de couverture, les déchets d'abattoir.

a) le fumier de ferme

C'est le principal fertilisant qui est le plus largement utilisé par les paysans des Haut-Plateaux où les terres cultivables commencent à se faire rares et où les paysans pratiquent une agriculture relativement intensive. Il n'est pas utilisé sur la Cote pour diverses raisons :

- terres déjà riches en matière organique (Est et Nord)
- sols déjà riches chimiquement et encore vastes (Sud-Ouest)
- paysans éleveurs et non agriculteurs (Ouest).

La quantité de fumier de ferme utilisée à Madagascar est estimée à environ 1 million de tonnes par an sur une potentialité de près de 60 millions de tonnes (+).

Les paysans utilisent principalement le fumier de ferme pour leurs rizières. Un tel apport permet à ces rizières de conserver leur niveau de rendement actuel, pendant des années d'exploitation sans interruption.

Les cultures de tanety (manioc, mais, haricot) ne reçoivent du fumier que quand le paysan en dispose suffisamment.

b) Les déchets de transformation des produits alimentaires (+)

Ce sont les bourres de coco (10.500 t/an), les écumes de sucrerie (27.500 t/an), les résidus de décorticage du café (10.000 t/an), les balles de riz dont 50.000 t/an sont disponibles auprès des rizières, mais une petite partie seulement est utilisée comme litière, les déchets humides de sisal (600.000 t/an) dont 10% seulement sont incorporés aux sols des sisaleraies.

(+) - Source : RABEZANDRINA (R). Recyclage de la Matière Organique à Madagascar. Rapport FAO ACCRA, Juin 1986.

c) Les plantes de couverture

Elles ne sont pratiquement utilisées que pour les 4.000 ha de la cocoteraie de SAMBAVA et les 1.000 ha de palmier à huile à TAMATAVE où elles restituent aux sols environ 20 t/ha/an de matières organiques.

d) Les déchets d'abattoir

Ils proviennent principalement des abattages des bovins aux abattoirs et sont constitués par les résidus des panses, les sabots et parfois le sang estimés autour de 7.500 t pour environ 250.000 tetes abattues en ces lieux, chaque année.

8 RECOMMENDATIONS

8.1 TECHNICAL ISSUES

8.1.1 Généralités

Différentes idées, opinions, apparaissent actuellement sur les messages ou types de recommendations qu'on doit transmettre aux paysans.

Il y a d'abord

1) Celle du Programme Engrais Malagasy (PEM) qui, d'après les résultats de ses nombreuses expérimentations, trouve que la formule, déjà ancienne de 60-60-45 pour les rizières est toujours valable dans beaucoup de cas et qu'il faut continuer à la vulgariser en attendant mieux.

2) L'IRRI aurait tendance à préconiser une diminution de la quantité de K2O, dans les formules de fertilisation des sols malgaches actuelles.

3) La Banque Mondiale pense meme que dans les conditions économiques actuelles, ce n'est pas la peine de faire de la fertilisation un thème à recommander aux paysans. En effet, le cout des engrais n'est plus supportable d'une façon perenne (Sustainable) par ces derniers et on ne peut pas fonder une politique agricole stable sur des engrais qu'on espère obtenir de donateurs.

La Banque Mondiale pense que la priorité des recommendations à faire aux paysans devrait porter sur l'amélioration des autres techniques culturales (sarclage, semence améliorée, ...)

8.1.2 Alternative fertilizers

Organic materials

Il est recommandé de

1) Etudier les possibilités d'utilisation pour l'agriculture malgache, des millions de tonnes de déjections bovines disponibles au niveau des parcs à boeufs principalement dans le Sud et l'Ouest de Madagascar (Cf. 283 Ab).

2) Etudier l'implantation d'une usine de transformation des ordures ménagères à ANTSIRABE où la demande en matières fertilisantes est pressante de la part des nombreuses organismes de développement situés dans cette région. Il est important cependant de ne pas répéter les erreurs de l'usine de TANANARIVE. (cf. 283 B)

3) Etudier l'insertion des engrais verts et des plantes de couverture dans le système d'exploitation agricole traditionnel (Cf 281 c et d).

4) Redynamiser la vulgarisation des étables fumières par des actions appropriées (Cf. 283 Aa).

Lime

La dolomie et la chaux agricole produites actuellement à MADAGASCAR sont nécessaires pour relever le pH des sols acides et pour en améliorer les propriétés physiques. Cependant, elles ne peuvent pas remplacer les engrais N.P.K. dans les fonctions nutritionnelles de ces derniers vis-à-vis de la plante.

Les engrais locaux

Il faut :

- relancer dès que possible la fabrication des phosphates d'os
- évaluer l'importance des guano des grottes et identifier les contraintes qui s'opposent à leur exploitation.

8.1.3 Other Technical Issues

Il est recommandé de :

1) Importer des engrais qui ont la préférence des paysans, des engrais auxquels ils sont habitués au point de vue aspect, couleur, ... etc. Tel est le cas du "11-22-16 Norad".

2) Approfondir les recherches pour confirmer ou infirmer les tendances actuelles à faire diminuer la dose de l'apport de K2O préconisée actuellement pour les sols malgaches.

La potasse est chère et il est prouvé que la plante peut absorber plus de K+ qu'elle n'en a besoin, entrainant ainsi une consommation de luxe en cet élément.

3) Rechercher des formules de fertilisation plus précises et adaptées à des zones de rizières à définir (alluviaux, hydromorphes, minéraux, semi-tourbeux ....). Cela permettrait de n'apporter aux sols que les éléments dont ils sont carencés au lieu d'une formule apportant systématiquement les 3 éléments NPK et qui coute cher.

4) Se rappeler qu'un changement d'aspect (poudre, granulé, couleur ....) d'un engrais auquel le paysan est habitué et dont il connait les effets bénéfiques, nécessite un recommencement des activités de démonstration longues et couteuses.

Présenter autant que possible, un nouvel engrais de meme efficacité, sous l'aspect de l'ancien qui a été accepté par le paysan.

ANNEX 1 - PART 2

SITUATION DE L'UTILISATION DES ENGRAIS A MADAGASCAR

par

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Consultant

Juin 1989

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S O M M A I R E

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SITUATION DE L'UTILISATION DES ENGRAIS A MADAGASCAR(+)

Pour pouvoir réaliser rationnellement cette première phase de la consultation, il nous faut au préalable, préciser quelques éléments concernant les principales productions agricoles de Madagascar et établir une classification des exploitations agricoles malgaches.

Les observations, données, renseignements... présentés dans ce travail, ont été conçus, sauf indication contraire, à partir de ceux que nous avons collectés depuis des années jusqu'à maintenant auprès des organismes et exploitations publics, para-publics et privés, pour élaborer nos cours d'agriculture générale, de fertilisation, de pédologie et de phytotechnie spéciale à l'Université.

0 - LES PRINCIPALES PRODUCTIONS AGRICOLES DE MADAGASCAR ET LEUR IMPORTANCE

Nous allons limiter cette étude aux principales cultures suivantes dont le tonnage de production, la surface cultivée ou la valeur, ont une certaine importance :

Cultures vivrières : RIZ, MAIS, MANIOC

Cultures de rente : CANNE A SUCRE, CAFE, COTON, TABAC ET POIVRE.

. Ce sont les principales cultures utilisatrices d'engrais.

. Les données disponibles sont en général en retard de deux ans, sauf pour le riz qui est de loin la plus importante production agricole malgache (environ 50 %).

(+) - *par René RABEZANDRINA, Docteur-ingénieur, Chef du Département AGRICULTURE à l'E.S.S.A. - UNIVERSITE. BP 175 - TANANARIVE.*

Le tableau suivant nous montre leur importance durant ces dernières années (SOURCE : Statistique agricole du M.P.A.R.A.).

	1985		1986		1987	
	Production en t	Surface en ha	P en t	S en ha	P en t	S en ha
Cultures vivrières						
PADDY	2.177.680	1.183.520	2.230.205	1.187.565	2.296.130	1.215.925
MANIOC	2.142.000	350.570	2.421.300	359.245	-	-
MAIS	140.200	14.000	152.890	148.000	ND	ND
Cultures de rente						
CANNE A SUCRE	1.744.150	60.100	1.950.000	59.500	-	-
CAFE	78.500	223.200	82.210	224.235	-	-
COTON	42.903	32.929	40.866	42.850	-	-
TABAC	4.680	ND	5.455	ND	-	-
POIVRE	2.800	6.200	2.830	6.100	-	-

Tableau n° 1 : *Principales productions agricoles malgaches.*

ND = non disponible.

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14 - CLASSIFICATION ET DESCRIPTION DES EXPLOITATIONS (1)

Nous allons classer les exploitations (farms) de Madagascar en deux catégories : les exploitations traditionnelles et les exploitations modernes. Cette classification nous permet chaque fois que c'est possible de répartir les productions, les rendements, les fertilisations suivant le niveau technique des exploitations.

14.1 - Les exploitations traditionnelles

Caractéristiques :
- Elles ont une superficie mise en culture inférieure à 10 ha.
- Elles ont moins de 5 salariés permanents.
- Elles ne disposent pas d'équipements modernes de pointe. Les exploitations utilisant la traction animale en font partie.

(1) - *Source : Caractéristique générale du milieu rural : Campagne 1984/1985. Service de la Statistique Agricole M.P.A.R.A.*

Nombre : 1.458.823 pour tout Madagascar
Superficie totale : 1.676.164 ha
Surface moyenne nationale # 1,15 ha, mais plus de la moitié de ces exploitations disposent de moins de 1 ha de terres mises en valeur.

Les exploitations septentrionales sont plus étendues que celles du Sud de Madagascar.

Leur taille n'est pas dépendante du niveau d'instruction du chef d'exploitation.

Mode d'exploitation :

Faire valoir direct	: 87 %	de l'effectif
Métayage-Fermage	: 5 %	-"-
Autres (occupation gratuite, redevance en travail...)	: 8 %	-"-

Attitude vis-à-vis de l'utilisation des engrais.

D'une façon générale, ces exploitations traditionnelles ont besoin, pour pouvoir utiliser les engrais, d'un encadrement plus ou moins dense suivant le niveau d'instruction du chef d'exploitation.

Ce dernier, avec la méfiance habituelle des gens de la campagne, accèpte bien les directives de l'encadreur, mais celui-ci

a) doit lui préconiser des actions nettement profitables, intéressantes ;

b) ne doit jamais se tromper ou faire des erreurs dans ses directives.

14.2 - Les exploitations modernes

Caractéristiques

- Terres mises en valeur supérieures ou égales à 10 ha,
- Employant au moins 5 salariés permanents,
- Existence de matériel, d'équipement ou d'installations particulières de pointe.

Nombre : 512 pour tout Madagascar
Superficie totale : 79.513 ha
Surface moyenne nationale : # 155 ha

Mode d'exploitation :

L'effectif de ces exploitations se répartit comme suit : (1)

Individuelles	73,7 %	377
Associations	11 %	56
Sociétés privées	7,5 %	39
Coopératives	1,6 %	8
Société d'Etat	6,2 %	32
Total	100 %	512

Toutefois, les 32 sociétés d'Etat, avec les 39 Sociétés privées et les 8 coopératives, qui ne représentent que 13 % de l'effectif, possèdent plus de 60 % des superficies mises en culture.

Attitude vis-à-vis de l'utilisation des engrais.

Les responsables de ces exploitations connaissent l'intérêt, [illegible] fertilisants. Ils savent les utiliser.

[illegible] sont aussi en mesure de calculer les V.C.R. ($\frac{Value}{Cost}$) correspondants et tiennent compte de tous les facteurs qui interviennent dans le prix de revient de l'*engrais épandu*.

Ils avaient de graves problèmes d'approvisionnement à un certain moment, problèmes qui ne devraient plus exister actuellement après la libéralisation du marché.

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19 - ETUDES DES RENDEMENTS POUR CHAQUE CULTURE

19.1 - Rendements moyens par ha

Ces rendements moyens ont été calculés à partir de la production nationale annuelle et des totaux des superficies cultivées correspondant, relevées dans les "fiches F.M.I." du Service de la Statistique Agricole du M.P.A.R.A. (1988).

PADDY

P.S.R. \ année	1982	1983	1984	1985	1986	1987	1988
Production en tonnes	1969905	2147000	2131000	2177680	2230205	2296130	2235200
Surface en ha	1188100	1188430	1170100	1183520	1187565	1213925	1189000
Rendement en t/ha	1,65	1,80	1,82	1,84	1,87	1,89	1,88

Tableau n° 2 : *Production, superficie et rendements moyens en PADDY à Madagascar.*

Remarques :

Ces moyennes nationales sont faibles, en dessous de 2 t/ha, car elles comprennent les rendements très faibles des cultures non irriguées (tavy et tanety). Nous verrons § 19.21 les rendements moyens *potentiels* pour chaque type de riziculture.

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MANIOC

P.S.R. \ Année	1982	1983	1984	1985	1986
Production en tonnes	1.898.340	1.992.225	1.047.100	2.142.000	2.421.300
Surface en ha	313.775	329.250	336.125	350.570	359.245
Rendement en t/ha	6,05/12,10	6,05/12,12	6,09/12,18	6,11/12,22	6,73/13,4

Tableau n° 3 : *Production, superficie et rendements moyens en MANIOC à Madagascar.*

Remarques :

1) Nous donnons deux chiffres pour exprimer les rendements :

a) le premier chiffre est obtenu par une simple division de la production annuelle par les surfaces cultivées. Ce qui est juste dans les régions côtières où le manioc a un cycle de 1 an, mais faux dans régions (Plateaux) où le manioc a un cycle de 2 ans.

b) le second chiffre est simplement le double du premier, quand on admet que la culture occupe le sol deux années de suite.

2) Nous donnerons § 19.22 les rendements moyens potentiels suivant les exploitations et le mode de culture (pure ou associée).

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MAIS

P.S.R. \ Année	1982	1983	1984	1985	1986
Production de grain en tonnes	113.000	132.100	141.000	140.200	152.890
Surface en ha	116.525	126.300	132.100	140.000	148.000
Rendement en t/ha	0,97	1,04	1,06	1,00	1,03

Tableau n° 4 : *Production, superficie et rendements moyens en MAIS à Madagascar.*

Remarques :

Les exploitations traditionnelles regroupent la quasi-totalité de la production maïsicole malgache.

Nous donnerons au § 19.2 l'estimation de la production potentielle en maïs et les rendements escomptés en utilisant des engrais.

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CANNE A SUCRE POUR TOUT MADAGASCAR

P.S.R. \ Année	1982	1983	1984	1985	1986
Production en tonnes	1.408.570	1.621.200	1.660.000	1.744.150	1.950.000
Surface en ha	47.670	57.100	59.050	60.100	59.500
Rendement en t/ha	29,55	28,39	28,11	29,02	32,77

Tableau n° 5 : *Production, superficie et rendements moyens en CANNE A SUCRE à Madagascar.*

Remarques :

Le tableau ci-dessus concerne toutes les exploitations traditionnelles et industrielles confondues. Mais, comme ces dernières qui produisent plus de 55 % de la production ont un niveau d'exploitation nettement plus élevé, nous pensons qu'il est utile de les distinguer des exploitations traditionnelles.

CANNE A SUCRE EN EXPLOITATIONS TRADITIONNELLES

P.S.R. \ Année	1982	1983	1984	1985	1986
Production en t	588.515	698.065	863.180	837.305	978.180
Surface en ha	31.550	38.550	38.080	38.325	33.920
Rendement en t/ha	18,65	18,10	22,66	21,84	28,8

Tableau n° 6 : *Production, superficie et rendements moyens en CANNE A SUCRE en exploitations traditionnelles, à Madagascar.*

CANNE A SUCRE EN EXPLOITATION INDUSTRIELLES

P.S.R. \ Année	1982	1983	1984	1985	1986
Production en t	820.055	923.135	796.820	906.845	971.820
Surface en ha	16.120	18.550	20.970	21.775	25.580
Rendement en t/ha	50,87	49,76	38,0	41,64	37,95

Tableau n° 7 : *Production, superficie et rendements moyens en CANNE A SUCRE en exploitations industrielles à Madagascar.*

CAFE

P.S.R. \ Année	1982	1983	1984	1985	1986
Production en t de café marchand	81.225	80.855	81.400	78.500	82.210
Surface en ha	218.575	223.000	223.100	223.200	224.235
Rendement en t/ha	0,371	0,362	0,364	0,351	0,366

Tableau n° 8 : *Production, superficie et rendements moyens en CAFE à Madagascar.*

Remarques :

Le café, première culture d'exportation de Madagascar est principalement cultivé sur la côte Est. Il est cultivé en association dans 76 % des exploitations traditionnelles avec la plupart du temps le poivrier, le bananier...

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COTON (Coton-graine)

P.S.R. \ Année	1982	1983	1984	1985	1986
Production en t de coton-graine	25.515	26.381	34.674	42.903	40.866
Surface en ha	17.480	19.929	23.595	32.929	42.850
Rendement en t de coton-graine	1,59	1,32	1,47	1,30	0,95

Tableau n° 9 : *Production, superficie et rendements moyens en COTON à Madagascar.*

Remarques :

Ces rendements sont relativements élevés par rapport à ceux obtenus en Afrique. Ils peuvent même atteindre plus de 3 t/ha de coton-graine dans certaines exploitations sur alluvions récentes (baiboho).

Cela s'explique par le fait que la culture du coton à Madagascar est effectuée d'une façon intensive, avec une organisation perfectionnée et un encadrement serré effectués par l'organisme de développement HASIMA.

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TABAC (brut)

P.S.R. \ Année	1982	1983	1984	1985	1986
Production en t de tabac brut	2.610	2.140	3.400	4.080	5.455
Surface en ha	3.900	2.250	3.400	N.D	N.D
Rendement en t/ha	0,67	0,95	1,00	N.D	N.D

Tableau n° 10 : *Production, superficie et rendements moyens en TABAC à Madagascar.*

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Remarques :

Comme celle du coton, la culture du tabac est effectuée à Madagascar d'une façon intensive avec un encadrement assuré par l'Office Malgache du Tabac (OFMATA). Une telle organisation facilite la vulgarisation des engrais.

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POIVRE (noir)

P.S.R. \ Année	1982	1983	1984	1985	1986
Production en t de poivre noir	2.585	2.600	2.610	2.800	2.830
Surface en ha	6.035	6.100	6.120	6.200	6.100
Rendement en t/ha	0,428	0,426	0,426	0,451	0,463

Tableau n° 11 : *Production, superficie et rendements moyens en POIVRE à Madagascar.*

Remarques :

Le poivrier est la plupart du temps cultivé en association avec le caféier qui est alors la culture principale. Les exigences du caféier ont alors priorité et le poivrier est obligé d'accepter le couvert végétal.

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Nous venons de présenter *les rendements moyens réels* obtenus à l'échelle de Madagascar. Voici les rendements potentiels escomptés pour chaque culture et à des niveaux différents d'application des fertilisants.

19.2 - Recommandations habituelles pour l'utilisation des engrais et rendements potentiels (+)

19.21 - PADDY

A - Recommandations et rendements attendus

Nous allons donner pour ce produit principal, les recommandations préconisées par l'U.R.E.R. il y a quinze ans mais qui

(+) *Sources : Les chiffres donnés dans ce § proviennent, sauf indications contraires sont les résultats d'enquêtes personnelles auprès de divers organismes de développement : URER, OVR, HASINA, SIRAMA, Opération CAFE-POIVRE, OFMATA,...*

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sont encore vulgarisées actuellement par les services responsables du M.P.A.R.A.

Riz de première saison (Vary aloha)

Niveaux d'amélioration	Kilogrammes supplémentaires de paddy escomptés à l'ha
(1) - Repiquage en ligne, sarclage à la houe rotative.	500
(2) - Pépinière améliorée (fumée et semis clair) + niveau (1)	+ 300
(3) - Niveau (2) + 30-60-45 NPK	+ 1.000 kg
(4) - Niveau (3) + 30N en couverture	+ 750 kg
Surplus total de production avec une action complète d'amélioration	2.550 kg/ha de surplus

Riz de 2è saison (Vaky ambiaty)

Niveaux d'amélioration	Kilogrammes supplémentaires de paddy escomptés à l'ha
(1) - Repiquage en ligne, sarclage à la houe rotative semis clair	800 kg
(2) - Niveau (1) + 30-60-45 de NPK	+ 1.000 kg
(3) - Niveau (2) + 30N (en couverture).	+ 750 kg
Surplus total de production avec une action complète d'amélioration	2.550 kg/ha

Il apparaît donc que dans les 2 cas (riz de 1ère et de 2è saison), l'application stricte de tous les thèmes d'amélioration permet d'escompter un supplément de production autour 2t5 à l'ha.

Soulignons toutefois que le niveau (1), repiquage en ligne qui permet *un bon contrôle des mauvaises herbes*, est absolument à faire avant d'apporter des engrais minéraux. C'est une condition *sine qua non* pour valoriser, rentabiliser ces derniers.

B - Rendements potentiels en paddy en fonction du type de riziculture (estimation effectuée en 1985 par Division Statistique du M.P.A.R.A.).

Riz irrigué (de submersion)

1ère saison	Production totale/an	399.400 t	
	Surface totale/an		156.157 ha
	Rendement : 2,55 t.		
2è saison	Production	1.732.430 t	
	Surface		683.125 ha
	Rendement : 2,54 t.		

Riz non irrigué (pluvial)

Tavy	Production	143.340 t	
	Surface		106.853 ha
	Rendement : 1,34 t.		
Tanety	Production	304.570 t	
	Surface		188.361 ha
	Rendement : 1,6		
Totaux :		2.579.740 t	1.134.396 ha.

Rendement national potentiel moyen : 2,27 t/ha

Remarque :

En 1985, le rendement réel moyen était de 1,84 t/ha (Tableau n° 2) alors qu'il y avait une potentialité d'obtenir 2,27 t/ha.

C - Observations

1 - Le repiquage en ligne a pour unique objectif de pouvoir utiliser la houe rotative et faciliter ainsi le sarclage.

2 - 300 kg de 11-22-16 peut apporter un supplément de récolte de paddy de 1.000 kg par rapport à une rizière uniquement bien sarclée à la houe rotative.

3 - Toutefois, ces 1.000 kg supplémentaires ne sont obtenus que si *les mauvaises herbes sont contrôlées*, (rôle du repiquage en ligne) sinon, l'engrais servirait à engraisser ces mauvaises herbes.

4 - 1 kg d'engrais NPK 11-22-16 utilisé permet d'escompter un supplément de récolte de 1.000 : 300 = 3,3 kg de paddy supplémentaire.

5 - *Un bon contrôle des mauvaises*, par ce repiquage en ligne, plus l'emploi de 300 kg/ha de 11-22-16 permet actuellement d'espérer l'augmentation du rendement moyen actuel à 1,88 t + 0,500 + 1,00 t = 3,38 tonnes/ha.

6 - Ces 3,38 t/ha peuvent encore être portés à 3,38 t + 0,75 t= 4,13 t si on apportait encore 30 UF d'azote supplémentaire en couverture.

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19.22 - MANIOC

A - Recommandations et rendements attendus

On préconise aux paysans d'apporter le maximum de *fumier de ferme* (même jusqu'à 40 t) dont ils peuvent disposer. Ils peuvent espérer ainsi 1 tonne supplémentaire de récolte pour 1 tonne de fumier apporté.

La fumure minérale préconisée tient compte des exportations moyennes, du manioc.

Une tonne de tubercules frais exporte approximativement :

2 kg de N
1 kg de P_2O_5
5 kg de K_2O.

La formule d'engrais proposée par les organismes vulgarisateurs, est basée sur ces exportations du manioc, même si d'autres facteurs (sol, variété, climat...) interviennent aussi.

Le paysan qui apporte à son champ de manioc 20-10-50 UF/ha d'engrais peut espérer une récolte supplémentaire d'environ 10 tonnes/ha, à condition toujours qu'il *contrôle bien les mauvaises herbes*.

B - Rendements potentiels en manioc frais en fonction du type d'exploitation

(Estimation effectuée en 1985 par la Division Statistique du M.P.A.R.A.).

Exploitation traditionnelle :
(culture pure et associée confondue)

Production en t/an 2.828.000 t
Surface en ha/an 181.670 ha
Rendement moyen : 15,56 t/ha.

Exploitation moderne

(culture pure et associée confondue)

Production en t/an	728.000 t	
Surface en ha/an		47.881 ha
Rendement moyen : 15,28 t/ha		
Totaux/an :	3.556.000 t	229.551 ha.

Remarque :

En 1985, le rendement moyen obtenu était de 6,11 t/ha (Cf. tableau n° 3), alors qu'il y avait une potentialité d'obtenir : 3.556.000 : 229.551 = 15,50 t/ha.

C - Observations

1 - Sur le plan national, il n'y a pas de différence nette entre les rendements potentiels espérés en exploitations traditionnelles et modernes. Toutefois, une de ces exploitations modernes, la Féculerie de MAROVITSIKA, produit depuis des années 40 t/ha sur 250 ha de manioc récolté par an.

Cette féculerie enfouit 40 t d'engrais vert (Crotalaria et Tephrosia), apporte 40 t de fumier, 400 kg de KCl (120 K_2O) et 200 kg d'hyperphosphate (60P_2O_5) par ha et par campagne pour obtenir de tels résultats.

2 - Nous répétons encore une fois que tous les rendements escomptés ci-dessus ne peuvent être obtenus sans un bon contrôle des mauvaises herbes.

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19.23 - MAIS

A - Recommandations et rendements attendus

La richesse du sol en éléments fertilisants est souvent le facteur limitant le rendement en maïs. En effet les cultures faites sans fumure sur sols ferrallitiques des plateaux ont donné des récoltes insignifiantes.

Sur ces sols on préconise

- une fumure de fond comprenant :

Dolomie	1.500 kg/ha
P_2O_5	400 kg/ha
K_2O	300 kg/ha

- une fumure d'entretien qui est fonction des rendements escomptés.

Ex : Pour obtenir un rendement de 6t/ha avec une variété sélectionnée il faut apporter en fumure d'entretien : 150-60-120 kg/ha. L'azote doit être appliqué en 3 épandages (semis, 1è buttage, 2è buttage).

Les besoins du maïs sont approximativement de 25-12-20 par tonne de grain récolté. Les rendements intermédiaires escomptés (2, 3, 4 ou 5 t) peuvent se calculer à partir de cette formule.

Les formules ci-dessus sont celles qui ont été vulgarisées par l'URER à partir des résultats de l'IRAM 1969, et qui continuent à être préconisées aux paysans actuellement.

A titre d'information, donnons ci-dessous le contenu des "Fiches techniques pour maïs" de JL, DZIDO, FOFIFA, 1988.

Forme et quantité de la fertilisation	Apport correspondant en engrais	Rendements/ha escomptés
5 tonnes de fumier de ferme	Sans apport	3 tonnes
5 t de fumier + (70-35-25) + 200 kg de dolomie	160 kg de 11-22-16 + 110 kg d'urée	4 tonnes
5 t de fumier + (85-45-30) + 300 kg de dolomie	200 kg de 11-22-16 + 140 kg d'urée	5 tonnes
5 t de fumier + (100-55-35) + 350 kg de dolomie	245 kg de 11-22-16 + 165 kg d'urée	6 tonnes
5 t de fumier + (120-65-40) + 400 kg de dolomie	285 kg de 11-22-16 + 195 kg d'urée	7 tonnes
5 t de fumier + (135-70-50) + 450 kg de dolomie	325 kg de 11-22-16 et 220 kg d'urée	8 tonnes

B - Observations

1 - Les recommandations de DZIDO diffèrent de celles de l'URER pratiquement par la quantité de K_2O à apporter. La tendance actuelle est en effet de minimiser le rôle de cet élément vis-à-vis des céréales (riz et maïs).

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2 - En culture traditionnelle, le maïs est la plante qui entre le plus fréquemment (60 %) dans une association (avec haricot, manioc, patate, arachide,...).

3 - Le prix du maïs a été longtemps très bas et durant cette période le gros problème qui se posait était la rentabilité d'une fumure.

4 - Si le rendement moyen réel à Madagascar est de l'ordre d'une tonne, on note toutefois de grandes variations suivant la qualité du sol et les soins apportés à la culture.

Sur les tanety des Hauts-Plateaux, les rendements sont souvent inférieurs à 1 tonne. Sur les terres d'alluvions (baiboho) ils atteignent 2 tonnes et plus. A la SAKAY, à la FIFAMANOR... on trouvait des rendements dépassant 3, 4, 5 et même 6 t/ha.

Les hauts rendements ne peuvent naturellement être obtenus que si les autres facteurs de production (eau, préparation du sol, variétés améliorées, semis corrects) sont respectés, en particulier la maîtrise des adventices.

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19.24 - CANNE A SUCRE

A - Recommandations en fertilisation et rendements escomptés

Les exploitations traditionnelles ne bénéficient pas d'une structure de vulgarisation et d'encadrement précise. Il n'y a pas de formule de fertilisation préconisée nettement. Les cultures restent en place pendant plus de 10 ans.

Les rendements s'en font sentir : autour de 20 t/ha et par an.

Les exploitations industrielles par contre possède chacune un "Service Expérimentation" qui maîtrise parfaitement l'utilisation des engrais:

- la détermination des besoins se font par Diagnostic foliaire.

- les apports pour un sol donné seront fonction :

- de la quantité de canne récoltée
- du brûlage ou du non brûlage avant récolte,
- de l'enfouissement ou non des bouts blancs,
- de l'apport ou non des écumes de défécation.

Les formules utilisées dans chaque sucrerie sont :

BRICKAVILLE

- 50 t d'écumes de défécation apportées avant labour, mais pas tous les ans.
- Fumure de fond, en début de cycle (6 ans) :
  300 kg de P_2O_5 sous forme hyper Reno
- Fumure d'entretien :
  60-0-150 ha sous forme de $SO_4(NH_4)_2$ et de ClK épandus en 2 fois.

NOSY-BE

- 50 t d'écumes/ha
- Fumure de fond :
  300 kg de P_2O_5 en super triple
- Fumure d'entretien :
  100-0-150 (Sulf. NH_4 + ClK).

AMBILOBE

- 10 t d'écumes/ha après récolte,
- en vierge (# fumure de fond + entretien) :
  100-350-150/ha
- en repousse (entretien) :
  100-0-60.

Avec de telles formules de fertilisation les rendements escomptés sont de 60 t à 120 t avec une moyenne de 90 t pour toute l'exploitation.

B - Observations

La production de canne à sucre est un des secteurs les plus consommateurs d'engrais.

En plantation industrielle, où les autres techniques culturales (travail du sol, plantation, entretien...) sont correctement respectées, la fertilisation minérale est un facteur, sinon le principal facteur agissant sur le niveau de rendement.

Les chutes de rendement autour de 50 t/ha observées depuis 10 ans auprès de ces exploitations industrielles peuvent être attribuées à des déficiences dans l'approvisionnement et l'emploi des engrais.

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19.25 - CAFE

A - Recommandations et rendements attendus

Les formules d'engrais ci-dessous résultent des expérimentations effectuées par l'I.F.C.C. en 1969 à ILAKA EST. Elles continuent à être vulgarisées par l'Opération Café actuellement.

On préconise :

- Au moment de la plantation : 20 kg de fumure organique (fumier ou compost) par trou.

- 1ère année : 50 g d'urée à épandre en 2 fois au début et à la fin de la saison des pluies/pied.

- 2ème année : 100 g d'urée en 2 applications/pied.

- 3ème année : 200 g d'urée en 2 applications/pied.

- 4ème année : 700 g de 20-10-10 en 2 applications/pied suivantes.

Le nombre de pieds de caféiers par ha est fonction des écartements adoptés.

3 X 3 m en carré : 1.111 plts/ha
3 m en triangle : 1.280 plts/ha.

Le rendement escomptés peut atteindre 2 kg/arbre, c'est-à-dire 2,2 t à 2,6 t/ha, à condition toutefois que les autres opérations culturales (fauchage des interlignes, sarclage des ronds, taille, lutte contre parasites et maladies, réglage de l'ombrage...) soient correctement effectuées.

B - Observations

1 - Notons l'absence de résultats récents de recherches vulgarisables.

2 - La formule d'engrais préconisée ci-dessus n'est applicable que dans les exploitations modernes où nous avons constaté effectivement des rendements moyens de plus de 2 tonnes/ha dans des exploitations modernes de plus de 200 ha.

3 - Le paysan qui adopterait cette formule, mais qui ne serait pas en mesure d'effectuer correctement toutes les autres opérations culturales, se ruinerait.

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19.26 - COTON

A - Recommandations en fertilisation et rendements escomptés

Le cotonnier à Madagascar est principalement cultivé sur alluvions en culture irriguée ou de décrue.

Le cotonnier a un besoin faible en P_2O_5 et ces alluvions micacés (baiboho) sont riches en K_2O. Il en résulte que la fumure recommandée sur ces alluvions est uniquement jusqu'à maintenant, une fumure azotée avec un apport de :

200 - 300 kg/urée/ha enfouie à côté des lignes de semis.

Le rendement escompté est de 3t/ha ou même plus.

B - Observations

1 - Le rendement en coton à Madagascar dépend beaucoup moins du niveau de fertilisation que

- de l'alimentation en eau de la plante,
- de la maîtrise des mauvaises herbes,
- du contrôle des parasites.

Le rendement moyen national n'a pas cessé de diminuer, non pas tellement à cause d'un défaut de fertilisation, mais d'un contrôle des mauvaises herbes et des parasites de plus en plus déficient depuis une dizaine d'années.

2 - Les sols alluvionnaires (baiboho) riches en micas sont reputés riches en K_2O. Nous pensons toutefois qu'après une vingtaine d'années d'exploitation sans apport en cet élément, ce dernier doit y manquer maintenant et qu'il faut en apporter.

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19.27 - TABAC

A - Recommandations en fertilisation, rendements escomptés

La pépinière sous forme de planches de terreau (1/2 bouse de vache, 1/2 terre) ne reçoit pas en général d'engrais minéraux, même si on a conseillé d'apporter (IRAM) :

- 50 gr de 6-6-10 par m^2, 4 jours avant semis
- de l'azote en cas de jaunissement des feuilles.

En plantation, la fumure minérale est peu utilisée en milieu paysannal qui se contente souvent d'un apport de fumier ordinaire à raison d'1 kg/pied.

D'après les essais en station agronomique

- l'azote agit sur le rendement
- le phosphore sur la qualité.

Les diverses stations de recherches de l'OFMATA continuent à mettre au point des formules de fertilisation adaptées

- aux types de sols : plateaux ou alluvions
- aux variétés de tabac : noir, jaune, léger ou corsé.

Les résultats définitifs ne sont pas encore disponibles.

Notons que l'emploi du chlorure de potassium est à éviter pour le tabac léger, à fumer. Le chlore gène la combustion.

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19.28 - POIVRE

A - Recommandations en fertilisation et rendements escomptés

On conseille d'apporter une fumure de fond et une fumure d'entretien.

L'écartement adopté en culture pure est de 4m X 2,5 m soit *une densité de 1.000 pieds à l'ha, en général.*

Fumure de fond :

Dolomie : 1 tonne/ha à la volée ou 1 kg/trou
P_2O_5 : 300 kg/ha -"- ou 300 g/trou
sous forme de phosphate tricalcique.

Fumure d'entretien :

Le poivrier est très avide d'azote.

Une récolte d'une tonne par ha de poivre noir exporte 40-12-20 kg d'U.F.

L'équilibre de la fumure d'entretien est donc de 4-1-2.

On conseille d'apporter les doses croissantes suivantes en fonction du développement de la plante.

1ère année : 25-0-20g par pied en 3 épandages
2ème année : 50-0-40g -"- -"-
3ème année :100-30-90g -"- -"-
4ème année :150-30-90g -"- -"-
5ème année :200-50-100g -"- -"-
et suivants.

Le rendement escomptés peut atteindre 3.000 kg/ha de poivre noir en *culture pure* avec une telle fertilisation.

B - Observations

1 - Le rendement théorique de 5 tonnes/ha, attendu avec l'emploi de 200-50-100g par pied, ne peut pas être atteint car il y a d'autres facteurs qui interviennent : lessivage des engrais, entretiens du sol, taille, ombrage...

2 - Plus de 98% des surfaces cultivées en poivre sont en association avec le caféier qui est alors la culture principale.

Dans ce cas le rendement descend entre 200 g et 500 g par liane car la fumure se réduit à quelque apport de terreau ou de fumier.

3 - Le poivrier est très exigeant en humus qui peut être apporté sous forme de terreau, engrais vert, paillage, résidus de tailles, fumier...

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19.3 - Observations générales

De nombreuses observations peuvent être faites sur ce chapitre "Etude des rendements". Nous allons nous limiter à la principale qui est la suivante : "La fertilisation n'est pas le seul facteur agissant sur le rendement des cultures". Il y en a d'autres (eau, température, nature et préparation du sol, techniques de semis, de récolte...) mais le plus important facteur limitant actuellement est *le contrôle des mauvaises.*

Ce contrôle se fait manuellement d'une façon générale. Il est très pénible car il se fait souvent en plein soleil. Le paysan a tendance à ne pas le faire ou à le faire trop tardivement c'est-à-dire une fois que les mauvaises herbes ont accompli leurs méfaits.

Les herbicides, même s'ils n'éliminent pas complètement les adventices, sont très appréciés par les paysans au Lac ALAOTRA.

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18 - EVALUATION DE LA RENTABILITE DES ENGRAIS

Connaissant les rendements moyens, les rendements potentiels des cultures en fonction de différentes doses d'engrais, il nous faut connaître les prix d'achat des produits aux producteurs et les prix de vente des engrais auprès des utilisateurs pour pouvoir évaluer la rentabilité d'une fumure minérale.

18.1 - PRIX DES PRODUITS AUX PRODUCTEURS

Il y a des prix officiels pour le riz, le café, le coton, le tabac, mais non pour le maïs, le manioc et le poivre.

Pour le coton et le tabac, les prix officiels sont les mêmes que les prix réels aux producteurs parce qu'il existe pour chacun de ces produits des organismes, HASIMA et OFMATA, qui en ont le monopole d'achat. Ces derniers appliquent strictement les prix fixés par le Gouvernement.

Il n'en est pas de même pour les prix du riz et du café qui varient en plus (la plupart du temps) ou (parfois) en moins, autour des prix officiels fixés, suivant les collecteurs. Cela pose quelques problèmes dans la détermination de leurs prix.

Aussi pour en obtenir les prix réels aux producteurs, nous avons utilisé les résultats de campagne de collecte d'un important organisme collecteur : COROI, qui nous a fourni en même temps les prix réels du poivre.

Les résultats ainsi obtenus ont été calculés à partir des milliers de tonnes de riz et de café et des centaines de tonnes de poivre collectées par cet organisme.

Pour le manioc et le maïs dont les prix varient d'une saison à une autre et d'une région à une autre au cours de la même année, nous avons choisi les moyennes des 4 trimestres de chaque année pour 2 régions productrices et représentatives : TIANARANTSOA pour le manioc et ITASY pour le maïs.

Les résultats sont présentés ci-dessous.

Produits \ Année / Prix		83-84 en FMG/kg	84-85 en FMG/kg	85-86 en FMG/kg	86-87	87-88 en FMG/kg
PADDY	Prix officiel	75	80	90	130	130
	Prix réel	80,6	76,7	149	119	160
CAFE	Prix officiel	330	395	470	470	820
	Prix réel	332	427	495	716	881
Manioc (prix réel)		93	92	110	ND	ND
Maïs (prix réel)		126	150	182	ND	ND
Canne à sucre (prix réel)		10	10	12	14	14
Tabac (prix réel)(+)		-	-	-	-	-
Poivre (prix réel)		175	336	362	492,6	1.235

Tableau n° 12 : *Prix des produits aux producteurs en FMG/Kg.*

18.2 - PRIX DES ENGRAIS AUX UTILISATEURS

La détermination des prix des engrais est relativement complexe pour les raisons suivantes :

(+) - *Nous n'avons pas pu obtenir les prix du tabac, car les responsables de l'OFMATA étaient en mission au cours de cette période électorale où nous avons fait nos enquêtes. Nous compléterons plus tard ce tableau.*

1 - Ces prix ont toujours été plus ou moins subventionnés. Les engrais n'ont pas toujours été vendus aux prix réels de revient, car certains étaient des dons.

2 - Deux événements importants sont venus bouleverser ces prix : la libéralisation du marché en avril 1987, et la dévaluation de juin 1987.

3 - Les types d'engrais importés peuvent varier d'une année à l'autre : on n'importe pas toujours les mêmes engrais chaque année.

18.21 - Evolution des prix subventionnés des engrais avant la libéralisation des prix d'avril 1987

Type d'engrais	01-79 MDRRA	06-82 MDRRA	07-83 MPARA	06-84 MPARA	09-86 MPARA	Avril 1987 MPARA
Sulfate d'Ammon.	100	100	120	120	120	120
UREE	35	100	140	180	180	180
P.K. 21/16,30/15	30	60	60	60	60	60
KCl	30	60	140	170	170	170
Phosphate d'os	41	50	50	50	50	50
Hyper Reno	41	50	50	50	50	50
Polyphos	25	50	50	50	50	50
Scories Thomas	25	50	50	50	50	50
Sulfate de Potas.	30	39	140	140	140	140
Phosphate bical.	50	50	140	140	140	140
Super Triple	50	50	140	140	140	140
N.P.K. 8.20.20	62	100	140	180	210	210
-"- 4.20.20	62	100	120	120	210	210
-"- 20.10.10	62	100	140	180	210	210
-"- 13.13.13.	62	100	140	140	210	210
-"- 15.15.15.	62	100	140	140	210	210
-"- 11.22.16	62	100	140	180	210	210
-"- 16.16.16.	-	-	-	180	210	210
Dolomie	12	24	60	60	60	60
REFERENCES : (Sources)	179-1232 DPSA/SUI Jan-Mai	N° 2286 82 du 14 Mai	N° 992 83 du 05 Mars	N° 2292 84 du 24 Mai	N° 1968 DAA/SC 7 Août	N° 1479/87 Minis.Comm. 20.03.87

Tableau n° 13 : *Prix subventionnés des engrais de 1979 à Avril 1987.*

Nous constatons d'après ce tableau n° 13 qu'en 10 ans
- le prix du $SO_4(NH_4)_2$ a été relativement stable,

- il en a été de même pour le tricalcique hyper Reno, les scories et le phosphate d'os (fabriqué à Madagascar).

Par contre les prix des autres engrais (urée, KCl, engrais composés...) ont plus que triplé en dix ans.

18.22 - Impact des dévaluations du FMG sur le prix des engrais

Le tableau n° 14 ci-dessous nous montre à la fois les détails du mode de calcul des prix des engrais et l'influence des dévaluations du FMG sur ces prix.

Nous avons établi ces 3 tableaux à partir d'un mode de calculs fourni par la Direction des Approvisionnements Agricoles du MPARA, avec un prix CAF de 211,56 $ US la tonne d'engrais et pour trois taux de change du $ en francs malgache : 1273,62 - 1199,34 - 985,96.

1 $ US =	1.273,62 FMG	1.199,34 FMG	985,96 FMG
CAF non dédouané	269.447 FMG	253.733 FMG	208.589 FMG
SGS	2.764	2.764	2.764
Transit	30.000	30.000	30.000
Frais bancaire (6,5 %)	17.514	16.492	13.558
Conditions FIOS	5.100	5.100	5.100
	324.825	308.089	260.011
Assurance locale (2,5%)	8.120	7.702	6.500
Transport-manutention	40.000	40.000	40.000
	372.945	355.791	306.511
Marge de gros (7%)	26.106	24.905	21.455
Prix de gros	399.051	380.696	327.966
Marge de détail (10%)	39.905	38.069	32.796
Prix d'une tonne et du kg aux consommateurs	438.956/t # 440 FMG/kg	418.765/t # 420 FMG/kg	360.762/t 360 FMG/kg

Tableau n° 14 : *Variations de prix d'une tonne d'engrais en fonction de la dévaluation du francs malgache.*

Il ressort de ce tableau qu'un même engrais, qui revient au même prix CAF peut être vendu aux consommateurs à 360 FMG ou 420 FMG ou 440 FMG suivant les cours du francs malgache.

18.23 - Relation entre nature des engrais importés et prix aux utilisateurs

Madagascar n'importe pas chaque année les mêmes formes d'engrais, ni les mêmes quantités. Leur prix de vente aux paysans vont varier aussi suivant leur nature. Toutefois, le tableau n° 15 ci-dessous nous donne une idée de ces formes d'engrais importés en 1987 et leurs prix aux utilisateurs.

Nature	Quantité en tonnes	Prix de vente du kg aux paysans	
		Avant mai (1) 1987	Après mai (2) 1987
Urée	4.500 t	180	320-400
16-16-16	9.000 t	210	280-400
8-20-20	3.000 t	210	-480
10-20-20	600 t		
10-26-26	150 t		
11-22-16	15.000 t	210	365-400
$SO_4(NH_4)_2$	1.200 t	120	
KCl	2.450 t	170	
Super simple	300 t		
Phosph. bical.	100 t	140	
Phosphate d'ammoniac	100 t		
	36.400 t		

Tableau n° 15 : *Engrais importés en 1987.*

(Source : Direction des App. Agricoles du M.P.A.R.A.).

18.24 - Evolution des prix des principaux engrais depuis cinq ans.

En tenant compte de ces différents éléments de variation des prix des engrais ci-dessus, et avec des données collectées directement auprès de COROI, nous avons établi ci-dessous, "le prix départ magasin central" des principaux engrais utilisés à Madagascar.

Type d'engrais	1984	1985	1986	1987	1988	1989
KCl	140	170	170	370	370	370
Hyper Reno	50	50	50	330	330	300
Urée 46 %	140	180	180	380	360	300
16-16-16	-	180	210	340	350	300
15-15-15	140	140	210	325	325	325
11-22-16	140	180	210	380	350	320
8-20-20	140	180	210	340	350	435
Sulfate de NH_4	120	120	120	310	310	310

Tableau n° 16 : *Prix aux utilisateurs des principaux engrais à Madagascar, au départ des magasins centraux.*

Ces prix sont ceux que paient réellement les utilisateurs quand ils viennent s'approvisionner directement aux magasins centraux. C'est souvent le cas des grandes entreprises (sucreries, sociétés de développement...). Sinon, ils doivent payer, en plus, des frais de transport (variables mais ils peuvent être estimés à 50 FMG/Kg en moyenne) et la "marge bénéficiaire d'intervention" du revendeur (10 %).

Il arrive donc que l'engrais soit vendu à 400 FMG/kg aux paysans. Cela va poser des problèmes car si on estime le surplus de production apporté par un kilogramme d'engrais, à 3,5 kg de paddy, il faut payer le paddy à 230 FMG le kg pour avoir un V.C.R = 2 $\left(\frac{3,5 \times 230}{400} \# 2\right)$.

Cette remarque nous amène à déterminer pour chaque production:

- le rapport $\frac{\text{Plus-value}}{\text{coût}}$ = (V.C.R)
- la rémunération journalière du travail (ROL)
- le rapport $\frac{\text{surplus de récolte}}{\text{Fertilisant}}$ = (FCR).

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ANNEX 1 - PART 3

SITUATION DE L'UTILISATION DES ENGRAIS A MADAGASCAR

par

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Juin 1989

SITUATION DE L'UTILISATION DES ENGRAIS
A MADAGASCAR
(suite de la première phase)

18-1 et 18-3 : VALUE COST RATIOS (V.C.R.) et FERTILIZER-CROP RATIOS.

Les éléments nécessaires pour évaluer ces deux rapports sont contenus dans le paragraphe 19.2 précédent.

Les prix retenus sont les prix réels en 1988 aussi bien pour les engrais que pour les produits.

Toutefois :

- pour le maïs et le manioc, nous avons retenu ceux de 1986, les seuls disponibles

- pour 20-10-10 et le super triple, nous avons estimé leur prix en 1988, à partir des prix 1988 de plusieurs engrais qui coûtaient autant qu'eux, avant 1987.

Rappelons ces prix retenus,

Produit	Prix au kg en FMG
Riz	160
Manioc	110
Maïs	182
Canne à sucre	14
Café	881
Coton	520

Engrais	Prix au kg en FMG
11-22-16	350
UREE	360
ClK à 60% de K_2O	370
$SO_4(NH_4)$ à 20% de N	350
20-10-10	350
Super triple	300

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Les rapports $\frac{\text{Plus-value}}{\text{Coût fertilisant}}$ et $\frac{\text{Surplus de production}}{\text{Quantité Engrais}}$ pour chaque production sont calculés et présentés dans les divers tableaux ci-dessous :

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	Quantité par ha	Forme et quantité en kg/ha	Surplus de production/ engrais	Coûts en FMG en 1988	Rapport Plus-value/coût fertilisant
Engrais (1er niveau)	30-60-45	300 kg de 11-22-16		300 X 350 = 105.000	
Surplus de production escompté (1)	1 tonne	1.000 kg	$\frac{1000}{300} = 3,33$	1.000 X 160 =160.000	$\frac{160.000}{105.000} = 1,52$
Engrais (2è niveau)	30-60-45 + 30 N	300 kg de 11-22-16 + 66 kg d'urée		300 X 350 = 105.000 66 X 360 = 23.760 128.760	
Surplus de production escompté (1)	1,75 t	1.750 kg	$\frac{1.750}{300+66} = 4,8$	1.750 X 160 =280.000	$\frac{280.000}{127.760} = 2,19$

(1) - *Pour obtenir ces surplus de production, le paysan doit absolument maîtriser les mauvaises herbes par un repiquage en ligne avec sarclage à la houe rotative.*

Notons que le V.C.R. ne dépasse 2 qu'avec le 2è niveau de fertilisation : 300 kg de 11-22-16 avec 66 kg d'urée en couverture.

M A N I O C

	Quantité par ha	Forme et quantité en kg/ha	Surplus de production/ engrais	Coûts en FMG en 1988	Rapport Plus-value/coût fertilisant
Engrais	20-10-50	100 kg de 20-10-10 66 kg de ClK	$\frac{10000}{100+66} = 60$	100 X 350 = 35.000 66 X 370 = 24.420 59.420	$\frac{1.100.000}{59.420} = 18,5$
Surplus de production escompté (1)	10 tonnes	10.000 kg		10.000 X 110 = 1.100.000	

(1) - *Un tel surplus de production n'est obtenu que sur un sol non compact relativement profond sinon il faut apporter du fumier pour rétablir la structure du sol.*

Le rapport plus-value/coût fertilisant manioc est certainement un des plus élevés qu'on puisse espérer.

MAIS

	Quantité par ha	Forme et quantité en kg/ha	Surplus de production/ engrais	Coûts en FMG	Rapport Plus-value/coût fertilisant
Engrais	150-60-120	300 kg de 11-22-16 250 kg d'urée 175 kg de K_2O	$\frac{5.000}{725} = 6,9$	300 X 350= 105.000 250 X 360= 90.000 175 X 370= 64.750 259.750	$\frac{910.000}{259.750} = 3,5$
Surplus de production	5 tonnes(1)	5.000 kg de grains secs		5.000 X 182(2) = 910.000	

(1) - *Surplus par rapport à la tonne de production obtenue normalement avec un sol ferrallitique moyen, qui ne nécessite pas une fumure de fond de 400 UF de P_2O_5, 300 UF de K_2O et 1.000 kg de dolomie préconisée pour les sols ferrallitiques très pauvres où le rendement est presque nul. Ce surplus n'est obtenu qu'avec une variété sélectionnée et une bonne maîtrise des mauvaises herbes.*

(2) - *Prix 1986, seul disponible.*

CANNE A SUCRE (Cas de la Sucrerie de NOSY-BE(1)

	Quantité par ha	Forme et quantité en kg/ha	Surplus de production/ engrais	Coûts en FMG	Rapport Plus-value/coût fertilisant
Engrais	100-75-150	500 kg de $SO_4(NH_4)_2$ 165 kg de super triple (3) 250 kg de ClK	$\frac{7.000}{(500+165+250} = 7,65$	500 X 310=155.000 165 X 300= 49.500 250 X 310= 75.000 279.500	$\frac{980.000}{279.500} = 3,50$
Surplus de production escompté	70 tonnes(2)	70.000 kg de tiges de cannes		70.000 X 14 = 980.000	

(1) - *La sucrerie de NOSY-BE apporte tous les 4 ans, au début du cycle, 300 kg de P_2O_5 de fumure de fond, soit l'équivalent de 75 kg par an et en fumure d'entretien chaque année, 100-0-50 sous forme de $SO_2(NH_4)_2$ et de ClK.*

Les autres sucreries utilisent une fumure qui se rapproche de celle de NOSY-BE.

(2) - *Ce chiffre est obtenu en retranchant de la moyenne (90 t/ha) des parcelles fumées, de la moyenne (20 t/ha) des parcelles non fumées des paysans.*

(3) - *Super triple à 45 % de P_2O_5 dont nous avons estimé le prix en 1988 à 300 FMG.*

CAFE

	Quantité par ha	Forme et quantité e. kg/ha	Surplus de production/ engrais	Coûts en FMG	Rapport Plus-value/coût fertilisant
Engrais (1)	170-85-85	840 kg de 20-10-10	$\frac{2.000}{840} \# 2,4$	840 X 350 = 294.000	$\frac{1.762.000}{294.000} = 6$ (3)
Surplus de production escompté	2 tonnes	2.000 kg de café marchand		2.000 X 881 = 1.762.000 (2)	

(1) - La fumure du caféier en pleine production est de 0,700 kg de 20-10-10 par pied à raison de 1.200 pieds par ha.

(2) - Prix réel en 1988, différent du prix officiel : 820 FMG.

(3) - Chiffre valable à condition que les techniques culturales (taille, sarclage de [illegible], fauchage des interlignes) soient effectuées correctement.

COTON

	Quantité par ha	Forme et quantité en kg/ha	Surplus de production/ engrais	Coûts en FMG en 1988	Rapport Plus-value/coût fertilisant
Engrais	140 UF de N	300 kg d'urée	$\frac{2.000}{300} = 6,67$	300 X 300=108.000	$\frac{1.040.000}{108.000} = 9,6$
Surplus de production escompté	2 tonnes (1)	2.000 kg de coton-graine		2.000 X 520 = 1.040.000 (2)	

(1) - 1 ha de cotonnier sur baiboho, sans cet apport d'engrais mais avec des techniques culturales et traitements corrects donne environ 1 tonne de coton graine.

(2) - Notons, que d'autres frais (ceux de récolte notamment) augmente avec l'augmentation du rendement..

P O I V R E (en culture pure[1]) : 4 m X 2,5 m

	Quantité par ha	Forme et quantité en kg/ha	Surplus de production/ engrais	Coûts en FMG	Rapport Plus-value/coût fertilisant
Engrais	200-50-100 (2)	500 kg de 20-10-10 200 kg d'urée 80 kg de ClK		500 X 350 = 175.000 200 X 360 = 70.000 80 X 370 = 29.600 274.600	
Surplus de production escompté	2,5 tonnes (3)	2.500 kg de poivre noir	$\frac{2.500}{500+200+80}$ = 3,2	2.500 X 1.235[4] = 3.087.500	$\frac{3.087.500}{274.000}$ = 11,25

(1) - *Le poivrier, en culture associée au caféier, ne comporte que 64 lianes/ha correspondant à 64 arbres d'ombrage/ha.*

(2) - *Fumure sur lianes sur pleine production correspondant à 200-50-100g par pied.*

(3) - *Surplus estimé par rapport au rendement d'un ha de culture pure non fumée*

(4) - *1.235 FMG/kg en 1988 est un prix exceptionnel. Ce prix n'était que de 492 FMG en 1987. Avec ce dernier prix le V.C.R. serait de : $\frac{1.230.000}{274.000}$ = 4,5.*

En résumé,

Produit concerné	Plus-value en FMG (V.C.R.) Coût engrais en FMG	Surplus de production en kg Engrais en kg
Riz : niveau 1	1.52	3,33
niveau 2	2,19	4,8
Manioc	18,5	60
Maïs	3,5	6,9
Canne à sucre	3,5	7,65
Café	6	2,4
Coton	9,6	6,67
Poivre	11,25	3,2

Soulignons que ces rapports, dont certains sont très élevés ne sont obtenus que si les conditions de réussite de l'engrais sont remplies, à savoir :

- bonne maîtrise satisfaisante des mauvaises herbes
- bonne maîtrise de l'eau
- bonne préparation du sol
- utilisation de semences améliorées.

19.2 - REMUNERATION JOURNALIERE DU TRAVAIL
(Return on labour)

Nous allons limiter l'évaluation de cette rémunération à deux productions : le riz et le maïs qui sont produits essentiellement en milieu paysannal. Les autres produits concernent davantage les grandes unités de production.

19.21 - Riz irrigué en culture manuelle en méthodes traditionnelles et améliorées

1 - CHANGE D'EXPLOITATION

11 - Temps de travaux/ha de rizière
(journée de 6 heures effectives)

	Opérations	Journées de travail H/J				Observations
		Méthode traditionnelle (MT)		Méthode améliorée (MA)		
PEPINIERE	Préparation semis	10		5		Moins de travail en MA car moins de plants nécessaires.
	Entretien	5		2		
	Arrachage des plants	10		5		
	Transport plants	10	35	3	15	
RIZIERE	Fumure	3		3		- L'entretien est plus facile en MA car le sarclage se fait à la houe rotative.
	Labour	50		50		
	Réfection diguette	4		4		
	Mise en eau	4		4		
	Hersage affinage	20		20		
	Repiquage	25		40		- Le repiquage en ligne en MA demande plus de temps.
	Entretien (sarclage...)	30		15		
	Moisson	20		20		
	Bottélage-moyette	20	176	20	176	
Aire de battage	Battage	10		15		Plus de travail en MA car davantage de récolte.
	Séchage, vannage, Transport	10	24	15	30	
	TOTAUX	235 J/H		221 J/H		Pas de différence nette entre MA et MT.

12 - Produits (Intrants)

Produit	Méthode traditionnelle (MT) Quantité en kg	P.U en FMG	Coût total en FMG	Méthode améliorée (MA) Quantité en kg	P.U en FMG	Coût total en FMG	Observation
Semences	100	160	16.000	30	320	9.600	
Fumier	1.000	10	10.000	1.000	10	10.000	
Engrais							
11-22-16	-	-	-	300	350	105.000	
Urée	-	-	-	66	360	23.760	
Produits phyto-sanitaires	-	-	-	3	3.300	9.900	
Total produit		26.000			158.260		

13 - Petits matériels

	5.000	15.000

- PRODUIT BRUT

Produit	2.250 kg	4.000 kg
Prix total à 160 FMG/kg	360.000 FMG	640.000 FMG

3 - REMUNERATION JOURNALIERE DU TRAVAIL (Return ou labour)

a) Avec la méthode traditionnelle

$$\frac{360.000 \text{ FMG} - 26.000 \text{ FMG} - 5.000 \text{ FMG}}{235} = 1400$$

b) Avec la méthode améliorée

$$\frac{640.000 - 158.260 - 15.000}{221} = 2111,9$$

Il apparaît donc que la technique améliorée valorise de 2.110 FMG - 1.400 FMG = 710 FMG de plus la journée de travail du paysan.

On se demande alors pourquoi cette technique ne se généralise pas. Il en existe plusieurs raisons dont :

1 - Le paysan ne dispose pas de 158.200 FMG pour les intrants. Avec une structure de prêt, les formalités sont compliquées et c'est une catastrophe (endettement définitif ou vente du patrimoine) en cas de calamité naturelle (inondation, grêle...).

2 - Les facteurs de production (semences, engrais, houe rotative...) ne sont pas toujours disponibles sur le marché et partout. Or le facteur manquant va être le facteur limitant le rendement à un niveau nettement moins élevé.

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19.22 - Maïs en culture traditionnelle et en culture améliorée

1 - CHARGES D'EXPLOITATION

11 - Temps de travaux par ha
(journées de 6 heures effectives).

Opérations	Journées de travail H/J		Observations
	Culture traditionnelle	Culture améliorée	
- Labour avec enfouissement fumier	75	75	• Le labour manuel sur tanety est très pénible et long. Un paysan, sans un salarié ne peut pas cultiver un ha de maïs.
- Semis	10	12	
- Sarclage-buttage	25	75	
- Epandage d'engrais + binage		6	• En culture améliorée, 3 sarclage-buttages sont effectués pour rentabiliser la forte fumure minérale.
- Récolte	10	20	
- Transport	2	6	
Totaux	122	194	

12 - Produits (intrants)

Produit	Méthode traditionnelle (MT)			Méthode améliorée (MA)			Observation
	Quantité en kg	P.U en FMG	Coût total en FMG	Quantité en kg	P.U en FMG	Coût total en FMC	
Semences	40	200	8.000	25	300	7.500	
Fumier	1.000	10	10.000	10.000	10	100.000	
Engrais							
11-22-16	-	-	-	300	360	108.000	
Urée	-	-	-	275	360	99.000	
ClK	-	-	-	120	310	37.200	
Produits phyto-sanitaires	-	-	-	12	2200	26.400	
Total produit	18.000 FMG			445.600 FMG			

13 - Petits matériels

	5.000 FMG	5.000 FMG

· PRODUIT BRUT

Produit	1.000 kg	6.000 kg
Prix total	182.000 FMG	1.092.000 FMG

- REMUNERATION JOURNALIERE DU TRAVAIL (Return on labour)

a) *Avec la méthode traditionnelle*

$$\frac{182.000 - 18.000}{122} = 1.345 \text{ FMG}$$

b) *avec la méthode améliorée*

· Charge totale d'exploitation :

75.000 + 100.000 + 108.000 + 99.000 + 37.200 + 26.400 = 445.600 FMG

· R.J du travail = $\frac{1.092.000 - 445.600}{194}$ = 3.332 FMG.

14 - FARMING LEVEL

141 - Comment les paysans ont-ils été formés dans l'utilisation des engrais ? Ils doivent suivre scrupuleusement les consignes du vulgarisateur. Ils n'ont pas le niveau d'instruction nécessaire pour comprendre le pourquoi des différentes recommandations qu'ils reçoivent.

142 - C'est une énorme contrainte pour l'utilisation des engrais car il faut, pour atteindre la majorité des paysans, un encadrement dense et pérénne très coûteux.

Ce n'est pas le cas pour les exploitations modernes qui ont des gens formés dans des collèges, des lycées, ou à l'Ecole Supérieure agricole.

143 - Les arguments du paysan pour ne pas utiliser les engrais :

. Résultats de la fertilisation aléatoire car il ne maîtrise pas toujours tous les autres facteurs de production (eau d'irrigation ou pluie, semences améliorées pour rentabiliser les engrais, sarclage à temps des parcelles...).

. Les paysans affirment que l'utilisation des engrais durcit leurs sols. C'est vrai, car en employant des engrais minéraux, ils n'apportent plus de fumier organique à leurs sols et la structure de ceux-ci se dégrade : ils deviennent plus compacts, plus durs à travailler.

144 - Niveaux de production

D'une façon générale, le niveau de production est le niveau traditionnel qui peut largement être amélioré et atteindre ainsi un niveau optimal.

Seules quelques exploitations modernes de formation ou de développement, atteignent un niveau de production optimal (FIFAMANOR, TOMBOTSOA, BEVALALA...)

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15 - FARM-YARD MANURE

L'intérêt de l'apport de matière organique n'est pas perçu par la population malgache d'une manière uniforme dans tout Madagascar. Pratiquement c'est sur les Hauts-Plateaux (Province de TANANARIVE et partie Ouest de la province de FIANARANTSOA), où les terres cultivables commencent à manquer et où les paysans pratiquent une agriculture et un élevage intensifs, que les paysan utilisent actuellement le fumier, et cela depuis longtemps, bien avant ce siècle.

La production annuelle de fumier de ferme à Madagascar peut être estimée environ 1,2 million de tonnes (dont plus de 80 % est destiné à la riziculture) même si le pays a une potentialité de production de plus de 60 millions de tonnes par an. Les 20% restan sont destinés aux cultures sèches des tanety (collines) : manioc, maïs, haricot, patate douce, tabac,...

La composition moyenne du fumier frais est de : 0,6 % de N, 0,2 % de P_2O_5 et 0,3 % de K_2O, *sur le plan national* l'apport d'éléments fertilisants par ces 1,2 million de tonnes de fumier n'est pas négligeable.

Au *niveau d'une exploitation* cependant, cet apport est faible et ne permet que maintenir les rendements de cultures à leurs niveaux traditionnels. En effet, la teneur du fumier en N, P_2O_5, K_2O est déjà faible, mais en plus l'obtention de cet amendement organique se heurte à divers obstacles pratiques :

- faible disponibilité des litières ;

- difficulté du paysan pour manipuler, transporter souvent sur sa tête, une aussi grande quantité de substance peu ragoûtante. (On préconise entre 10 - 20 tonnes de fumier par ha).

Ces paysans n'en disposent pas suffisamment. Les plantes manquent d'éléments N P K pour leur nutrition et cela empêche l'obtention du rendement optimal qu'on peut espérer.

La tentative effectuée par l'Etat de produire industriellement un engrais organico-biologique (EOB) à AMBOVOMBE, dans le Sud de Madagascar a échoué : le produit commercialisé était trop cher pour la quantité d'unité fertilisante qu'il contenait.

Une incorporation d'engrais à ce EOB aurait pu le valoriser davantage.

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16 - FERTILIZER KNOWLEDGE

161 - Les recherches agronomiques sur la fumure minérale sont effectuées par le FOFIFA, l'I.R.R.I. et par les services "Expérimentations" de certaines unités de productions agricoles. Les résultats sont communiqués aux organismes de développement, qui les transmettent ensuite à leurs vulgarisateurs.

Il s'en suit que les paysans des *fermes traditionnelles* ne connaissent pas les modalités d'action des différents engrais, et se contentent d'appliquer strictement les instructions des techniciens vulgarisateurs. Ils font appel à ceux-ci en cas de problème. Le type de formation qu'ils acquièrent ainsi est obtenu par expérience, par habitude. Or les problèmes résultent du fait que les formes d'engrais commercialisés ne sont pas toujours les mêmes tous les ans et ces changements déroutent souvent les paysans.

Cette situation les codamne à ne jamais pouvoir se passer des encadreurs.

Pour les *exploitations modernes* par contre, leurs responsables sortent des collèges et des lycées agricoles ou même de la Faculté agronomique. Ils ont les connaissances techniques et scientifiques nécessaires pour utiliser les engrais minéraux d'une façon optimale.

162 - *Les paysans traditionnels* ne connaissent que les différences de présentation physique (granulé, poudre, couleur, aspect...) des engrais.

Les responsables des *exploitations modernes* connaissent les différences entre les divers engrais notamment en ce qui concerne leur composition, leur forme, leur mode d'action et d'utilisation... En plus ils connaissent bien aussi les contraintes à respecter et les travaux nécessaires à effectuer si ils veulent rentabiliser les engrais (maîtrise de l'eau et des mauvaises herbes, densité optimale de semis ou de plantation, etc...).

Les paysans traditionnels par contre doivent être encadrés pour réaliser les techniques culturales qui doivent accompagner nécessairement l'emploi d'engrais. L'échec le plus courant de cet emploi provient du non respect par les paysans de ces techniques culturales.

12 - FARMING SYSTEMS

121 - Trois types de cultures existent à Madagascar :

- *la riziculture irriguée* et pluviale (tavy) qui occupe de 63,7 % des surfaces cultivées. Ce pourcentage élevé s'explique par le niveau de consommation de riz élevé de la population.

- *les cultures temporaires* à cycle végétatif court : le maïs, les tubercules, le coton... Elles occupent 23,2 % des superficies.

- *les cultures permanentes* (10,9 % des superficies) sont surtout reparties dans le Nord et sur la côte Est. Ce sont des cultures de rente.

122 - Les paysans malgaches ne connaissent pas le système de culture en couloir.

Le riz irrigué n'est jamais associé à une autre culture.

Le riz pluvial sur brûlis (tavy) est parfois associé au maïs.

Le maïs est surtout cultivé en association avec d'autres cultures (manioc de 1ère année, haricot, voandzeia) dans 77 % de la superficie développée ; sa production dans sa quasi-totalité est paysannale.

Parmi les cultures permanentes, le caféier est souvent associé en milieu paysannal au bananier, au poivrier...

123 - Il n'y a pas de coopératives agricoles du type capitaliste à Madagascar. Les coopératives socialistes ont pratiquement cessé de fonctionner et reprennent sous forme de précoopérative (PROCOOPS).

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13 - CULTIVATING PRACTICES

131 - RIZ

On peut classer les modes de culture du riz à Madagascar en :

- Riziculture sèche qui peut être

  soit primitive : tavy

  soit améliorée : riz pluvial (de tanety).

- Riziculture de submersion

soit avec semis direct
soit avec repiquage.

1311 - Riziculture sèche

a) Riziculture primitive

Le tavy se pratique sur brûlis forestier, sans labour et avec des semis directs en poquets. Les soins sont réduits à quelques sarclages et le rendement ne dépasse pas 800 kg de paddy à l'hectare.

Il faut faire coïncider l'évolution

b) Le riz pluvial ou Riziculture sèche améliorée agricole de la plante (cycle végétatif) avec la saison des pluies. Il faut des variétés résistantes à des courtes périodes de sécheresse éventuelles, à cycle court et des techniques de lutte contre les mauvaises herbes efficaces (semis direct en lignes pour faciliter les sarclages, désherbage chimique, etc...). Il prend de l'extension dans le Moyen-Ouest (SAKAY, ODEMO, TSIROANOMANDIDY, MANDOTO).

1312 - Riziculture de submersion

a) Avec semis direct.

On sème directement dans les rizières, sans passer par la pépinière, et on ne repique pas. La technique est adoptée dans l'Alaotra et dans les plaines fluviales de l'Ouest. Le principal inconvénient en est la lutte difficile contre les mauvaises herbes et généralement le rendement est inférieur au riz repiqué.

b) Avec repiquage.

Cette technique permet de mieux lutter contre les mauvaises herbes. En effet, le riz repiqué a une avance sur les herbes aquatiques et la lame d'eau existant dans la rizière au moment du repiquage gêne les herbes terrestres. Mais cette technique n'est pas toujours la plus économique.

D'une façon générale quelque soit le mode de riziculture adopté, il faut :

1°) éviter que le riz manque d'éléments fertilisants et surtout éviter une déficience en eau pendant les *périodes* dites *critiques* de *tallage* et surtout *d'épiaison*.

2°) lutter efficacement contre les mauvaises herbes sans attendre leur envahissement, par :

- un bon travail du sol pour les enfouir ;
- un repiquage éventuel ;
- une bonne conduite de l'eau : irrigation et assèchement de la rizière aux moments convenables ;
- des sarclages ou des traitements avec herbicides chimiques *effectués à temps.*

3°) éventuellement : ne pas repiquer des plants trop âgés pour ne pas limiter, restreindre le tallage.

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132 - MAIS

A Madagascar, en culture traditionnelle, c'est la plante qui entre le plus fréquemment dans une association, en particulier avec le haricot où il sert de tuteur (manioc, arachide, patate, etc...).

Le maïs ne tallant pas, il ne faut pas compter sur la fumure pour rattraper un peuplement trop faible.

La *période critique* est la *floraison* au point de vue eau et *éléments fertilisants.*

Les épis sont récoltés à maturité quand les grains sont suffisamment durs pour ne plus être rayé par l'ongle. Ils sont mis à sécher sur le fil de fer ou encore débarrassés des spathes dans des cribs.

Après ils sont égrenés : le rendement à l'égrenage est de 80 % environ (20 % des spathes et rafles secs), le rendement par ha à Madagascar est de l'ordre d'une tonne sur les tanety. A la SAKAY, au Moyen-Ouest grâce à des techniques culturales rationnelles on atteint 4 - 5 ou même 6 tonnes à l'ha (TOMBOTSOA).

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133 - MANIOC

On peut classer les modes de culture du manioc à Madagascar en culture traditionnelle et en culture rationnelle.

1331 - Culture traditionnelle

- Souvent associé avec maïs, haricot, etc... qui sont récoltés la 1ère année, si le cycle du manioc est de deux ans.
- Sur tanety pauvre, dégradé.
- Pas de fumure, ni de variété améliorée.
- Destination : consommation humaine et animale.
- Rendement : 3 à 10 tonnes/ha de manioc frais.

1332 - Culture rationnelle ou industrielle

- Culture pure sur plus de 100 ha.
- Sur terre alluvionnaire ou tanety enrichi.
- Adoption d'une rotation :
  - 2 ans manioc
  - 2 ans engrais vert : Crotalaria
- Fumure abondante :
  - engrais vert : plante qu'on cultive et qu'on enfouit sur le sol même de sa culture.
  - fumier : 40 t/ha
  - engrais minéraux : - 200 kg de hyperphosphate
    - 400 kg de ClK/ha.
- Utilisation de boutures vigoureuses, sélectionnées, de variétés améliorées.
- Culture mécanisée : travail du sol, arrachage.
- Rendement de 40 à 60 t/ha.
- Destination : transformation en fécule, tapioca ou provende.

Ce qu'il faut souligner dans la culture du manioc, c'est l'importance de la fumure organique. On admet en général qu'un rapport de fumier d'1 tonne fait augmenter le rendement d'une tonne, naturellement jusqu'à une certaine limite (50 tonnes environ).

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134 - CANNE A SUCRE

La canne à sucre en culture familiale à raison de 1 à 2 ares par famille sert à la consommation de bouche et à la fabrication de vin de cannes (betsabetsa).

En culture industrielle, il existe 5 sucreries à Madagascar dont les productions sont de :

- BRICKAVILLE	10.000 t de sucre	5.000 hl d'alcool
- NAMAKIA	25.000 t de -"-	15.000 hl d'alcool
- NOSY-BE	20.000 t de -"-	12.000 hl d'alcool
- SOSUMAV	35.000 t de -"-	12.000 t de mélasse
- SIRANALA	10.000 t de -"-	2.000 t de mélasse ?

Ces cultures industrielles adoptent une rotation en laissant une ou deux années de jachère entre une ancienne et une nouvelle plantation de cannes.

Le sol est nettoyé en rasant les anciennes souches, puis labouré, pulvérisé, billonné.

Les boutures sont sélectionnées, parmi les pieds vigoureux et sont mis en terre après traitement antifongique. On les recouvre ensuite de 2 à 4 cm de terre.

L'entretien consiste à faire un buttage et des sarclages. La récolte se fait soit manuellement, soit à la coupeuse mécanique après brûlage des feuilles (la veille de la coupe) (NB, SOSUMAV).

La fumure adoptée est variable suivant les sucreries (Cf. § 19.24).

Le rendement à Madagascar est de 40 à 150 t/ha. On replante généralement quand ce rendement descend au-dessous de 40 t.

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135- COTON

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Par suite du parasitisme élevé, la culture du cotonnier dans une région nécessite une discipline stricte de la part des paysans. Souvent celle-ci est réalisée par l'association entre un organisme (SAMANGOKY, HASIMA) et les cultivateurs. Il existe quand même quelques planteurs privés, souvent européens qui s'occupent eux-mêmes des traitements concernant leurs concessions (avec des pulvérisateurs, ou poudreuses individuelles).

Le type d'association est souvent comme suit :
L'organisme prend en charge :

- l'aménagement du terrain et éventuellement l'irrigation ;
- le labour ;
- le billonnage (écartement 1 m) ;
- la fourniture de semences traitées (fongicide) ;
- les insecticides et les traitements (aériens) ;
- l'achat de la récolte ;
- la fumure.

Le cultivateur associé s'occupe :

- du semis = (en poquet de 6 à 7 grains par trou avec 1 X 0,30 m) ;
- du démariage à 2 plants ;
- des sarclages ;
- de la récolte (beaucoup de mains-d'oeuvre) ;
- de la coupe et du brûlage du cotonnier pour lutter contre la bactériose et le ver rose (lepidoptère).

Les deux parties associées se partagent la récolte dans des proportions variables et fixées à l'avance.

Pour la culture proprement dite, on adopte souvent une rotation ; par exemple à la SAMANGOKY.

4 ans coton ;

1 an antaka (Dolichos Lablab).

Le rendement par ha peut atteindre 3,5 ou 4 tonnes/ha de coton-graine. Le seuil de rentabilité des rendements est de :

- 1,2 t/ha en culture sèche (baiboho et pluviale) ;
- 1,8 t/ha en culture irriguée (SAMANGOKY).

\+ +

\+

136 - <u>CAFE</u> (Canephora : 90 % de la production de Madagascar).

La multiplication du caféier Canephora se fait par bouturage.

Il faut un parc à bois qui fournit les boutures issues d'un clone sélectionné. Sur chaque plant du parc à bois, on prélève tous les 8 mois des rameaux orthotropes avec lesquels on prépare les boutures. Celles-ci sont mises à séjourner dans des bacs de bouturage où elles développent des racines. Elles sont ensuite placées en pépinière pendant 8 mois avant être plantées définitivement sur le terrain avec un écartement de 3 m X 3 m (111 plantes/ha).

Il faut ombrager, surtout si on n'apporte pas de fumure, avec des arbres d'ombrage (ALBIZZIA, STIPULATA, INGA DULCIS).

Les opérations d'entretien sont :

- le fauchage des interlignes
- le réglage de l'ombrage
- la fumure organique et minérale
- la récolte (3 à 5 ans après la plantation)
- la taille.

ANNEX 2

BACKGROUND TABLES ON FERTILIZER SALES

ANNEX 2

Contents:

Tables A1 to A24b: Fertilizer sales by type and by region, 1985 to 1988.

Source: Approvisionnements en intrants agricoles par CIRVA (CIRconscription de Vulgarisation Agricole). Direction de l'Approvisionnement Agricole, MPARA.

Tables A25 to A28: Fertilizer sales by type, by crop and by region, 1985 to 1988.

Source: Data calculated on the bases of tables A1 to A24b, supplemented with data from HASYMA, SIRAMA and MPARA.

NOTE TO TABLES A1 TO A24b

These tables present the semestrial returns made to MPARA by all distributors of agricultural inputs.

Distributors include:

MPARA and COROI stores in 1985 and 1986
Crop development projects
Regional development projects
Private commercial distributors

Crop and regional development projects which have reported to D.A.A. on input sales include:

AFAFI	- Rice
FAMAMA	- Cashew nuts
FANALAMANGA	- Forest
FIFABE	- Rice
FIFAMANOR	- Rice, Food crops, Cattle
HASYMA	- Cotton
MAMISOA	- Soya
NAMAKIA	- Rice
OCPG	- Coffee, Pepper, Vanilla, Cloves.
ODR	- Rice
OFMATA	- Tobacco
SAMAGOKY	- Rice/ Cotton
SAMBAVAVA VOANIO	- Rice
SIRAMA	- Sugar
SIRANALA	- Sugar
SOAMA	- Rice
SODEMO	- Rice
SOMALAC	- Rice
SOMAPALM	- Oil Palm
SORIFEMA	- Manioc

Private commercial distributors include:

COMAP
COROI
ECOPLAN
HOECHST
OCM (Omnium Commercial de Madagascar)
R.A. IMPORT-EXPORT
SEIM
SEPCM
SOGEDIS

NOTES TO TABLES A25 TO A28

Tables A25 to A28 have been calculated on the bases of the previous sets of data (Agricultural input sales by CIRVA). They have been supplemented for completeness by fertilizer sales data from HASYMA and SIRAMA/SNBCE. Where this information was already contained in the D.A.A. data source, the data were substituted with the original data from the users.

Where information seemed incomplete for the MPARA sales, it was supplemented by D.A.A.'s information on fertilizer sales based on the payments made by the various stores to the D.A.A.

Data were, as far as possible, checked for dubble-counting.

Calculations for fertilizer sales by crop were based on the sales of crop and regional development programmes. As fertilizer sold by private distributors is sold mainly to smallholder farmers, it has been assumed that the bulk of this fertilizer would be applied to rice and other food crops. The quantities of fertilizer applied to other food crops have been assumed to be minimal and hence all fertilizer sold by private distributors has been allocated to rice.

Data send to D.A.A. include stocks at the end of the previous reporting period, purchases during the period, sales, movements of inputs between CIRVAs and losses during the period and stocks at the end of the period. Sometimes they also give the prices of input per unit and the source of the purchase of inputs. For the present study only the fertilizer data have been retained.

As noted in the main report, these data are a valuable information source but are unexploited by the DAA: data are neither checked against real stocks in the stores, nor checked for internal consistency. Reporting to D.A.A. seems to be done on irregular bases.

Table A 1

Agricultural input sales by region, 1985 (in Kilos): FIANARANTSOA.

REGION	FERTILISER TYPE	price /Kilo	Previous stocks	Received during yr	Total Supply	Sales	Move out of CIRAA	Lost	TOTAL	End Yr STOCK
MPARA	S.A.	180	140		140	11			11	129
Farafangana	Urea	180	215,461	150	215,611	81	6,000		6,081	209,531
	Hyper Reno	140	25,636		25,636				0	25,636
	KCL	170	2,109		2,109	50			50	2,059
	PK 21.16		3,464		3,464				0	3,464
	11.22.16	180	208		208				0	208
COROI	15.15.15	140	523		523	523			523	0
Farafangna	11.22.16	180	23,042	24,285	47,327	20,625		33	20,658	26,670
MPARA	Urea	180	3,748	98	3,846	80	455		535	3,311
Mananjary	S.A.		393		393		350		350	43
	Hyper Reno		8,494		8,494				0	8,494
	11.22.16		9,339		9,339				0	9,339
	15.15.15	62	300		300	300			300	0
COROI	15.15.15	140	6,135		6,135	4,868			4,868	1,267
Manajary	16.16.16.	180		3,000	3,000	3,000			3,000	0
	11.22.16	180		25,000	25,000	12,039	1,010		13,049	11,951
MPARA	11.22.16	180	70		70	12	58		70	0
Fianarantsoa	15.15.15	140	190		190	190			190	0
	Chlor.Potas	170	2,296	3,505	5,801	3,651	15		3,666	2,136
	Hyper Reno	50	2,983		2,983	1,100			1,100	1,883
	Polyfos	50	65		65	62	1		63	2
	Urea	180	40,079	7,248	47,327	13,618	3,338		16,956	30,372
	Sulf.Ammon.	120	4,485		4,485	1,454	142		1,596	2,889
	PK 21.16	60	300		300				0	300
	Dolomie	60	1,212	400	1,612	528			528	1,084

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Table A 1 (continued)

Agricultural input sales by region, 1985 (in Kilos): FIANARANTSOA.

REGION	FERTILISER TYPE	price /Kilo	Previous stocks	Received during yr	Total Supply	Sales	Move out of CIRAA	Lost	TOTAL	End Yr STOCK
COROI	11.22.16	180	46,390	483,972	530,362	494,845	24,400	383	519,628	10,735
Fianarantsoa	15.15.15		39,597		39,597	27,338	1,934		29,271	10,326
	16.16.16			168,950	168,950	107,908			107,908	61,042
Fianarantsoa	Urea	180	259,421	7,576	266,997	13,699	9,773		23,471	243,526
SPAA	Sulfat.Ammo	120	5,018		5,018	1,465	492		1,957	3,061
	Hyper Reno	50	63,614		63,614	1,774	6,175		7,949	55,665
	Polyfos	50	65		65	62	1		63	2
	KCl	170	23,968	3,505	27,473	3,951	5,161		9,112	18,362
	pk 21.16	60	3,908		3,908		1		1	3,907
	pk 30.15	60	50		50		0		0	50
	11.22.16	180	14,449		14,449	38	158		196	14,253
	15.15.15.	140	490		490	490	0		490	0
	Dolomie	60	5,313	400	5,713	528	3,082		3,610	2,103
COROI	11.22.16	180	560,750	892,236	1,452,986	1,068,284	262,407		1,330,691	122,295
Fianarantsoa	15.15.15.	140	256,578	36,133	292,711	80,222	189,965		270,186	22,525
SPAA	16.16.16	180		776,008	776,008	276,756	145,120		421,876	354,132
	Urea	180	62,586	86,510	149,096	57,638	69,983		127,620	21,476
	KCl	170	29,433	1,613	31,045	198	240		438	30,608
	Dolomie	60	3,472	24,992	28,464	2,968	12,415		15,383	13,080
	Hyper Reno	50	3,521	9,319	12,840	2,000	4,192		6,192	6,648

Comments:
FIANANARANTSOA S.P.A.A. = Fianarantsoa CIRVA, Ambositra CIRVA, Mananjary CIRVA, Farafanga CIRVA.
In 1985 Ambositra CIRVA is missing as an element but is included in the Fianarantsoa SPAA figures.

Table A 2

Agricultural input sales by region, 1985 (in Kilos): ANTANANARIVO.

REGION	FERTILISER TYPE	price /Kilo	Previous stocks	Received during yr	Total Supply	Sales	Move out of CIRAA	Lost	TOTAL	End Yr STOCK
MFARA Miarinarivo	Hyper Reno	50	97,011	61,295	158,306	135,472	303		135,775	22,531
	ECL	170	65,081	11,100	76,181	2,041	353		2,394	73,787
	S.A.	120	780		780	711			711	69
	Dolomie	60	45,022	32,690	77,712	1,991	859		2,850	74,862
	Urea	180	618		618			218	ERR	ERR
	11.22.16	180	50		50				0	50
	15.15.15	140	60	500	560	298			298	262
	pk 21.16	140	486	150	636	500			500	136
CUROI Miarinarivo	Urea	180		80,000	80,000	36,241	19,050	1,044	56,335	23,665
	11.22.16	180	4,193	299,995	304,188	129,383	156,500	3,269	289,152	15,036
	15.15.15	140	13,467		13,467	11,006		1,188	12,194	1,273
	16.16.16	180		94,998	94,998	45,685		2,408	48,093	46,905
MFARA Tana	engrais				0	783,882			783,882	(783,882)
MFARA Antsirabe	Urea				0	197,293			197,293	(197,293)
	S.A.				0	39,614			39,614	(39,614)
	11.22.16				0	1,039,758			1,039,758	(1,039,758)
	15.15.15				0	11,743			11,743	(11,743)
	16.16.16				0	723,805			723,805	(723,805)
	divers				0	17,178			17,178	(17,178)
OFMATA. Tana	15.15.15.		110,450	193,400	303,850	289,968			289,968	13,882
	11.22.16			330,000	330,000	326,525			326,525	3,475
	20.10.10.			40,000	40,000	40,000			40,000	0
	Urea			50,000	50,000	28,700			28,700	21,300
	16.16.16.			264,000	264,000				0	264,000
HANITSOA. Tana HFI				892,000	892,000	875,000			875,000	17,000

Table A 2 (continued)

Agricultural input sales by region, 1985 (in Kilos): ANTANANARIVO.

REGION	FERTILISER TYPE	price /Kilo	Previous stocks	Received during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
SIRAMA, Tana	Urea			1,485,000	1,485,000	1,050,000		1,050,000	435,000
	TSP			30,824	30,824	30,824		30,824	0
	Chlor.Potass			480,000	480,000	400,000		400,000	80,000
	Sulf.Potass			750,000	750,000	720,000		720,000	30,000
	Sulf.Ammon			300,000	300,000			0	300,000
	Phosp.Bicalc.			50,000	50,000			0	50,000
	Sulfonitrate Pot.			810,000	810,000	810,000		810,000	0
	Phosp.Ammon.			164,000	164,000	164,000		164,000	0
	Phosp.Alum.Calc			292,000	292,000	292,000		292,000	0
Namakia, Tana	Sulfate Ammon		360,000		360,000			0	360,000
SEPCM, Tana	Sulf.Ammon.			200,000	200,000	145,000		145,000	55,000
	10.20.20.			500,000	500,000			0	500,000
	16.16.16.			500,000	500,000	300,000		300,000	200,000
	Borascine			20,000	20,000			0	20,000
	Solubor			5,000	5,000			0	5,000
	Nitrate Ammon			50,000	50,000			0	50,000
COROI, Tana	16.16.16.			6,333,030	6,333,030	4,748,214		4,748,214	1,584,816
	NPK 7.13			20,937	20,937	1,000		1,000	19,937
	Urea			14,931	14,931	10,000		10,000	4,931
	Hyper Reno			95,918	95,918			0	95,918
	Sulf.Potass.				0			0	0
	Urea 46%			564,455	564,455			0	564,455
	Urea 40%			96,450	96,450			0	96,450
	Sulf.Ammon			1,129,040	1,129,040	801,969		801,969	327,071
	20.10.10.			492,350	492,350			0	492,350

Comments

ANTANANARIVO S.F.A.A. Antananarivo CIRVA, Antsirabe CIRVA, Mairinarivo CIRVA.

Table A 3
Agricultural input sales by region, 1985 (in Kilos): TOAMASINA.

REGION	FERTILISER TYPE	price /kilo	Previous stocks	Received during yr	Total Supply	Sales	Move out of CIRAA	Lost	TOTAL	End Yr STOCK
MPARA Fenerive	S.A. 21%	120	82		82	6			6	76
	Urea 46%	180	43,829		43,829	4,829		445	5,273	38,556
	Hyper Reno	50	41		41				0	41
	KCL	170	6,442		6,442	191		204	395	6,047
	PK 21.16	120	855	6,977	7,832	4,100		1,078	5,178	2,653
	11.22.16	180	27,298		27,298	2,009		1,000	3,009	24,289
COROI Fenerive Est	11.22.16	180	28,737	400	29,137	14,185	950		15,135	14,002
MPARA Moramanga	Urea 46%	180	2,052	4,150	6,202	2,307			2,307	3,895
	Dolomie	60	5,760		5,760	31			31	5,729
	Hyper Reno	140	81		81	12			12	69
	Hyper Phosp	140	544		544				0	544
COROI Moramanga	11.22.16		97,107	303	97,410	2,514	3,800		6,314	91,097

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Table A 3 (continued)
Agricultural input sales by region, 1985 (in Kilos): TOAMASINA.

REGION	FERTILISER TYPE	price /Kilo	Previous stocks	Received during yr	Total Supply	Sales	Move out of CIRAA	Lost	TOTAL	End Yr STOCK
MPARA Ambatondrazaka	Urea 46%	180	413,158		413,158	62,696	117,150	373	180,219	232,939
	11.22.16	180	2,836		2,836	333		50	383	2,453
	15.15.15	140	1,001		1,001	78			78	923
	FE 21.16	60	2,399		2,399	294		26	320	2,079
	KCL	170	780		780			19	19	761
	Hyper Reno	50	36,189		36,189	35,331		215	35,546	643
	Dolomie	60	385,121		385,121	20,033	47,000		67,033	318,089
	Hyper Phosp	50	200		200	30		165	195	5
	Phosp.Trica	140	50		50			50	50	0
COROI Ambatondrazaka	11.22.16		145,050		145,050	45,926			45,926	99,124
MPARA Toamasina	Engrais		59,488	15,745	75,232	36,738	2,020		38,758	36,475
FANALAMANGA, Antsiranalala	Engrais simples azotes			499,460	499,460	86,050			86,050	413,410
	NPK			2,980,000	2,980,000	537,510			537,510	2,442,490
SORIFEMA, Vohidiala	Urea			32,780	32,780	32,780			32,780	0
SOMAFALM, Tamatave	Chlor.Potass.		n.a.	30,094					0	13,941
	Urea		n.a.	14,677					0	423

TOAMASINA S.P.A.A. = Ambatondrazaka CIRVA, Moramanga CIRVA, Fenerive Est CIRVA.

Table A 4

Agricultural input sales by region, 1985 (in Kilos): MAHAJANGA.

REGION	FERTILISER TYPE	price /Kilo	Previous stocks	Received during yr	Total Supply	Sales	Move out of CIRAA	Lost	TOTAL	End Yr STOCK
MFARA	Urea	180	7,058	91	7,149	354	67		421	6,728
Maintirano	11.22.16	180	1,184		1,184	916			916	268
MFARA	Hyper Reno	140	3,744		3,744				0	3,744
Antsohihy	11.22.16	180		1,500	1,500	112		10	122	1,379
MFARA	11.22.16	180	469		469	6			6	464
Mahajanga	15.15.15	140	500		500	2			2	498
	Urea	180	9,820		9,820	221			221	9,599
	Hyper Reno	180	3 080		3,080	1,200		50	1,250	1,830
	KCL	170	6,590		6,590				0	6,590
	Dolomie	60	583		583	300			300	283
COROI	11.22.16		501,095		501,095				496,731	4,365
Mahajanga	Urea		8,984		8,984				8,379	605
Mahajanga SPAA	Engrais			43,900	43,900				0	43,900

Comments:
MAHAJANGA S.P.A.A. - Mahajanga CIRVA, Antsohihy CIRVA, Maintirano CIRVA.

Table A 5

Agricultural input sales by region, 1985 (in Kilos): TOLIARA.

REGION	FERTILISER TYPE	price /Kilo	Previous stocks	Received during yr	Total Supply	Sales	Move out of CIRAA	Lost	TOTAL	End Yr STOCK
MPARA Toliara	Urea	180	206,233	538	206,771	166	1,106	7	1,279	205,492
COROI Toliara	11.22.16		38,200		38,200	141	5,200	9	5,350	32,850
MPARA Taolagnaro	15.15.15	140	634		634			284	284	350
	Urea	180	8,071		8,071	117			117	7,954
	Hyper Reno	50	1,020		1,020				0	1,020
	Dolomie	60	1,000		1,000				0	1,000
	KCL	170	1,395		1,395			135	135	1,260
	Sulf.Ammon.	140	106		106				0	106
COROI Taolagnaro	11.22.16	180	6,555	5,000	11,555	4,307	1,399		5,706	5,849
Toliara SPAA	Urea				0	1,859			1,859	(1,859)
	11.22.16				0	4,583			4,583	(4,583)
	Sulf.Ammon.				0	50			50	(50)
SAHAHGOKY, Tanandava	Urea		834,117	98,500	932,617	263,395			263,395	669,222
	Sulf.Potass		155,557	199,500	355,057	57,965			57,965	297,092
SIRAHALA Analaiva	10.10.20		996,570	1,259,360	2,255,730	807,220			807,220	1,448,510
	Urea		238,330	206,100	444,430	116,410			116,410	328,020
	Phosp.NHU		0	204,100	204,100	41,400			41,400	162,700
	15.15.15.		82,950		82,950	13,850			13,850	69,100

TOLIARA S.P.A.A.= Toliare CIRVA, Tolagnaro CIRVA.

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Table A 6

Agricultural input sales by region, 1985 (in Kilos): ANTSIRANANA.

REGION	FERTILISER TYPE	price /Kilo	Previous stocks	Received during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
MRARA Antalaha	Urea	180	26		26	26		26	0
COROI Antalaha	11.22.16	180	50	8,108	8,158	3,949		3,949	4,209
	Urea	180		2,000	2,000	809		809	1,191
Antsiranana SFAA	Urea	180	26		26	26		26	0
	Dolomie		42		42			0	42
COROI Antsir.SFAA	Urea	180	52,009		52,009	49,443		49,443	2,566
	11.22.16	180	22,507	48,587	71,094	24,566		24,566	46,528
SOAMA, Andapa	Urea			15,774	15,774	1,101		1,101	14,673
	11.22.16			25,922	25,922	2,183		2,183	23,739
SAMBAVAVA VOANIO Sambava	Chlor.Potass.		1,075,409	895,285	1,970,694	863,259		863,259	1,107,435
	Kieserite		278,377	317,773	596,150	138,773		138,773	457,377
	Sulf.Ammon		179,352	302,561	481,913	148,514		148,514	333,399
	SSP		348,341	92,487	440,828	149,499		149,499	291,329
	TSP		109,276	197,268	306,544	15,256		15,256	291,288

ANTSIRANANA S.F.A.A.= Antsiranana CIRVA, Antalaha CIRVA.

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Table A 7

Agricultural input sales by region, 1986 (in Kilos): FIANARANTSOA.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Recieved during yr	Total Supply	Sales	Move out of CIRAA	Lost	TOTAL	End Yr STOCK
AFAFI,	Urea			5,000	5,000	5,000			5,000	0
Fianarantsoa	15.15.15.			20,000	20,000	20,000			20,000	0

Table A8

Agricultural input sales by region, 1986 (in Kilos): ANTANANARIVO.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Recieved during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
SEIM	15.15.15.			1,989,350	1,989,350	1,989,350		1,989,350	0
Tana	16.16.16.			300,000	300,000	300,000		300,000	0
	Urea			400,000	400,000	190,000		190,000	210,000
SOGEDIS	16.16.16.			550,000	550,000	550,000		550,000	0
Tana	Urea			200,000	200,000	35,150		35,150	164,850
COROI	16.16.16.		1,584,816	6,500,000	8,084,816	5,463,667		5,463,667	2,621,149
Tana	PK 7.13		19,937		19,937	15,147		15,147	4,790
	Urea		4,931	9,600	14,531	14,531		14,531	0
	Hyper Reno		95,918		95,918	9,447		9,447	86,471
	Urea		96,450		96,450	94,430		94,430	2,020
	Sulf.Ammon.		327,071		327,071	325,126		325,126	1,945
	20.10.10		492,350		492,350	492,350		492,350	0
	8.20.20			150,000	150,000			0	150,000
	8.20.20			15,000	15,000			0	15,000
	8.20.20			35,000	35,000			0	35,000
	Urea		564,455	135,000	699,455	361,064		361,064	338,391
	Urea			2,500,000	2,500,000			0	2,500,000
	Urea			315,000	315,000			0	315,000
	15.15.15.			350,000	350,000			0	350,000
	15.15.15.			150,000	150,000			0	150,000
	15.15.15.			1,000,000	1,000,000			0	1,000,000
	16.16.16.			2,200,000	2,200,000	2,200,000		2,200,000	0
SIRAHA	Urea			2,000	2,000			0	2,000
Tana									

Note: The 2 purchases and sales of 16.16.16. from SEIM and SOGEDIS were initially bought from COROI and have thus been left out of our final sales figures in order to avoid dubble-counting.

Table A9

Agricultural input sales by region, 1986 (in Kilos): TOAMASINA.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Recieved during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
SOMAPALM, Tamatave	Chlor.Potass		13,941	116,500	130,441	130,441		130,441	0
	Urea		423	160,000	160,423	160,423		160,423	0
	Hyper Reno			300	300	0		0	300
FANALAMANGA, Antsiranana	Dolomie			7,940	7,940	7,940		7,940	0
	8.16.24		2,295,779		2,295,779	1,438,885		1,438,885	856,894
	11.22.16			200	200	200		200	0
	16.16.16.			10,000	10,000	8,600		8,600	1,400
	Urea		503,610		503,610	90,070		90,070	413,540
OCPG, Toamasina	20.10.10.			400,000	400,000			0	400,000

Table A10

No semestrial returns were available for Mahajanga in 1986.

Table A11

Agricultural input sales by region, 1986 (in Kilos): TOLIARA.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Recieved during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
SODEMO, Morondava	Urea		54,550		54,550	54,550		54,550	0
	Sulf.Potass.		15,000		15,000	15,000		15,000	0
	Phosp.Ammon		15,000		15,000	15,000		15,000	0
	Solubor C		775		775	100		100	675
	Boracine		1,200		1,200	1,200		1,200	0
SIRANALA, Analaiva	10.10.20.		1,448,510	350,000	1,798,510	657,030		657,030	1,141,480
	Urea 46%		328,200	176,000	504,200	76,510		76,510	427,690
	Phosp.Ammon		160,800	170,000	330,800	237,120		237,120	93,680
	15.15.15.		69,100	0	69,100	69,100		69,100	0

Table A12

Agricultural input sales by region, 1986 (in Kilos): ANTSIRANANA.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Recieved during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
SO.A.MA, Andapa	Urea		14,674		14,674	5,474		5,474	9,200
	11.22.16		23,739		23,739	7,149		7,149	16,590
	Polyfos		732		732	32		32	700
	Dolomie		390		390	240		240	150
	Sulf.Potass.		100		100	30		30	70
	Chlkor.Potass.		250		250	50		50	200

240

Table A13

No data available for agricultural input sales in FIANARANTSOA, 1987.

Table A14

Agricultural input sales by region, 1987 (in Kilos): ANTANANARIVO.

REGION	Fertilizer Type	price /Kilo	Previous Stocks	Received during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
Fifamanor Antsirabe	15.15.15.	250	5,000		5,000			0	5,000
	16.16.16.	250	30,684	42,000	72,684	44,384		44,384	28,300
	11.22.16	250			0			0	0
	Urea	250	27,000		27,000	5,350		5,350	21,650
	KCL	100	6,100		6,100	550		550	5,550
	PK 5.16	180	1,185		1,185			0	1,185
	Nitr.Calc.	180	1,394		1,394			0	1,394
	SGU	200	0		0			0	0
	Scories Tho	50	0		0			0	0
	Dolomie	72	1,700	39,000	40,700	36,000		36,000	4,700
	Chaux Agric	56	630		630			0	630
	Bora/Borat	234	1,359		1,359	912		912	447
	Nutramine	408			0			0	0
	Superphosp	170		100	100			0	100
	EDR	100			0			0	0
	Ca (NO3)2	180			0			0	0
Fifamanor, vulgarisation	NPK		68,720	89,000	157,720	135,916		135,916	21,804
	Dolomie			93,250	93,250	91,210		91,210	2,040
	Chaux Agricol		170		170			0	170
	Urea		2,918	6,000	8,918	8,918		8,918	0
Fifamanor Elevage	16.16.16.		82,950	207,000	289,950	135,950		135,950	154,000
	Urea			34,500	34,500	25,400		25,400	9,100
	Dolomie		24,100	64,000	88,100	88,100		88,100	0
	Borax			110	110			0	110

Table A14 (Continued)

Agricultural input sales by region, 1987 (in Kilos): ANTANANARIVO.

REGION	Fertilizer Type	price /Kilo	Previous Stocks	Received during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
COROI, Tana	Chlor.Potass.		9,589	2,300,000	2,309,589	2,306,097		2,306,097	3,492
	Sulf.Ammon		1,699	1,000,000	1,001,699	742,022		742,022	259,677
	Hyper Reno		88,318	0	88,318	41,272		41,272	47,046
	Urea perlee 46%		507,395	8,025,000	8,532,395	5,819,690		5,819,690	2,712,705
	16.16.16.		112,680	5,800,000	5,912,680	5,798,826		5,798,826	113,854
	15.15.15.		1,900	1,500,000	1,501,900	810,721		810,721	691,179
	11.22.16		6,373	8,938,000	8,944,373	7,662,034		7,662,034	1,282,339
	8.26.20.			200,000	200,000	112,071		112,071	87,929
	Phosp.Ammon			219	219	219		219	0
	Phosp.Bicalc.			770	770	770		770	0
R.A. Import Export, Tana	11.22.16			5,600,000	5,600,000			0	5,600,000
Hoechst, Tana	Blankorn			20,000	20,000	19,950		19,950	50
	NPK			1,200,000	1,200,000	817,745		817,745	382,255
COMAP, Tana	Bayfolan	Litres		10,000	10,000	339		339	9,661
SEIM, Tana	Urea 46%		299,700		299,700	277,538		277,538	22,162
	15.15.15.			250,000	250,000	250,000		250,000	0
	16.16.16.			500,000	500,000	403,000		403,000	97,000
	11.22.16			500,000	500,000	230,000		230,000	270,000

Table A15

Agricultural input sales by region, 1987 (in Kilos): TOAMASINA.

REGION	Fertilizer type	price /Kilo	Previous Stocks	Received during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
OCPG, Toamasina	Urea			3,000,000	3,000,000	2,864,000		2,864,000	136,000
	Sulf.Potass.			2,320,000	2,320,000	2,204,000		2,204,000	116,000
	Super triple			110,000	110,000	104,500		104,500	5,500
	Phosp.Bicalc			770,000	770,000	716,000		716,000	54,000
SOMALAC, Ambongalava	Urea 46%		88,000		88,000	28,762		28,762	59,238
	15.15.15		3,340		3,340	2,216		2,216	1,124
	16.16.16.		39,574		39,574	6,282		6,282	33,292
	KCL		278		278	184		184	94
	Hyper Reno		2,666		2,666	277		277	2,389
	Heobor		550		550	550		550	0
	Scories Thiomas		965		965			0	965
FAHALAMANGA, Antsirabala	16.16.16.		368,000		368,000	46,000		46,000	322,000
	Engrais Zema		165,000		165,000	165,000		165,000	0

Table A16

Agricultural input sales by region, first semester 1987 (in Kilos): MAHAJANGA.

REGION	Fertilizer Type	price /Kilo	Previous Stocks	Received during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
FITABE, Maravoay	Urea local		6,684		6,684	166		166	6,518
	Urea KFW		4,840		4,840			0	4,840
	Super Phosp		4,400		4,400			0	4,400
	Sulf Potass		8,150		8,150			0	8,150
	NKP local		7,550		7,550			0	7,550
	KFW		3,100		3,100			0	3,100

Table A17

Agricultural input sales by region, first semester 1987 (in Kilos): TOLIARA.

REGION	Fertilizer Type	price /Kilo	Previous Stocks	Received during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
SIRANALA, Analaiva	10.10.20.		1,347,760		1,347,760	329,780		329,780	1,017,980
	DAP		106,400		106,400	16,870		16,870	89,530
	Urea		445,990	85,000	530,990	38,950		38,950	492,040
SAMANGOKY, Tanandava	Phosp.Ammon		7,500		7,500	7,500		7,500	0
	Urea		348,500		348,500	164,012		164,012	184,488
	Sulf.Potass.		80,100		80,100	2,250		2,250	77,850

Table A13

Agricultural input sales by region, first semester 1987 (in Kilos): ANTSIRANANA

REGION	Fertilizer Type	Price /Kilo	Previous Stocks	Received during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
SOAMA, Andapa	Urea		9,200		9,200	904		904	8,296
	11.22.16		16,590		16,590	5,445		5,445	11,146
	Polytos		700		700			0	700
	Dolomie		150		150			0	150
	Sulf.Potass.		70		70			0	70
	Chlor.Potass.		200		200			0	200
SOAVANIO, Sambava	Sulf.Ammon.		70,107		70,107	50,626		50,626	19,481
	Urea		25,000		25,000			0	25,000
	Ammonitrate		5,000		5,000	5,000		5,000	0
	Superphosp.Tripl		91,285		91,285	0		0	91,285
	Superphosphl.simp		187,846		187,846	23,141		23,141	164,705
	Hyper Reno		200		200			0	200
	Phosp.Bicalc.		400		400	400		400	0
	Phosp.TRicalc		52,950		52,950			0	52,950
	Chlor.Potass		264,307		264,307	195,308		195,308	68,999
	Kieserite		220,474		220,474	57,975		57,975	162,499
	Boracine		26,595		26,595			0	26,595
	Heeber		3,000		3,000	3,000		3,000	0

Table A19

Agricultural input sales for FIAHARANTSOA, 1988 are not available.

Table A20a

Agricultural input sales by region, first semester 1988 (in kilos): ANTANANARIVO.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Received during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
HASYMA, Antananarivo	Urea		3,817,410		3,817,410	1,150,870		1,150,870	2,666,540
	Phosp		1,435,210		1,435,210	360,760		360,760	1,074,450
	Sulf		1,498,775		1,498,775	686,991		686,991	811,784
	Solubor		27,797	20,000	47,797	24,247		24,247	23,550
	Borocine		15,690	100,000	115,690	61,538		61,538	54,152
SIRAMA Antananarivo	Urea 46%			4,515,000	4,515,000	604,184		604,184	3,910,816
	Phosp.Tricalc.			500,000	500,000			0	500,000
	Sulf.Potass			2,880,000	2,880,000	7,056		7,056	2,872,944
	Phosp.Ammon.			135,000	135,000			0	135,000
	Phosp.Bicalc.			570,000	570,000	344,000		344,000	226,000
	Sultonitr.Ammon			680,000	680,000	280,000		280,000	400,000
	Chlor.Potass.			695,000	695,000	280,000		280,000	415,000
	Superphosp.Triple			80,000	80,000	28,000		28,000	52,000
	Sulf.Ammon			50,000	50,000	4,000		4,000	46,000
ECOPLAN Antananarivo	11.22.16		1,517,000		1,517,000	403,000		403,000	1,114,000
	15.15.15.			500,000	500,000	195,750		195,750	304,250
SEIM Antananarivo	16.16.16.		99,087		99,087	99,087		99,087	0
	Urea		22,700		22,700	6,300		6,300	16,400
	11.22.16		338,870		338,870	122,120		122,120	216,750
HOECHST, Antananarivo	11.22.16		303,650		303,650	303,650		303,650	0
	10.10.10.		3,350		3,350	3,350		3,350	0
	Super triple		4,600		4,600	4,600		4,600	0
R.A. Import Export, Tana	11.22.16		5,600		5,600	0		0	5,600

Table A20a (continued)

Agricultural input sales by region, first semester 1988 (in Kilos): ANTANANARIVO.

REGION	Fertilizer type	price /Kilo	Previous Stock	Received during yr	Total Supply	Sales	Move out of CIRAA	Lost	TOTAL	End Yr STOCK
CORDI Antananarivo	Calcaire broye		88		88				0	88
	Chlor.Potass.		2,492	40,839	43,331	2,155			2,155	41,176
	Chaux Agricole		82	12,000	12,082	2,000			2,000	10,082
	Hyper Reno		47,046	0	47,046	100			100	46,946
	Sulf.Ammon		203,660	31,091	234,751	130,412			130,412	104,339
	Urea 40%		26	8,868	8,894				0	8,894
	Urea 46%		1,861,906	58,793	1,920,699	1,912,309			1,912,309	8,390
	8.20.20.		10	1,676,853	1,676,863	5,607			5,607	1,671,256
	15.15.15.		384,428	10,600	395,028	1,728			1,728	393,300
	16.16.16.		88	3,743,999	3,744,087	611,383	117,258		728,641	3,015,446
Fifamanor, elevage	16.16.16.		154,000		154,000					
	Urea		9,100	55,000	64,100	107,300			107,300	46,700
	Dolomie			35,250	35,250	11,950			11,950	52,150
	Borax		110		110	21,050			21,050	14,200
Fifamanor, recherche	15.15.15.		5,000		5,000				0	110
	16.16.16.		28,300		28,300	15,755			0	5,000
	Urea		21,650		21,650	1,550			15,755	12,545
	KCL		5,550		5,550	162			1,550	20,100
	PK 5.16		1,185		1,185	100			162	5,388
	Nitr.Calc.		1,394		1,394	100			100	1,085
	Dolomie		4,700	30,000	34,700	17,650			100	1,294
	Chaux agricole		630		630				17,650	17,050
	Borax/Borate		447		447	339			0	630
									339	109

Table A 20b

Agricultural input sales by region,second semester 1988 (in Kilos): ANTANANARIVO.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Received during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
Fifamanor Antsirabe	15.15.15		5,000		5,000	2,200		2,200	2,800
	16.16.16.		12,545		12,545	12,045		12,045	500
	Urea		20,150	66,000	86,150	650		650	85,500
	KCL		5,388		5,388	294		294	5,094
	PK 5.16		1,085		1,085			0	1,085
	Nitr.Calc		1,294		1,294			0	1,294
	Dolomie		17,050		17,050	17,050		17,050	0
	Chaux agricoles		630		630	300		300	330
	Chaux agricoles 2			16,140	16,140	4,800		4,800	11,340
	Borax/Borate		109		109	36		36	73
COROI Antananarivo	Chlor.Potass.		41,176		41,176	40,422		40,422	754
	Sulf.Ammon.		143,460		143,460	132,929		132,929	10,531
	Hyper Reno		46,946		46,946	46,946		46,946	0
	Urea 46%		54,537	1,337,705	1,392,242	668,241		668,241	724,001
	Urea s		8,894		8,894	8,700		8,700	194
	16.16.16.		3,016,945		3,016,945	372,282		372,282	2,644,663
	15.15.15.		393,300		393,300	393,279		393,279	21
	8.20.20.		1,671,243		1,671,243	19,734		19,734	1,651,509
	11.22.16			1,077,486	1,077,486	829,051		829,051	248,435
Fifamanor Antsirabe by COROI	NPK		2,354	24,000	26,354	16,559		16,559	9,795
	Urea		40	49,000	49,040	2,140		2,140	46,900
	Dolomie		3,490	26,000	29,490	22,390		22,390	7,100
	Chaux		0	41,200	41,200	16,850		16,850	24,350
	Borax		7,812		7,812	42		42	7,770

Table A20b (continued)

Agricultural input sales by region, second semester 1988 (in Kilos): ANTANANARIVO

REGION	Fertilizer Type	price /Kilo	Previous Stock	Received during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
Fitamanor	16.16.16.		46,700		46,700	45,850		45,850	850
	Urea		52,150		52,150	21,850		21,850	30,300
	Dolomie		14,200		14,200	14,200		14,200	0
	Borax		110		110			0	110
	Calcaire broye			20,620	20,620	15,120		15,120	5,500
ODR Antsirabe	11.22.16		1,132		1,132	443		443	689
	16.16.16.		548		548	109		109	439
	0.20.20.		1,235		1,235	354		354	881
	15.15.15.		378		378	92		92	286
	Urea		1,341		1,341	253		253	1,088
	Sulf.Ammon		80		80	77		77	3
	Chaux		153		153	128		128	25
SEPCH, Antananarivo	Dolomie		27,000	76,500	103,500	72,268		72,268	31,232
	11.22.16		200	1,000	1,200	304		304	896
SOGEBIS, Antananarivo	11.22.16	360	9,950		9,950	9,950		9,950	0
	Urea	270	43,350		43,350	43,350		43,350	0
	16.16.16.	270	10,000		10,000	9,450		9,450	550

Table A21

Agricultural input sales by region, 1988 (in Kilos): TOAMASINA.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Received during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
MPARA Moramanga	Urea	180	44		44	44		44	0
	Dolomie	60	2,575		2,575	15		15	2,560
	Hyper Reno	140	69		69			0	69
	Hyper Phosp	140	544		544			0	544
COROI Moramanga	11.22.16	210	25		25			0	25
COMAF Moramanga	11.22.16	205		150	150	150		150	0
	8.20.20	380		200	200	200		200	0
	15.15.15	385		1,150	1,150	1,150		1,150	0
	Urea	385		224	224	224		224	0
	Sulf.Ammon	322		100	100	100		100	0
MPARA Fenerive Est	12.22.16				0			0	0
	PK 21.16				0			0	0
	KCL				0			0	0
COROI Fenerive Est	11.22.16	210	239		239			0	239
MPARA Ambatondrazaka	Urea	180	145,270		145,270		5	5	145,265
	11.22.16	210	718		718			0	718
	Hyper RP	50	3,415	141,100	144,515	144,100		144,100	415
	Hyper RG	50	5		5			0	5
	Dolomie	60	278,003		278,003	90,000	7,523	97,523	180,480
	15.15.15	210	323		323			0	323
	PK 21.16	60	1,866		1,866		40	40	1,826
	KCL	170	692		692	500		500	192

Table A21 (continued)

Agricultural input sales by region, 1988 (in Kilos): TOAMASINA.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Received during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
COROI Ambatondrazaka	11.22.16		432		432			0	432
MPARA Toamasina	Urea	180	4,818		4,818	46		46	4,772
	15.15.15	210	1,134		1,134	10		10	1,124
	11.22.16	210	1,836		1,836	20		20	1,816
	Chlor.K	170	150		150			0	150

Table A21b

Agricultural input sales by region,second semester 1980 (in Kilos: TOAMASINA.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Recieved during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
SOMAPALM Tamatave	Urea		86,163		86,163	36,013		36,013	50,150
	KCL		180,300		180,300	130,000		130,000	50,300
	16.16.16.		2,100	400	2,500	1,750		1,750	750
	11.22.16			4,000	4,000	50		50	3,950
	Hyper Reno		1,200		1,200	0		0	1,200
OCPG, Toamasina	Dolomie			4,000	4,000	1,500		1,500	2,500
	10.20.20.		11,000		11,000	6,250		6,250	4,750
	KCL		285		285			0	285

Table A21a

Agricultural input sales by region, first semester 1988 (in Kilos): TOAMASINA.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Received during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
SOMALAC Ambongalava	Hyper Reno	330	237		237			0	237
	11.22.16	350	n.a.	172		3,515		3,515	
	15.15.15.	325	622		622	1		1	621
	16.16.16.	350	8,403		8,403	6,686		6,686	1,717
	Triple Phos	399	0	25,000	25,000	385		385	24,615
	Urea 46%	360	45,038		45,038	17,235		17,235	27,803
	KCL	370	86		86			0	86
SOMAFALM, Tamatave	Urea		92,763		92,763	6,650		6,650	86,113
	KCL		182,000		182,000	2,150		2,150	179,850
	16.16.16		3,600	400	4,000	1,400		1,400	2,600
	11.22.16			4,000	4,000			0	4,000
	Hyper Reno		3,600		3,600	2,400		2,400	1,200
OCFGC, Toamasina	Urea			25,000	25,000			0	25,000
	10.20.20.			83,600	83,600			0	83,600
	20.10.10.			100,000	100,000			0	100,000

Table A22

Agricultural input sales by region, 1988 (in Kilos): MAHAJANGA.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Recieved during yr	Total Supply	Sales	Move out of CIRAA	Lost	TOTAL	End Yr STOCK
Mahajanga	11.22.16	210	200		200				0	200
SPAA	Urea	180	306		306	119			119	187

Table A22a

Agricultural input sales by region, first semester 1988 (in Kilos): MAHAJANGA.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Received during yr	Total Supply	Sales	Move out of CIRAA	Lost	TOTAL	End Yr STOCK
FAHAHA, Mahajanga	20.10.10.		540,000		540,000	198,850			198,850	341,150

Table A22b

Agricultural input sales by region,second semester 1988 (in Kilos): MAHAJANGA.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Recieved during yr	Total Supply	Sales	Move out of CIRAA	Lost	TOTAL	End Yr STOCK
FAHAHA Mahajanga	20.10.10.		343,300		343,300				0	343,300

Table A23a

Agricultural input sales by region, first semester 1988 (in Kilos): TOLIARA.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Recieved during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
Sodemo, Morondava	engrais		38,550		38,550	1,400		1,400	37,150

Table A23b

Table A4.5b: Agricultural input sales by region,second semester 1988 (in Kilos): TOLIARA

REGION	Fertilizer Type	price /Kilo	Previous Stock	Recieved during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
SODEMO Morondava	engrais		37,150		37,150	1,000		1,000	36,150
SIRAHALA Morondava	10.10.20		822		822	800		800	22
	Urea 46%		568		568	275		275	292
	Phosp.Ammon		85		85	59		59	25
	Hyper Reno		1		1	0		0	1

Table A24a

Agricultural input sales by region, first semester 1988 (in Kilos): ANTSERANANA.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Received during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
SO.A.MA, Andapa	Urea		4,859		4,859	2,036		2,036	2,823
	11.22.16		7,500		7,500	3,246		3,246	4,254
	Dolomie		60		60	40		40	20
	Phosp		550		550			0	550
	Sulf.Potass.		70		70			0	70
	Chlor.Potass.		100		100			0	100
SUAVOANIO, Sambava	Sulf.Ammon.		258,008	227,668	485,676	48,429	7,626	56,055	429,621
	Superphosp.Tripl		54,116		54,116	51,616	2,500	54,116	0
	Superphosp.simpl		183,174	255,986	439,160	184,934	7,892	192,826	246,334
	Urea		25,000		25,000			0	25,000
	Phosp.Tricalc.		50,411		50,411	37,842		37,842	12,569
	Chlor.Potass.		448,674	668,678	1,117,352	325,413	25,587	351,000	766,352

Table A24b

Agricultural input sales by region,second semester 1988 (in Kilos): ANTSIRANANA.

REGION	Fertilizer Type	price /Kilo	Previous Stock	Recieved during yr	Total Supply	Sales	Move out of CIRAA Lost	TOTAL	End Yr STOCK
Operation Cafe Vatomandry	Urea 46%		33,550		33,550	1,004		1,004	32,546
	11.20.20.		24,250		24,250	3,000		3,000	21,250
OCPG, Sambava	20.10.10.		16,500		16,500	5,900		5,900	10,600
	15.15.15.		350		350			0	350
	11.22.16		650		650			0	650
	Urea 46%		84,500		84,500	2,000		2,000	82,500
	Ammophos		9,400		9,400	1,900		1,900	7,500
	TSP 45/46		5,500		5,500			0	5,500
	Hyper Reno		5,000		5,000			0	5,000
	Chlor.Potass.		2,300		2,300			0	2,300
	kieserite		861		861			0	861
OCPC Ambanja	Urea		49,170		49,170	46,520		46,520	2,650
	20.10.10		75,200		75,200	75,200		75,200	0
	15.15.15.		47,854		47,854	38,104		38,104	9,750
	KCL		5,400		5,400	550		550	4,850
	Dolomie		9,210		9,210	910		910	8,300

Table A25

Fertilizer sales by fertilizer type, by region and by crop, 1985 (in kilos).

FIANANARANTSO	MPARA	CORDI	TOTAL	TOTAL IN TONS
	Fianarantso	Fianarantsoa		
11.22.16	38	1,068,284	1,068,322	1,068
15.15.15.	490	80,222	80,712	81
16.16.16		276,756	276,756	277
Urea	13,699	57,638	71,336	71
Sulfat.Amon.	1,465		1,465	1
Hyper Reno	1,774	2,000	3,774	4
Polyfos	62		62	0
KCL	3,951	198	4,148	4
Dolomie	528	2,968	3,496	3
		GRAND TOTAL IN TONS		1,510

Table A25 (continued)

Fertilizer sales by fertilizer type, by region and by crop, 1985 (in kilos).

ANTANANARIVO	MFARA Miarinarivo	COROI Miarinarivo	MFARA Tana	MFARA Antsirabe	OFMATA Tana	MAMISOA Tana	SIRAMA Tana	SEFOM Tana	COROI Tana	HASYMA 1 Tana	TOTAL	TOTAL IN TONS
11.22.16		129,383		1,039,758	326,525						1,495,666	1,496
15.15.15	298	11,006		11,743	289,968						313,015	313
16.16.16		45,685		723,805				300,000	4,748,214		5,817,704	5,818
20.10.10.					40,000						40,000	40
Urea		36,241		197,293	28,700		1,050,000		10,000	5,259,100	6,581,334	6,581
NPK 7.13									1,000		1,000	1
pk 21.16	500										500	1
Hyper Reno	135,472										135,472	135
KCL	2,041						400,000				402,041	402
S.A.	711			39,614				145,000	801,969		987,294	987
Dolomie	1,991										1,991	2
engrais			783,882	17,178							801,060	801
NPK						875,000					875,000	875
Superphosp.triple							30,824				30,824	31
Sulf.Potass							720,000			1,868,540	2,588,540	2,589
SUlfonitrate.Potass							810,000				810,000	810
Phosp.Amon.							164,000			1,167,830	1,331,830	1,332
Phosp.Alum.Calc							292,000				292,000	292
Solubor										27,380	27,380	27
Boracine										88,700	88,700	89
Neobor										1,650	1,650	2

GRAND TOTAL IN TONS: 22,623

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Table A25 (continued)

Fertilizer sales by fertilizer type, by region and by crop, 1985 (in kilos).

TOAMASINA	MFARA Fenerive	COROI Fenerive	MFARA Moramanga	COROI Moramanga	MFARA Ambatondraz	COROI Ambatondraz	MFARA Toamasina	FAHALAMANGA Antsiranala	SORIFEMA Vohidiala	TOTAL	TOTAL IN TONS
S.A. 21%	6									6	0
Urea 46%	4,829		2,307		62,696				32,780	102,612	103
FCL	191									191	0
FE 21.16	4,100				294					4,394	4
11.22.16	2,009	14,185		2,514	333	45,926				64,967	65
15.15.15					78					78	0
Dolomie			31		20,033					20,064	20
Hyper Reno			12		35,331					35,343	35
Hyper Phosp.					30					30	0
Engrais							36,738			36,738	37
Engrais simples azotes								86,050		86,050	86
NPK								537,510		537,510	538
									GRAND TOTAL IN TONS:		888

MAHAJANGA	MFARA Maintirano	MFARA Antsohihy	MFARA Mahajanga	TOTAL	TOTAL IN TONS
Urea	354		221	575	1
11.22.16	916	112	6	1,033	1
15.15.15			2	2	0
Hyper Reno			1,200	1,200	1
Dolomie			300	300	0
			GRAND TOTAL IN TONS:		3

Table A25 (continued)

Fertilizer sales by fertilizer type, by region and by crop, 1985 (in kilos).

TOLIARA	HPARA Toliara	COROI Toliara	HPARA Taolagnaro	COROI Taolagnaro	SIRANALA Analaiva	SAMANGOKY Tanandava	TOTAL	TOTAL IN TONS
10.10.20					807,220		807,220	807
11.22.16		141		4,307			4,448	4
15.15.15.					13,850		13,850	14
Urea	166		117		116,410	263,395	380,088	380
Phosp.NHU					41,400		41,400	41
Sulf.Potass						57,965	57,965	58
						GRAND TOTAL IN TONS:		1,305

ANTSIRANANA	HPARA Antsiranana	COROI Antsiranana	SOAMA Andapa	SAMBAVAVA V Sambava	TOTAL	TOTAL IN TONS
Urea	26	49,443	1,101		50,570	51
11.22.16		24,566	2,183		26,749	27
Chlor.Potass.				863,259	863,259	863
Kieserite				138,773	138,773	139
Sulf.Ammon				148,514	148,514	149
Superphosp.simple				149,499	149,499	149
Superphosp.triple				15,256	15,256	15
				GRAND TOTAL IN TONS:		1,393

Table A25 (continued)

Fertilizer sales by fertilizer type, by region 1985 (in MT).

MADAGASCAR in MT	ANTANANARIVO	FIANARANTSOA	TOAMASINA	MAHAJANGA	TOLIARA	ANTSIRANANA	TOTAL in MT
10.10.20							
11.22.16	1,496	1,068	65	1	807		807
15.15.15	313	31	0	0	4	27	2,661
16.16.16	5,818	277			14		408
20.10.10.	40						6,094
Urea	6,581	71	103	1	380	51	40
HPK 7.15	1						7,187
pk 21.16	1		4				1
Hyper Reno	135	4	35	1			5
KCL	402	4	0				176
S.A.	287	1	0			863	1,270
Dolomie	2	3	20	0		149	1,137
engrais	801		37				26
Engrais simples azotes			86				838
HPK	875		538				86
Superphosp.tr	31						1,413
Superphosp.simple						15	46
Sulf.Potass	2,582					149	149
Sulfonitrate.	810				58		2,647
Phosp.Ammon.	1,332						810
Phosp.Alum.Ca	292						1,332
Polyfos		0					292
Hyper Phosp.			0				0
Phosp.NHU							0
Kieserite					41		41
Solubor	27					139	139
Boracine	89						27
Neober	2						89
							2
	22,623	1,510	888	3	1,305	1,393	27,722

Table A26

Fertilizer sales by fertilizer type, by region and by crop, 1986 (in kilos).

ANTANANARIVO	MFARA 1	SMBCE 1	HASYMA 1	SEIM	SOGEDIS	COROI	TOTAL	TOTAL IN TONS
FK 7.13						15,147	15,147	15
8.20.20.	43,431						43,431	43
11.22.16	149,216						149,216	149
15.15.15.	11,169			1,989,350			2,000,519	2,001
16.16.16.	1,365,188			300,000	550,000	6,813,667	9,028,855	9,029
20.10.10						492,350	492,350	492
Urea	233,649	960,000	5,265,590	190,000	35,150	470,025	7,154,414	7,154
S.A.	69					325,126	325,195	325
FCI	6,215	400,000					406,215	406
Dolomie	3,380						3,380	3
Hyper Reno	15,106					9,447	24,553	25
Sulf.Potass.		410,000	1,823,560				2,233,560	2,234
Soluber			37,100				37,100	37
Epracine			126,880				126,880	127
Fhosp.Ammon.			1,654,980				1,654,980	1,655
Superphosp.Triple		110,000					110,000	110
						GRAND TOTAL IN TONS:		23,806

MAHAJANGA	MFARA 1	TOTAL	TOTAL IN TONS
11.22.16	15,755	15,755	16
Urea	4,312	4,312	4
Dolomie	235	235	0
Hyper Reno	1,500	1,500	2
GRAND TOTAL IN TONS:			22

Table A26 (continued)

Fertilizer sales by fertilizer type, by region and by crop, 1986 (in kilos).

FIANARANTSOA	ALAFI	MFARA 1	TOTAL	TOTAL IN TONS
11.22.16		104,276	104,276	104
15.15.15.	20,000	13,859	33,859	34
16.16.16.		856,449	856,449	856
Urea	5,000	71,658	76,658	77
Hyper Reno		2,230	2,230	2
KCL		1,156	1,156	1
Sulf.Ammon.		1,025	1,025	1
		GRAND TOTAL IN TONS		1,076

TOAMASINA	FAHALAMANGA Antsiranalala	MFARA 1	SOMAPALM Tamatave	TOTAL	TOTAL IN TONS
Dolomie	7,940	32,298		40,238	40
Urea	90,070	110,875	160,423	361,368	361
8.16.24	1,438,885			1,438,885	1,439
16.16.16.	8,600			8,600	9
11.22.16	200	186,121		186,321	186
15.15.15		594		594	1
Hyper Reno		10,850		10,850	11
KCL		79	130,441	130,520	131
		GRAND TOTAL IN TONS:			2,177

Table A26 (continued

Fertilizer sales by fertilizer type, by region and by crop, 1986 (in kilos).

TOLIARA	SIRANALA Analava	SODEMO Morarandava	MFARA 1	TOTAL	TOTAL IN TONS
Urea 46%	76,510	54,550	1,044	132,104	132
10.10.20.	657,030			657,030	657
15.15.15.	69,100			69,100	69
Phosp.Ammon	237,120	15,000		252,120	252
Baracine		1,200		1,200	1
Sulf.Potass.		15,000		15,000	15
Solubor C		100		100	0
11.22.16			29,617	29,617	30
Sulf.Ammon.			50	50	0
Hyper Reno			200	200	0
Dolomie			100	100	0
KCL			101	101	0
			GRAND TOTAL IN TONS:		1,157

ANTSERANANA	SO.A.MA Andapa	MFARA 1	TOTAL	TOTAL IN TONS
Urea	5,474	71,658	77,132	77
Sulf.Potass.	30		30	0
Dolomie	240		240	0
Polyfos	32		32	0
11.22.16	7,149	104,276	111,425	111
15.15.15		13,859	13,859	14
16.16.16.		856,449	856,449	856
Chlor.Potass	50	1,156	1,206	1
Sulf.Ammon.		1,025	1,025	1
		GRAND TOTAL IN TONS:		1,061

Table A26 (continued)

Fertilizer sales by fertilizer type, by region 1986 (in MT).

MADAGASCAR in MT	ANTANANARIVO	FIANARANTSOA	TOAMASINA	TOLIARA	ANTSERANANA	MAHAJANGA	TOTAL in MT
FK 7.13	15						15
8.16.24			1,439				1,439
8.20.20.	43						43
10.10.20.				657			657
11.22.16	149	104	186	30	111	16	597
15.15.15.	2,001	34	1	69	14		2,118
16.16.16.	9,029	856	9		856		10,750
20.10.10	492						492
Urea	7,154	77	361	132	77	4	7,806
Hyper Reno	25	2	11	0		2	39
KCl	406	1	131	0	1		539
Sulf.Ammon.	325	1		0	1		327
Dolomie	3		40	0	0	0	44
Phosp.Ammon	1,655			252			1,907
Baracine	127			1			128
Sulf.Potass.	2,234			15	0		2,249
Solubor C	37			0			37
Polyfos					0		0
Superphosp.T	110						110
	23,806	1,076	2,177	1,157	1,061	22	29,299

GRAND TOTAL MADAGASCAR 1986: 29,299

Table A27

Fertilizer sales by fertilizer type, by region and by crop, 1987 (in kilos).

MAHAJANGA	FIFABE Maravoay	TOTAL	TOTAL IN TONS
Urea	166	166	0
GRAND TOTAL IN TONS			0

TOLIARA	SAMANGOKY Tanandava	SIRANALA Analaiva	TOTAL	TOTAL IN TONS
10.10.20.		329,780	329,780	330
Urea	164,012	38,950	202,962	203
Sulf.Potass	2,250		2,250	2
Phosp.Amon	7,500		7,500	8
DAP		16,870	16,870	17
GRAND TOTAL IN TONS				559

ANSTERANANA	SOAVANIO Sambava	SO.A.MA Andapa	TOTAL	TOTAL IN TONS
11.22.16		5,445	5,445	5
Urea		904	904	1
Kieserite	57,975		57,975	58
Neebor	3,000		3,000	3
Chlor.Potas	195,308		195,308	195
Phosp.Bical	400		400	0
Sulf.Amon.	50,626		50,626	51
Ammonitrate	5,000		5,000	5
Superphosp.	23,141		23,141	23
GRAND TOTAL IN TONS				342

Table A27 (continued)

[illegible] Fertilizer sales by fertilizer type, by region and by crop, 1987 (in kilos).

ANTANANARIVO

	CORDI	COMAP	FIFAMANOR	HOECHST	SEIM	HASYMA	SIRAMA	TOTAL	TOTAL IN TONS
8.20.20.	112,071							112,071	112
11.22.16	7,662,034				230,000			7,892,034	7,892
15.15.15.	810,721				250,000			1,060,721	1,061
16.16.16.	5,798,826		180,334		403,000			6,382,160	6,382
Chlor Potas	2,306,097		550				690,000	2,996,647	2,997
Hyper Reno	41,272							41,272	41
Phosp.Ammon	219					85,810		86,029	86
Phosp.Bical	770							770	1
Sulf.Ammon	742,022							742,022	742
Urea 46%	5,819,690		[illegible],668		277,538	2,602,750	1,100,000	9,839,646	9,840
Bayfolan		339						339	0
Bora/Borat			912					912	1
Dolomie			215,310					215,310	215
MFK			135,916	817,745				953,661	954
Blaukorn				19,950				19,950	20
Solubor						22,710		22,710	23
Boracine						68,810		68,810	69
Phosp								0	0
Sulf.Potass.						640,980	350,000	990,980	991
Sulfonitr.Ammon.							1,270,000	1,270,000	1,270
Super Triple							111,000	111,000	111
							GRAND TOTAL IN TONS		32,807

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Table A27 (continued)

Fertilizer sales by fertilizer type, by region and by crop, 1987 (in ki

TOAMASINA	OCFG	SOMALAC Ambongalava	FAHALAMANGA Antsiranala	TOTAL	TOTAL IN TONS
15.15.15		2,216		2,216	2
16.16.16.		6,282	46,000	52,282	52
Urea	2,864,000	28,762		2,892,762	2,893
KCl		184		184	0
Hyper Reno		277		277	0
Sulf.Potass	2,204,000			2,204,000	2,204
Super tripl	104,500			104,500	105
Phosp.Bical	716,000			716,000	716
Neobor		550		550	1
Engrais Zema			165,000	165,000	165
			GRAND TOTAL IN TONS:		6,138

Table A27 (continued)

Fertilizer sales by fertilizer type, by region, 1987 (in MT).

MADAGASCAR	ANTANANARIVO	TOAMASINA	MAHAJANGA	TOLIARA	ANTSIRANANA	TOTAL
10.10.20.				330		330
8.20.20.	112					112
11.22.16	7,892				5	7,897
15.15.15.	1,061	2				1,063
16.16.16.	6,382	52				6,434
Chlor.Potas	2,997	0			195	3,192
Hyper Reno	41	0				42
Phosp.Ammon	86			8		94
Phosp.Bical	1				0	1
Sulf.Ammon	742				51	793
Urea 46%	9,840	2,893	0	203	1	12,936
Bayfolan	0					0
Bora/Borat	1					1
Dolomie	215					215
MFK	954					954
Blaukorn	20					20
Solubor	23					23
Boracine	69					69
Phosp	0					0
Sulf	0					0
Sulf.Potass	991	2,204		2		3,197
Super tripl	111	105				216
Phosp.Bicalc		716				716
Heobor		1			3	4
Engrais Zema		165				165
DAP				17		17
Ammonitrate					5	5
Superphosp.simple					23	23
Kieserite					58	58
Sulfonitr.A	1,270					1,270
	32,807	6,138	0	559	342	39,846

Table A28

Fertilizer sales by fertilizer type, by region and by crop, 1988 (in Kilos).

ANTANANARIVO

	COROI	HASYMA	HOECHST	SEIM	SIRAMA	SEFCM	SOGEDIS	FIFAMANOR	ODR	TOTAL	TOTAL IN TONS
8.20.20.	25,341								354	25,695	26
10.10.10.			3,350							3,350	3
11.22.16	829,051		303,650	122,120		304	9,950		443	1,265,518	1,266
15.15.15.	395,007							2,200	92	397,299	397
16.16.16.	983,865			99,087			9,450	73,650	109	1,165,961	1,166
Urea 46%	2,589,250	2,663,000		6,300	4,515,000		43,[illegible]00	133,490	253	9,950,643	9,951
Sulf.Amon.	263,341				50,000				77	313,418	313
Hyper Reno	47,046									47,046	47
Chlor.Potas	42,577				695,000			456		738,033	738
Phosp.Bicalc.					570,000					570,000	570
Boracine		47,230								47,230	47
Solubor		25,110								25,110	25
Super triple			4,600							4,600	5
Superphosp.Triple					80,000					80,000	80
Sulf.Potass		1,009,400			2,880,000					3,969,400	3,969
Sulfonitr.Amon					680,000					680,000	680
Dolomie						72,268		83,240		155,508	156
Borax/Borate								21,467		21,467	21
NPI								16,559		16,559	17
Calcaire broye								15,120		15,120	15
FF S.16								100		100	0
Chaux agric	2,000							22,050	128	24,178	24
Phosp.Tricalc.										500,000	500
Phosp.Amon.		991,300			500,000					1,126,300	1,126
					135,000						

GRAND TOTAL IN TONS: 21,143

Table A28 (continued)

Fertilizer sales by fertilizer type, by region and by crop, 1988 (in Kilos).

TOAMASINA	SONAFALH Tamatave	OCFG Toamasina	Op.Coffee Vatomandry	SONALAC Ambongalava	COMAP Moramanga	MFARA Moramanga	MFARA Toamasina	TOTAL	TOTAL IN TONS
8.20.20					200			200	0
10.20.20.		6,250						6,250	6
11.20.20.			3,000					3,000	3
11.22.16	50			3,515	150		20	3,735	4
15.15.15.				1	1,150		10	1,161	1
16.16.16.	3,150			6,686				9,836	10
Urea	42,663		1,004	17,235	224	44	46	61,216	61
Sulf.Ammon					100			100	0
Hyper Rene	2,400							2,400	2
KCL	132,150							132,150	132
Triple Phosp				385				385	0
Dolomie		1,500				15		1,515	2
							GRAND TOTAL IN TONS:		222

MAHAJANGA	FAMAMA	MFARA Mahajanga	TOTAL	TOTAL IN TONS
20.10.10.	198,850		198,850	199
Urea		119	119	0
		GRAND TOTAL IN TONS:		199

Table A28 (continued)

Fertilizer sales by fertilizer type, by region and by crop, 1988 (in ki

TOLIARA	SODEMO Morondava	SIRAHALA Morondava	TOTAL	TOTAL IN TONS
engrais	2,400		2,400	2
Phosp.Ammon		59	59	0
Urea 46%		275	275	0
10.10.20		800	800	1
		GRAND TOTAL IN TONS:		4

ANTSIRAHANA	OCPC Ambanja	OCPG Sambava	SOAVOANIO Sambava Consumption	SOAVOANIO Sambava Sales	SO.A.MA Andapa	TOTAL	TOTAL IN TONS
11.22.16					3,246	3,246	3
15.15.15.	38,104					38,104	38
20.10.10	75,200	5,900				81,100	81
Urea	46,520	2,000			2,036	50,556	51
Sulf.Ammon.			48,429	7,626		56,055	56
KCL	550		325,413	25,587		351,550	352
Phos.Ammon.		1,900				1,900	2
Superphosp.simple			184,934	7,892		192,826	193
Superphosp.Triple			51,616	2,500		54,116	54
Phosp.Tricalc.			37,842			37,842	38
Kieserite			117,954	166		118,120	118
Boracine			4,279			4,279	4
Dolomie	910				40	950	1
					GRAND TOTAL IN TONS:		991

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Table A28 (continued)

Fertilizer sales by fertilizer type, by region, 1990 (in MT).

MADAGASCAR	ANTANANARIVO	TOAMASINA	MAHAJANGA	TULIARA	ANTSIRANANA	TOTAL
0.20.20.	26	0				26
10.10.10.	3	6				10
10.10.20	0		0	1		1
11.22.22.	3	3	0	0		3
15.15.15.	1,266	4	0	0	3	1,272
16.16.16.	[illegible]	1	0	0	38	437
20.10.10.	1,166	10	0	0	0	1,176
Urea 46%	0		199	0	81	280
Sulf.Ammon.	9,951	61	0	0	51	10,063
Nitro Rene	313	0	0	0	56	370
Chlor.Potas	17	2	0	0	0	19
Phosp.Bical	738	132	0	0	352	1,222
Phosp.Trica	570	0	0	0	0	570
Poracine	500	0	0	0	38	538
Soluber	47	0	0	0	4	52
Super tripl	25	0	0	0	0	25
Superphosp.	5	0	0	0	54	59
Sulf.Potass	80	0	0	0	193	273
Sulfonitr.A	3,969	0	0	0	0	3,969
Dolomie	600	0	0	0	0	600
Borax/Borat	156	2	0	0	0	157
Kiesorite	21	0	0	0	1	22
NPK	0	0	0	0	118	118
Calcaire br	17	0	0	0	0	17
PK 5.16	15	0	0	0	0	15
Chaux agric	0	0	0	0	0	0
Phosp.Ammon	24	0	0	0	0	24
engrais	1,126	0	0	0	2	1,128
	0	0	0	2	0	2
	21,143	222	199	4	991	22,558

ANNEX 3

COMPANY PROFILES

SUMMARY TABLE OF FIRMS INVOLVED IN MADAGASCAR'S FERTILIZER SECTOR

NAME OF FIRM	COROI	SEPCM	ECOPLANTS	AGRICO	OCM	SEIM
MAIN ACTIVITIES	Import/Export	Agricultural inputs	Agricultural inputs	Agricultural inputs & agricultural & marine machinery	Agricultural inputs & farm implements	Oil & soap manufacture
DATE OF CREATION	1951	1965	1986	1987	1986	1960
DATE OF START OF FERTILIZER MARKETING	1951	1965	1986	1987	1986	1986
TYPE OF BUSINESS	Wholesale	Wholesale	Retail	Retail	Retail	Retail
NO. OF AGENCIES OR BRANCHES	19	2	1	1	1	2
NO. OF RETAIL OUTLETS	73	4	7	5	2	3
NO. OF GRADUATE TECHNICIANS	14	1	1	-	-	1
ADDITIONAL SERVICES	Extention/ training	Extention/ training	-	-	-	-
EXPERIENCE	Many years in the importation and distribution business	Especially in the sale of bulk quantities for cotton & sugar inputs	New entrant	New entrant	New entrant	New entrant

SUMMARY TABLE OF FIRMS INVOLVED IN MADAGASCAR'S FERTILIZER SECTOR (CONT'D)

NAME OF FIRM	BAYER/FIAVAHA	HOECHST	AFAFI	SAFAFI
MAIN ACTIVITIES	Agricultural inputs	Pharmaceutical products		Agricultural inputs
DATE OF CREATION	1988	1975	1987	1984
DATE OF START OF FERTILIZER MARKETING	1988	1987	1987	1985
TYPE OF BUSINESS	Wholesale & Retail	Wholesale & Retail	Wholesale & Retail	Retail
NO. OF AGENCIES OR BRANCHES	1	1	1	4
NO. OF RETAIL OUTLETS	1	2	-	-
NO. OF GRADUATE TECHNICIANS	2	2	2	4
ADDITIONAL SERVICES	Extention/ training	Extention/ training	-	Extention/ training
EXPERIENCE	New entrant	New entrant	New entrant	New entrant

3 PROFILE OF THE FERTILIZER DISTRIBUTION AGENCIES

3.1 AN OVERVIEW OF THE MAIN AGENCIES

COROI is the largest and one of the oldest firms currently operating in Madagascar's fertilizer sector. Its distribution network is served by 17 branches nationwide.

SOCIETE D'ENGRAIS ET DE PRODUITS CHIMIQUES DE MADAGASCAR (SEPCM) is the oldest private sector firm in Madagascar's fertilizer sector and has operated for the last 30 years through a centralized distribution system. It deals either directly with the large operators or with the wholesalers in Antanararivo.

OCM OMNIUM uses the same distribution system as SEPCM but for a greater variety of commodities. Fertilizers do not constitute OCM's main activity. It is also extensively involved in the sale of agricultural equipment as well as in the transport business.

ECOPLANTS, AGRICO and SIEM are the three firms that make an effort to locate themselves in the rural areas through their retailers. However, their source of fertilizer supply is solely from donations which considerably limits their variety of products as they depend almost entirely on official aid imports.

FIAVAMA, HOECHST and AFAFI prefer to operate under a system of ordered fertilizer supplies. Veterinary products and pesticides make up the greater part of their sales.

All the above-mentioned organizations apart from SEPCM and COROI are relatively young and still consolidating their operations. It is not entirely correct to describe the fertilizer marketing system as having a coordinated distribution network because it is made up essentially of wholesalers and retailers who try at their own level to identify the big consumer zones for fertilizer.

3.2 DETAILED DESCRIPTION OF SOME THE MAIN FERTILIZER AGENCIES

COROI

Formed in 1951, COROI is the leading company in terms of fertilizer distribution currently operating in Madagascar. It operates through 17 branches nationwide and keeps in constant contact with the distributors and villagers purchasing fertilizers and pesticides. Although all branch offices have a common marketing policy, they also have a certain amount of autonomy which permits them to contract wholesale distributors or retailers of their choice. COROI's territorial advantage leaves it well ahead of all other operators. It is the leading fertilizer dealer and maintains the highest sales volumes for cotton, sugarcane and coconut inputs.

The sale of fertilizer is carried out at two main levels:

- minimum sales at the branch offices are in 50 kg units
- the distributors dispose of fertilizer either by 50 kg bag units or by the kilo.

Promotion

No promotion has been done for fertilizers as yet. Advertisements have been carried out for other inputs such as insecticides. COROI is the only organization that carries out trial demonstrations for smallholders showing them application techniques either individually or through group training programs.

Distribution Capacity in Rural Areas

Operators are generally restricted to supplying their respective distributors along the main trunk roads.

Here again, CCROI is the only organization that holds sufficient fertilizer stocks and adequate vehicles enabling it to reach the remotest areas.

Operators are now making added efforts to serve the countryside by increasing the number of distributors and by employing mobile sales units.

SOCIETE D'ENGRAIS ET DE PRODUITS CHIMIQUES DE MADAGASCAR (SEPCM)

SEPCM's sales network in Madagascar is made up of depots in Tamatave, Antsirabe, Arivonimamo, Ambatondra and Zaka.

SEPCM carries out demonstrations on the application of insecticides and herbicide in the western and southern areas of the country and visits its clients regularly during its rounds.

SEPCM is involved in the sale of donated fertilizer supplies on a sporadic basis, and its operations are directed from one agency in Toamasina which deals mainly with clearing and customs operations.

AGRICO

AGRICO is a commercial company created in 1986, and deals with the distribution of agricultural inputs and small-scale farm implements and veterinary products. AGRICO is a subsidiary firm of MARGOS, a specialized firm which also deals with the importation of printing material, hydraulic accessories and spare parts for factories.

AGRICO imports directly with available international donor funds or distributes Aid-in-Kind fertilizer supply. Its distribution network covers the whole country. Average distances from Tana to wholesale points is 100 to 120 km and from there, the retailers are situated up to a maximum of 5 or 10 km away.

Most recent estimates indicate that AGRICO has 4,000 MT of fertilizer in storage despite the high cost of storage as a percentage of the value of the fertilizer stored. Subcontractors are used for the transport of fertilizer to selling paints around the country.

AGRICO faces problems acquiring good quality seeds and securing adequate supplies of agricultural implements. AGRICO aims to provide technical assistance to farmers in agronomy, finance and management.

ECOPLANTS

Created in 1986. ECOPLANTS does not import fertilizer but instead receives allocations of donor aid supplies, particularly from NORAD. Payment to the supplier is effected with 6 months credit limit.

Problems arise from the fact that constant supplies of aid fertilizer cannot be guaranteed. A suggested solution is to import simple component fertilizers and to blend them on arrival. This would reduce the fertilizer costs and provide more reliable supplies of the types of fertilizer that are needed by the farmers, none of whom are able to import fertilizer at the current prices.

10 to 15,000 MT could potentially be distributed by ECOPLANTS. It has 30 selling points in Tamatave, Fianarantsoa and Mahajanga and has taken over the selling points from MPARA. Its fertilizer storage capacity is 600 MT and it also leases 2 SNCF depots.

ECOPLANTS acts as the Madagascar agent for other European companies in France, Italy and Germany.

Most fertilizer is sold in 1 kg bags and primarily to small holder farmers. Since 1986, many smallholders have received BTM credits.

Fertilizer is sold either as grouped orders for one locality or on market days when salesmen have the opportunity to perform extension work, giving farmers advice on fertilizer use, crop selection etc. This extension element in their distribution network is one of their greatest strengths.

OCM OMNIUM

OCM is a private company, founded in 1982. OCM is also the agent for Fiat, Jeep 4 Wheel Drive, and other trucks. They import and distribute many agricultural inputs, from fertilizer and pesticides to small agricultural implements. Most of their products are purchased from the local suppliers. OCM has also been involved in various farming activities and has 300 Ha of

land cultivated with maize, rice and vegetable as well as an experimental pig farm.

OCM started procuring, marketing and distributing fertilizer in 1984. However they have so far not done any direct imports of fertilizer, and have only distributed the aid allocated to them by MPARA.

OCM's distribution network is made up of depots in Tana, which can handle up to 3,500 MT of fertilizer and 27 selling points up-country which are leased from MPARA (ie, old MPARA depots). These selling points can store 100 to 500 MT. Their maximum distance from Tana is 400 km.

Fertilizer is generally not stored at the regional selling points because of the security problem. It is stored in Tana and distributed to local selling points on demand. These selling points serve the farmers living in that area and supply the retailers who then distribute to the farmers in the more remote areas. Alternatively, OCM can deliver directly to a retailer. They own 4 trucks with a carrying capacity of up to 60 MT. This puts them at an advantage over other distributors.

The selling points also handle OCM's other products such as agricultural implements; fertilizer alone is not perceived as a profit-making commodity. OCM does not provide any extension services. Criteria for fertilizer distribution amongst the 27 selling points are mainly based on a standard list compiled and published regularly by MPARA. MPARA estimates the requirements as per area and these are communicated to every distributor. However, the demand cannot be satisfied due to limited supplies.

SEIM

SEIM's primary business activity is as a producer of edible oils. The fertilizer and other agricultural chemical inputs business is only a secondary activity. The country's only existing and previously state-run oil refinery was taken over by SEIM in 1970. Although production had reached a peak of 20,000 MT it decreased to 125 MT when the Government decided to take over the collection of seeds, and delayed payment to the farmers. Also the Government didn't monitor the crop quality and yields as had been done by the private sector. The refinery had to be closed in 1975 because of lack of raw materials. It was reopened in 1986 but it is still faced with production problems.

SEIM has four distribution points: Tana, Mahajanga, Lac Aloatre and one in the north of the country. In order to cover the high cost of input collection, SEIM diversified into other businesses such as garments, precious stones (they are the main producers of quartz) and fertilizers in 1985. They have 350 employees plus 50 in the regional areas. SEIM still manages to import small quantities of fertilizer, mainly in response to tenders. Distribution and sales to smallholders and retailers is carried out at three rural selling points.

SAFAFI

SAFAFI was created in 1982 for the coordination of NORAD funded Lutheran Church projects.

Fertilizer donations from NORAD were about 400 MT in 1988, 11,000 MT in 1987 and about 1,000 MT in 1986.

Projects run by SAFAFI are

- FAFAFI (extension and input supply)
- demonstration farms
- research centers
- training centers (Vonipeno and Antsirabe) with demonstration farms to train the young farmers
- demonstration plots (6) which are managed by the farmers themselves and advised by SAFAFI (this includes animal husbandry)
- laboratories (fertilizer, seeds and diseases research)
- training center for extension workers.

Crops catered for are mainly rice, maize and vegetables. Financing of the projects is done by Lutheran World Relief, NNS (Norad), American Lutheran Church and local participation.

Fertilizer and other inputs are sold to farmers at prices they can afford (ie not on a cost-plus basis). The extension workers administer the distribution of inputs which are sold either on cash or credit terms depending on their estimation of the farmer's repayment capacity.

Urea is not available in sufficient quantities and the types of fertilizer received are not always the ones required. The 1986 and 1987 markets were saturated with 16.16.16 whereas the demand for 11.22.16 was not satisfied. In 1990 SAFAFI plans to import directly because the fertilizer purchased from COROI and others is becoming comparatively more expensive.

The initial phases of all projects under SAFAFI are estimated to last for upto 3 years, after which each project will be evaluated before the start the second phase. A new research center has been established in Tana.

Under the SAFAFI program all fertilizer is sold at the same price throughout Madagascar.

Extension workers are restricted in their distribution of fertilizer because of poor transport facilities. Most of them use bicycles and can only deliver minimal amounts of fertilizer at a go.

HOECHST (Madagascar) LTD

Hoechst Madagascar is an affiliate of Hoechst AG in Madagascar. Created in 1969, Hoechst Madagascar is part of the HOECHST Group of the Indian Ocean and comprises the Seychelles, the Comoran Islands, Mauritius and Reunion.

The firm, which is purely commercial, distributes Hoechst and Roussel Ulclaf products. It offers a wide range of products and services to the manufacturing and agricultural industries such as paint, plastics, agrochemicals etc. Hoechst Madagascar distributes its products country-wide through about 20 distributors.

Hoechst Madagascar has almost abandoned the importation of fertilizers due to the competition posed by abundant Aid-in-Kind fertilizer imports.

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ESTIMATED AVERAGE RICE PADDY YIELDS PER HECTARE UNDER DIFFERENT OPTIONS

TABLE 8.7a
ESTIMATED AVERAGE RICE PADDY YIELDS PER HECTARE

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Table 8.1

DEVELOPMENT STRATEGIES

ZERO OPTION SCENARIO
RICE PRODUCTION, CONSUMPTION AND IMPORTS
SCENARIO WITHOUT YIELD IMPROVEMENTS

	(A) population (NOTE 1) mill.	(B) rice cons. (NOTE 2) tons'000	(C) paddy culture area output (NOTE 3) ha.'000	(D) total rice equiv. (NOTE 4) ton'000	(E) rice deficit ton'000	(F1) foreign exch. cost (NOTE 5) $ mn	(F2) foreign exch. cost (NOTE 5) FMG bn
1988	10.9	1,618	1,223	1,517	101	35	56
1989	11.2	1,663	1,235	1,533	130	45	72
1990	11.5	1,709	1,248	1,548	161	55	89
1991	11.8	1,756	1,260	1,563	192	66	107
1992	12.1	1,804	1,273	1,579	225	77	125
1993	12.4	1,854	1,285	1,595	259	89	144
1994	12.8	1,905	1,298	1,611	294	101	164
1995	13.1	1,958	1,311	1,627	331	114	184
1996	13.5	2,012	1,324	1,643	369	127	205
1997	13.9	2,067	1,338	1,660	408	140	227
1998	14.3	2,124	1,351	1,676	448	154	250
1999	14.7	2,183	1,364	1,693	490	168	273
2000	15.1	2,243	1,378	1,710	533	183	297

EXCH. RATE FMG/$ 1,620

NOTES TO TABLE 8.1

(NOTE 1)

Revised official population estimates 1988
Source:"Inventaire Socio-economique" Vol.I Table 2.2.2 p 41
(Direction General de la Banque des Donees de l' Etat, 1988)
Growth projections in column (A) are based on official estimates of population growth rate: 2.76% p.a.

(NOTE 2)

Re: consumption estimates in Col. (B):
Consumption estimates for 1988 are based on production estimates for 1988 plus hypothetical imports. The conversion factor for paddy to rice used in these estimates is 0.66.

	PADDY	RICE
	ton'000	ton'000
1988 production (paddy or rice equivalent)	2,300	1,518
Hypothetical imports (rice and paddy equivalent)	152	100
TOTAL:	2,452	1,618

1988 domestic consumption of rice (ton'000)	1,618
1988 population (millions)	10.86
1988 hypothetical consumption per person (kg/year)	149

Projections in col. (B) assume continued consumption per capita at 1988 levels, ie 149 kg/year

(NOTE 3)

Assumed area under cultiv. 1988 (ha.'000)	1,223
Projected annual growth of area	1.0%

(NOTE 4)

Assumed average paddy yield = 1880 kg/hectare; equivalent to an output of 1,241 kg of rice/hectare.

In a scenario without improvements of agricultural practices, average yields will at best remain at 1988 levels. This presupposes that marginal land will yield as much as average land per hectare.

(NOTE 5)

Cost of imported quality rice at depot
ANTANANARIVO incl.local transport & handling (FMG/kg) 574

price/kg cif (US$)		0.32
exchange rate (FMG/US$)		1,620
cif (FMG)		524.4
intermediate costs/kg to base point including importer's/wholesaler's margin		
9.5% of import price cif (FMG)		50
cost of import rice FMG/kilo ex-store at base point:		574
foreign exch. content & cost FMG/kg	97%	557
DIRECT AND INDIRECT FOREIGN EXCHANGE COST ($/kg)		0.34

TABLE 8.2

DEVELOPMENT STRATEGIES

OPTION 1 SCENARIO
RICE PRODUCTION AND CONSUMPTION
WITH YIELD IMPROVEMENTS WITHOUT FERTILIZERS

	(A)	(B)	(C)	(C1)	(C2)	(C3)	(D)	(F3A)	(F3)
	population	rice cons.	TOTAL paddy area (NOTE 6)	cumul. conversion to OPT.1 (NOTE 7)	cumul. conversion (NOTE 8)	average paddy yield	total rice equiv. output	indirect foreign exchange cost (NOTE 9)	forex saving rel. to ZERO.OPT (NOTE 9)
	mill.	MT'000	ha.'000	ha.'000	%	kg/ha.	MT'000	$ mn	$ mn
1988	10.9	1,618	1,223	190	16	2,005	1,618	1	34
1989	11.2	1,663	1,235	246	20	2,039	1,663	1	44
1990	11.5	1,709	1,248	304	24	2,075	1,709	1	54
1991	11.8	1,756	1,260	364	29	2,111	1,756	1	65
1992	12.1	1,804	1,273	426	33	2,148	1,804	2	76
1993	12.4	1,954	1,285	491	38	2,185	1,854	2	87
1994	12.8	1,905	1,298	557	43	2,223	1,905	2	99
1995	13.1	1,958	1,311	626	48	2,262	1,958	2	111
1996	13.5	2,012	1,324	698	53	2,302	2,012	2	124
1997	13.9	2,067	1,338	772	58	2,342	2,067	3	137
1998	14.3	2,124	1,351	849	63	2,383	2,124	3	151
1999	14.7	2,183	1,364	928	68	2,424	2,183	3	165
2000	15.1	2,243	1,378	1,010	73	2,466	2,243	4	180

EXCH.RATE FMG/$ 1,620.00
(NOTE 6)

NOTES TO TABLE 8.2

Col. (C): Assumed area under cultivation 1988 and projected annual growth of area same as in ZERO OPTION

Col. (C1): This column represent the cumulative area which has to be converted from traditional farming methods to OPTION 1 improved methods if the food deficit shown in zero option scenario shall be avoided.

Each convertion of one hectare from traditional (ZERO OPTION) agriculture to improved OPTION 1 methods yields additionally 528.00 kg rice/ha.

(NOTE 7)

Col (C2) gives a measure of the implicit difficulties in this scenario. By year 2000 three-quarters of all paddy fields will have been converted to improved methods, if the scenario shall be valid.
improved methods, if the scenario shall be valid.

(NOTE 8)

Col. (C3) represents the average yield per hectare which would result if a certain hectarage of paddy fields were converted each year from traditional to improved methods.

(NOTE 9)

Col. (F3) indicates that the foreign exchange saving from OPTION 1 is nearly a 100%. There is a small import content also in local rice produced without fertilizer, listed in col (F3a), ie an element of foreign exchange cost in the transport and handling of local rice. This is taken into account: 11 FMG/kg or 7 $/MT of marginal rice output.

TABLE 8.3

DEVELOPMENT STRATEGIES

OPTION 2 SCENARIO
RICE PRODUCTION, CONSUMPTION AND IMPORTS OF FERTILIZER (OPTION 2)
WITH YIELD IMPROVEMENTS ALSO RESULTING FROM IMPROVED HUSBANDRY

	(A) population mill.	(B) rice cons. MT'000	(C) TOTAL paddy area (NOTE 6) ha.'000	(C1) cumul. conversion to OPT.1 (NOTE 10) ha.'000	(C2) cumul. conversion (NOTE 11) %	(C3) average paddy yield (NOTE 12) kg/ha.	(D) total rice equiv. output MT'000	(H) required import of NPK or equiv. (NOTE 13) MT'000
1988	11	1,618	1,223	85	7	2,005	1,618	25
1989	11	1,663	1,235	109	9	2,039	1,663	33
1990	12	1,709	1,248	135	11	2,075	1,709	41
1991	12	1,756	1,260	162	13	2,111	1,756	49
1992	12	1,804	1,273	189	15	2,148	1,804	57
1993	12	1,854	1,285	218	17	2,185	1,854	65
1994	13	1,905	1,298	248	19	2,223	1,905	74
1995	13	1,958	1,311	278	21	2,262	1,958	84
1996	14	2,012	1,324	310	23	2,302	2,012	93
1997	14	2,067	1,330	343	26	2,342	2,067	103
1998	14	2,124	1,351	377	28	2,383	2,124	113
1999	15	2,183	1,364	412	30	2,424	2,183	124
2000	15	2,243	1,378	449	33	2,466	2,243	135

	(I1) domestic cost increase ovforex. ZERO OPTIcosts FMG bn.	(I2) direct & indirect forex. costs (NOTE 14) FMG bn.	(I3) direct & indirect forex. costs (NOTE 14) $ mn.	(J) forex. saving rel. to ZERO OPTION $ mn.
1988	13.5	10	6	28
1989	17.5	13	8	37
1990	21.6	16	10	45
1991	25.9	19	12	54
1992	30.3	23	14	63
1993	34.9	26	16	73
1994	39.6	29	18	83
1995	44.5	33	20	93
1996	49.6	37	23	104
1997	54.9	41	25	115
1998	60.3	45	28	126
1999	65.9	49	30	138
2000	71.8	53	33	150

EXCH.RATE FMG/$ 1,620.00

NOTES TO TABLE 8.3
(NOTE 6)

Col. (C): Assumed area under cultivation 1988 and projected annual growth of area same as in the ZERO OPTION scenario.

NOTE 10

Col. (C1): This column represent the cumulative area which has to be converted from traditional farming methods to OPTION 2 improved methods, if the food deficit shown in SCENARIO 1 shall be avoided. The conversion includes the improved husbandry of OPTION 1 and the input of 300 kg of NPK or equivalent fertilizer PLUS insecticides per hectare.

Each conversion of one hectare from traditional agriculture to OPTION 2 methods via OPTION 1 yields an average increase of: 1,800 kg of paddy/hectare
equal to: 1,188 kg rice/hectare

NOTE 11

Col.(C2) now indicates considerably reduced requirements to convert agriculture to modern methods,within a short time span. Even so 33% of all rice areas would have to be converted to modern methods by the end of the decade. While more feasible than full concentration on a fertilizer free conversion, it still requires that 21% of the rice areas be converted by 1995, if rice imports are to be avoided.

NOTE 12

Col. (C3) represents the average yields per hectare with a mixture of traditional and of OPTION 2 methods. The total output is the same as with OPTION 1. The balancing factor is that a much smaller hectarage needs to be converted to the higher yielding OPTION 2 system.

NOTE 13

The import tonnage of fertilizer required to satisfy the need for local rice is determined by the input requirement of 300 kg/hectare.

NOTE 14

Foreign exchange costs in this scenario are determined by import prices for NPK assumed at US 0.20 $/kg c.i.f and of the direct and indirect import costs in all local operations, including the transport of rice from farmgate to central depot.

The total forex content in local rice produced by OPTION 2
methods in this scenario is 194 FMG/kilo of rice.
At an exchange rate of 1620 FMG/$, the forex content
of local rice works at at 0.12 $/kilo at a central store,
as against imported rice at 0.34 $/kilo at a central store,

TABLE 8.4

DEVELOPMENT STRATEGIES

ECONOMICS of SELF SUFFIENCY IN RICE PRODUCTION versus RICE IMPORTS. A COMPARISON OF DIRECT AND INDIRECT FOREIGN EXCHANGE IMPLICATIONS OF THREE DEVELOPMENT SCENARIOS for the years 1988 - 2000.

	ZERO OPT. SCENARIO foreign exch. cost	OPTION 1 indirect foreign exch. cost	OPTION 1 forex. saving rel. to ZERO OPT.	OPTION 2 demand schedule for fer-tilizer	OPTION 2 direct & indirect forex. costs	OPTION 2 forex. saving rel. to ZERO OPTION
	$ mn	$ mn	$ mn	MT'000	$ mn	$ mn
1988	35	1	34	25	6	28
1989	45	1	44	33	8	37
1990	55	1	54	41	10	45
1991	66	1	65	49	12	54
1992	77	2	76	57	14	63
1993	89	2	87	65	16	73
1994	101	2	99	74	18	83
1995	114	2	111	84	20	93
1996	127	2	124	93	23	104
1997	140	3	137	103	25	115
1998	154	3	151	113	28	126
1999	168	3	165	124	30	138
2000	183	4	180	135	33	150

EXCH.RATE FMG/$ 1,620

TABLE 8.5

FINANCIAL BENEFIT/COST RATIOS
IN PADDY PRODUCTION 1984 - 1988.
ESTIMATED AT FARM GATE LEVEL.

	ZERO OPTION	OPTION 1	OPTION 2	OPTION 3
1984	1.07	1.51	1.47	1.67
1985	1.01	1.43	1.40	1.59
1986	1.38	1.99	2.11	2.42
1987	1.10	1.59	1.69	1.93
1988	1.14	1.66	1.66	1.93

PARAMETERS

Farmgate costs & prices FMG/kilo
Implicit labour costs FMG/day

	UREA	NPK	PADDY	LABOUR
1984	180	180	81	480
1985	180	180	77	480
1986	210	180	149	740
1987	210	180	119	740
1988	210	300	160	1,000

TABLE 8.6

SENSITIVITY TESTS on NPK and PADDY PRICES
Impact on Benefit/Cost ratios

Input costs FMG/kilo

NPK=519

PADDY PRICE	331	224	208	192	176
b/c ratios:					
ZERO	2.35				
1	3.43				
2	2.90				
3	3.22				

NPK=300

PADDY PRICE	331	224	208	192	176
b/c ratios:					
ZERO		1.59	1.48	1.36	1.25
1		2.32	2.16	1.99	1.82
2		2.33	2.16	2.00	1.83
3		2.70	2.51	2.32	2.12

NPK=270

PADDY PRICE	331	224	208	192	176
b/c ratios:					
ZERO					1.25
1					1.82
2					1.88
3					2.18

NPK=240

PADDY PRICE	331	224	208	192	176
b/c ratios:					
ZERO				1.36	
1				1.99	
2				2.10	
3				2.44	

NPK=210

PADDY PRICE	331	224	208	192	176
b/c ratios:					
ZERO			1.48		
1			2.16		
2			2.34		
3			2.71		

NPK=180

PADDY PRICE	331	224	208	192	176
b/c ratios:					
ZERO		1.59		1.36	1.25
1		2.32		1.99	1.82
2		2.60		2.22	2.04
3		3.00		2.57	2.36

PADDY PRICE	331	224	208	192	176

TABLE 8.7

ESTIMATED RICE PADDY YIELDS PER HECTARE UNDER DIFFERENT OPTIONS

ZERO OPTION: tradtional husbandry without use of fertilizer
OPTION 1: improved husbandry without use of fertilizer
OPTION 2: OPTION 1 plus 300 kilo/hectare of NPK 11-22-16
OPTION 3: OPTION 2 plus 66 kilo/hectare of UREA 46%

HYPOTHETICAL YIELDS PER HECTARE BY QUARTILES, AT THE NATIONAL LEVEL.

Paddy yield kilos/hectare and percent of national average yields.

YIELDS AND MARGINAL YIELDS BY QUARTILES	ZERO option traditional husbandry no fert. TOTAL HARVEST paddy kg	increase paddy kg	OPTION 1 improved hus-bandry no fert. TOTAL HARVEST paddy kg	increase paddy kg	OPTION 2 improved hus-bandry + NPK TOTAL HARVEST paddy kg	increase paddy kg	OPTION 3 =OPTION 2 +66 kg urea 46% TOTAL HARVEST paddy kg
lowest quartile	1,300	600	1,900	700	2,600	500	3,100
second quartile	1,700	800	2,500	950	3,450	800	4,250
third quartile	2,100	900	3,000	1,100	4,100	870	4,970
highest quartile	2,400	900	3,300	1,200	4,500	900	5,400
AVERAGE	1,875	800	2,675	988	3,663	768	4,430
Reference averages	1880	800	2680	1000	3680	750	4430

	OPTION 1 over ZERO OPT. percent marginal increase	OPTION 2 over OPTION 1 percent marginal increase	OPTION 3 over OPTION 2 percent marginal increase	OPTION 3 over ZERO OPT. PERCENT TOTAL INCREASE
lowest quartile	46%	37%	19%	138%
second quartile	47%	38%	23%	150%
third quartile	43%	37%	21%	137%
highest quartile	38%	36%	20%	125%
checksum average	43%	37%	21%	136%
national average	43%	37%	20%	136%

TABLE 8.7a

ESTIMATED RICE PADDY YIELDS PER HECTARE

ZERO OPTION: traditional husbandry without use of fertilizer
OPTION 1: improved husbandry without use of fertilizer
OPTION 2: OPTION 1 plus 300 kilo/hectare of NPK 11-22-16
OPTION 3: OPTION 2 plus 66 kilo/hectare of UREA 46%

	kg/ha
ZERO OPTION	1880
OPTION 1	2680
OPTION 2	3680
OPTION 3	4430

TABLE 8.7b

ESTIMATED RICE PADDY YIELDS PER HECTARE

ZERO OPTION: traditional husbandry without use of fertilizer
OPTION 1: improved husbandry without use of fertilizer
OPTION 2: OPTION 1 plus 300 kilo/hectare of NPK 11-22-16
OPTION 3: OPTION 2 plus 66 kilo/hectare of UREA 46%

HYPOTHETICAL YIELDS PER HECTARE AT THE NATIONAL LEVEL

	ZERO option traditional husbandry no fert. TOTAL HARVEST paddy kg	OPTION 1 improved hus-bandry no fert. TOTAL HARVEST paddy kg
AVERAGE YIELDS	1,880	2,680
MARGINAL INCREASE (paddy kg)		800
MARGINAL INCREASE, percent		43%
CUMULATIVE INCREASR OVER ZERO OPTION (paddy kg)		800
CUMULATIVE INCREASE (percent)		43%

	OPTION 2 improved hus-bandry + NPK TOTAL HARVEST paddy kg	OPTION 3 =OPTION 2 +66 kg urea 46% TOTAL HARVEST paddy kg
AVERAGE YIELDS	3,680	4,430
MARGINAL INCREASE (paddy kg)	1,000	750
MARGINAL INCREASE, percent:	37%	20%
CUMULATIVE INCREASE OVER ZERO OPTION (paddy kg)	1,800	2,550
CUMULATIVE INCREASE (percent)	96%	136%

TABLE 8.7c

PERCENTAGE IMPROVEMENTS IN PADDY YIELDS (kg/hectare) EXPECTED FROM CHANGES IN FARMING SYSTEMS

	OPTION 1 over ZERO OPTION percent marginal increase	OPTION 2 over OPTION 1 percent marginal increase
lowest quartile	46%	37%
second quartile	47%	38%
third quartile	43%	37%
highest quartile	38%	36%
national average	43%	37%

	OPTION 3 over OPTION 2 percent marginal increase	OPTION 2 over ZERO OPTION PERCENT TOTAL INCREASE	OPTION 3 over ZERO OPTION PERCENT TOTAL INCREASE
lowest quartile	19%	100%	138%
second quartile	23%	103%	150%
third quartile	21%	95%	137%
highest quartile	20%	88%	125%
national average	20%	96%	136%

TABLE 8.7d

ASSUMED DISTRIBUTIONS OF YIELDS BY DIFFERENT QUARTILES IN DIFFERENT FARMING SYSTEMS WITH AVERAGE YIELDS = 100%

YIELDS AND MARGINAL YIELDS BY QUARTILES	ZERO OPTION paddy kg	OPTION 1 paddy kg	OPTION 2 paddy kg	OPTION 3 paddy kg
lowest quartile	69%	71%	71%	70%
second quartile	91%	93%	94%	96%
third quartile	112%	112%	112%	112%
highest quartile	128%	123%	123%	122%
AVERAGE	100%	100%	100%	100%

TABLE 8.8

SUMMARY OF OPTION RESULTS
AT FARM GATE LEVEL AND
AT WORLD MARKET IMPORT PARITY
COSTS AND PRICES

EXCH.RATE FMG/$ 1,620

	output paddy per hectare	value of paddy at farm-gate	value of output of paddy per ha.	cost per hectare	benefit-cost ratio of output
	kg/ha	FMG/kg	FMG'000	FMG'000	
ZERO OPTION	1,875	331	620	264	2.35
OPTION 1	2,675	331	884	258	3.43
OPTION 2	3,663	331	1,211	418	2.90
OPTION3	4,430	331	1,465	455	3.22

	NET earnings per hectare excluding labour value	NET earnings per nectare including labour value	farmgate production cost of paddy per hectare including labour cost	farmgate net per kilo of paddy produced	FARMGATE NET INCLUDING LABOUR VALUE per kilo of paddy
	FMG'000	FMG'000	FMG'000	FMG'000	FMG'000
ZERO OPTION	356	591	141	190	315
OPTION 1	626	847	96	234	317
OPTION 2	793	1,014	114	217	277
OPTION3	1,010	1,232	103	228	278

OPTION 2: RATIO OF MARGINAL OUTPUT (paddy kilo) to input of 3.29 kg
RATIO OF MARGINAL OUTPUT (rice kilo) to input of 2.17 kg

NOTES TO TABLE A4.1 IMPORT PARITY VALUE OF RICE AT FARMGATE.
Import price for quality rice based on current USAID food aid shipment. Prices for broken rice and low quality rice considerably lower.

Intermediate costs/kg to base point (depots at ANTANANARIVO) of FMG 50/kilo based on corresponding handling costs for NPK (at FMG 95/kilo) but reduced to take into account relative ease of handling rice compared to fertilizers, better choice of transport (generally rail), and lower effective margins for operators. For NPK handling cost breakdown see TABLE A4.4.

Price at depot is -educed at farm-gate level by transport, collection and handling costs between farm and depot, as listed in TABLE A4.1. Foreign exchange content in local rice production & operations detailed in TABLE A4.7

NOTES TO TABLE A4.2 VALUE OF UREA AT FARM GATE.
Costs to depot based on actual costs adjusted for exchange rates. Costs between depot/store and farmgate based on information from distributor. Import content of transport and handling operations are consultant's estimates.

NOTES TO TABLE A4.3 SCHEDULE OF COSTS AND FOREIGN EXCHANGE COMPONENTS IN TRANSPORT AND HANDLING OF UREA AND NPK BETWEEN QUAY SIDE AND DEPOT.
Costings based on actual costs for recent (1989) shipments ,adjusted for exchange rates. Import content of transport and handling operations are consultant's estimates.

NOTES TO TABLE A4.4 VALUE PER KILO OF NPK AT FARM GATE.
Costings based on actual costs for recent (1989) shipments , adjusted for exchange rates. Import content of transport and handling operations are consultant's estimates. Foreign exchange content of local handling and transport = consultant's estimates.

NOTES TO TABLE A4.5 LABOUR INPUTS AND COSTS. Based on agronomist's estimates for 1989. Labour inputs in ZERO OPTION higher than in other options because of dense planting.

INPUTS OF PESTICIDES AND FUNGICIDES. Inputs and basic costs estimated by agronomist. Costs then adjusted by consultant for recent changes in exchange rates.

NOTES TO TABLE A4.6 FOREIGN EXCHANGE CONTENT OF FARM INPUTS.
This table summarizes estimates of previous Appendix Tables.

NOTES TO TABLE A4.7 FOREIGN EXCHANGE CONTENT IN LOCAL RICE.
This Table estimates foreign exchange costs, direct and indirect, per hectare. Costs per kilo derived from yields per hectare in different options, per quartile.

NOTES TO TABLE TABLE A4.8 FOREIGN EXCHANGE CONTENT OF IMPORTED AND LOCAL RICE. This Table summarizes information contained in Table A4.1 for imported rice, into store at base point and in Table A4 for local rice also into store at base point, using average yields per hectare for each option.

NOTES TO TABLE A4.9 IMPORT PARITY COST OF PRODUCTION per hectare at FARM GATE. This Table draws on and summarizes information in previous Tables of Chapter 7 and of Appendix 4. It is assumed that local resource costs adequately reflect relative scarcities of labour and transport. Likewise imported inputs such as NPK and Urea are priced without administrative adjustments of prices.

If paddy also were valued at import parity prices for imported quality rice (FMG331/kilo) all farming systems would show considerable benefits to the farmer, compared to imported rice. In each system he will be induced to increase his production. Since there is a physical limit to how much hectarage that a standard family can handle, he will only increase his profits by increasing his yield per hectare.

NOTES TO TABLE A4.10 SCENARIOS FOR RICE PRODUCTION AND DEMAND 1988 - 2000 AND REQUIRED CHANGES IN FARMING SYSTEMS.

This Table sets out assumptions of population estimates and projections in column (A). Based on estimated consumption of rice in 1988 in column (B), the Table then increases national consumption pro rata with population.

Column (C): Estimates of cultivated areas (1988) are increased by 1 percent per year. It should be noted that this estimate is based on constant yields with un-changed farming systems. In reality it is possible and likely that marginal yields will be lower than average yields. Marginal land under cultivation may then increase faster than here assumed, to make up for the lower yields per hectare. But the effect on total output might well be the same as assumed in Column (D).

Column (D) translates increasing hectarage (C) and constant average yields into domestic output in rice equivalent tonnage (conversion ratio 1 kilo paddy =0.66 kilo of rice).

Column (E) gives the difference between projected demand in (B) and projected output in (D).

Column (F) indicates the area which would have to be in farming system OPTION 1 each year, to eliminate the deficit in (E).

Column (G) gives the alternative scenario, if the conversion goes from ZERO to OPTION 2 (via OPTION 1).

Column (H) is based on the hectarage under (G) and a consumption of 300 kilo of NPK (or equivalent) per hectare.

Columns (I) and (J) are self explanatory alternatives.

TABLE A4.1

ESTIMATES OF COSTS AND OF IMPORT CONTENT OF IMPORTED RICE & IMPORT PARITY VALUE OF RICE AND PADDY AT FARM-GATE AT WORLD MARKET PRICES

Import value of rice and import parity value of rice and paddy at farm -gate. EXCH.RATE FMG/$ 1,620				import content coeff-cient		foreign exch. FMG/kg	
price:kg							
cif US $	US$	.32	D				
exchange rate FMG$	FMG	1,620	D		1		
cif FMG	FMG	524.40	D		1	524	
intermediate costs:kg to base point including importer's/wholesaler's margin							D
9.5% of import price cif:	FMG	50.00	D		.65	33	
cost of import rice FMG/kilo ex-store at base point:	FMG	574.40	D		97% D	557	D

between domestic grower and rice deficit base point on:		km	D transport cost FMG/ton/km	AVERAGE transport cost:kilo rice from farm to base point FMG/kilo		forex transport cost/kilo rice from farm to base point FMG/kilo
main roads:	km	130	80	10.4	.65D	6.76
secondary roads:	km	20	130	2.6	.65D	1.69
access roads & tracks	km	10	500	5	.5	2.5

AVERAGE transport distance km 160D ----------

total transport costs for rice from farm to base-point store: handling, collection & distribution costs, percent of base-point price ex-store (not incl; transport):	FMG/kilo	18D	10.95
		7.0%	
		40D	
SUB-TOTAL HANDLING, COLLECTION, TRANSPORT & DISTRIBUTION COSTS:		58B	
Import parity price of rice at farm-gate:	FMG/kilo	516D	
Conversion factor paddy to rice		66%	
Import parity price of paddy at farm-gate	FMG/kilo	341D	
milling cost FMG/kg paddy:	FMG/kilo	10	
NET FARM-GATE IMPORT PARITY VALUE FMG/kg OF PADDY:	FMG/kilo	331	

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NET FARM-GATE IMPORT PARITY VALUE FMG/kg OF RICE: FMG/kilo 501

TABLE A4.2 VALUE PER KILO OF UREA AT FARM GATE. COST COMPONENTS AND IMPORT CONTENT (at world market prices)

EXCHANGE RATE FMG/$ 1,620

Import parity cost of UREA at farm gate, at world market prices.

	UREA OPTION 3		import content coefficient	foreign exchange content FMG/kilo
import price c.i.f $/kg	.21			
import price c.i.f FMG/kilo	342	D	1	341.82
	FMG/kilo			
all intermediate costs except duty and importer's margin between quay-side and base	101	D	37%	37.53
importer's margin 10%	44	D	5.88%	2.6
VALUE EX-STORE incl. transport up to 50 km	487			
average additional main road transport:	6.4		65%	4.16
80 km @ FMG 80.00 per ton/km				
retailer's margin 10% incl. transport up to 30 km from retail store	49		5%	2.54
VALUE EX-RETAIL STORE:	542			
average additional access road transport from retail store	5		65%	3.25
10 km @ FMG 500.00 per ton/km				
VALUE PER KILO OF UREA AT FARM-GATE FMG/kilo	547		72%	392
UREA per hectare kilos:	66			
TOT.FARMGATE VALUE FMG'000	36	FMG '000	FMG'000	26

Farm-gate cost as a percentage of import cost cif: 160% not including import duty.

TABLE A4.3

SCHEDULE OF COSTS AND FOREIGN EXCHANGE COMPONENTS IN TRANSPORT AND HANDLING OF UREA and NPK BETWEEN QUAY SIDE AND DEPOT.

EXCHANGE RATE FMG/$ 1,620

UREA

		cif cost 342 FMG/kilo		import content coefficient	foreign exchange content FMG/kilo
bank charges	2.96%	10.10	D	0%	.00
SGS	.69%	2.35	D	100%	2.35
clear & forwdg	4.54%	15.51	D	0%	.00
road transport	14.18%	48.48	D	65%	31.51
interest	4.50%	15.38	D	0%	.00
loss	.60%	2.05	D	100%	2.05
storage	1.00%	3.42	D	0%	.00
sundries	.95%	3.24	D	50%	1.62
		100.53	D	37%	37.53
importer's margin		44.23	D	5.88%	2.6

Import coefficients are Consultant's estimates.

EXCHANGE RATE FMG/$ 1,620

NPK

	NPK	cif cost 324 FMG/kilo		import content efficient	foreign exchange content FMG/kilo
bank charges	2.96%	9.58	D	0%	.00
SGS	.69%	2.22	D	100%	2.22
clear & forwdg	4.54%	14.70	D	0%	.00
road transport	14.18%	45.95	D	65%	29.87
interest	4.50%	14.58	D	0%	.00
loss	.60%	1.94	D	100%	1.94
storage	1.00%	3.24	D	0%	.00
sundries	.95%	3.07	D	50%	1.53
intermediate costs:		95.29	D	37%	35.57
importer's margin:		41.93	D	6.20%	2.60
				forex component	38.17

Farm-gate cost as a percentage of import cost cif: 160% not including import duty.

The cost schedule for NPK is modelled on the schedule for UREA, with minor adjustments for handling differences.

TABLE A4.4

VALUE PER KILO OF NPK AT FARM GATE. COST COMPONENTS AND IMPORT CONTENT (at world market prices)

EXCHANGE RATE FMG/$ 1,620

Import parity cost of NPK at farm gate, at world market prices.

	NPK	import content efficient	foreign exchange content FMG/kilo
import price c.i.f $/kg	.20		
import price c.i.f FMG/kilo	324 D	1	324
	FMG/kilo		
all intermediate costs except duty and importer's margin between quay-side and base	95 D	37%	35.57
importer's margin 10%	42 D	6.20%	2.60
VALUE EX-STORE incl. transport up to 50 km	461		
average additional main road transport: 80 km @ FMG 80.00 per ton/km	6.4	65%	4.16
retailer's margin 10% incl. transport up to 30 km from retail store	47	5%	2.54
VALUE EX-RETAIL STORE:	514		
average additional access road transport from retail store 10 km @ FMG 500.00 per ton/km	5	65%	3.25

VALUE PER KILO OF NPK AT FARM GATE. COST COMPONENTS

VALUE PER KILO OF NPK AT FARM-GATE FMG/kilo	519	72%	372
NPK per hectare kilos:	300		
	==========		
TOT.FARMGATE VALUE FMG'000	156 FMG '000	FMG'000	112

Farm-gate cost as a percentage of import cost cif: 160% not including import duty.

TABLE A4.5

LABOUR INPUTS AND COSTS.
INSECTICIDES COSTS AND IMPORT CONTENT

LABOUR INPUTS AND COSTS
IN DIFFERENT FARMING SYSTEMS

LABOUR INPUTS & COSTS

LABOUR cost/day	FMG 1,000

Labour in days per hectare	cost/hectare FMG'000
ZERO OPT. 235	235
OPTION 1 221	221
OPTION 2 221	221
OPTION 3 222	222

INPUTS OF PESTICIDES AND FUNGICIDES
in farming systems 2 & 3
Exchange rate FMG 1,620.00 per $

pesticides & fungicides	OPTIONS 2 and 3	import content efficient	foreign exchange content FMG
kilos	3.00		
price/kg	3,500.00	70%	2450
TOTAL:	10,500	70%	7350

TABLE A4.6

FOREIGN EXCHANGE CONTENT OF FARM INPUTS

including indirect forex content in transport & distribution costs.

EXCH.RATE FMG/$ 1,620

		NPK	UREA	CHEMICALS
forex/kg input	FMG	372	392	2450
input per hectare	kilo	300	66	3
cost per hectare	FMG	111,634	25,865	7,350

FOREIGN EXCHANGE COST PER HECTARE OF PADDY

PER HECTARE	labour cost	seeds and related	insect-icides & chemi-inputs	tools cals	all inputs excl. erts.	ferti-lizers only	TOTAL COSTS includ. ferts.	margin-al cost per hec-tare
	FMG'000	FMG'000	FMG'000	FMG'000	FMG'000	FMG'000	FMG'000	FMG'000
ZERO OPT.	0	0	0	0	0	0	0	0
OPTION 1	0	0	0	0	0	0	0	0
OPTION 2	0	0	7	0	7	112	119	119
OPTION 3	0	0	7	0	7	137	145	26

	FMG	forex cost/kilo	forex % of cost
farmgate value/kg NPK	519	372	72%
farmgate value/kg UREA	547	392	72%

TABLE A4.7 FOREIGN EXCHANGE CONTENT IN LOCAL RICE
(mainly fertilizers, chemicals and local transport)

EXCH.RATE FMG/$ 1,620

	OPTION 1 marginal output of RICE equiv.per hectare kilo/ha	OPTION 1 marginal forex content in rice harvest trans-port FMG/ha	OPTION 1 marginal forex content in out-put and trpt. of rice FMG/kilo	OPTION 2 marginal output of RICE equiv.per hectare kilo/ha	OPTION 2 marginal forex content in out-put and transprt of rice FMG/kilo	OPTION3 marginal output of RICE equiv.per hectare kilo/ha	OPTION 3 marginal forex content in out-put and transprt of rice FMG/kilo
lowest quartile	396	4,336	11	462	268	330	89
second quartile	528	5,782	11	627	201	528	60
third quartile	594	6,504	11	726	175	574	56
highest quartile	594	6,504	11	792	161	594	54
average	528	5,782	11	652	194	507	62

ALL OPTIONS:
conversion factor paddy/rice 66%
foreign exch.cost in transport of rice from farm to base-point FMG/kilo 11 D

OPTION 2:

forex content of MARGINAL inputs per hectare not including transport of rice from farm to base-point : FMG/ha 118,984 D

OPTION 3:
forex content of MARGINAL inputs per hectare not including transport of rice from farm to base-point : FMG/ha 25,865 D

OPTION 3:
forex content of TOTAL inputs per hectare not including transport of rice from farm to base-point : FMG/ha 144,849 D

foreign exchange content of imported rice at base-point (including foreign exchange cost of domestic transport) FMG/kilo 557

	OPTION Total output of RICE equiv.per hectare kilo/ha	OPTION 3 average forex content in out-put and transprt of rice FMG/kilo
	2,046	82
	2,805	63
	3,280	55
	3,564	52
	2,924	60

TABLE A4.8 FOREIGN EXCHANGE CONTENT OF IMPORTED AND LOCAL RICE (FMG/kilo)

EXCHANGE RATE FMG/$ 1,620

	IMPORTED RICE forex content of imports & transport MGF/kilo	OPTION 1 marginal forex content in output and trpt. of rice FMG/kilo	OPTION 2 marginal forex content in output and transprt of rice FMG/kilo
lowest quartile	557	11	268
second quartile	557	11	201
third quartile	557	11	175
highest quartile	557	11	161
average	557	11	194
AVERAGE NET SAVINGS OF FOREIGN EXCHANGE BY PRODUCING ONE KILO OF LOCAL RICE		546	363

TABLE A4.9

IMPORT PARITY COSTS of production per hectare AT FARM GATE
(at world market prices)
EXCH.RATE FMG/$ 1,620.00

ALL COSTS EXPRESSED PER HECTARE AT IMPORT PARITY PRICES at FARMGATE

PER HECTARE	labour cost	seeds &c. inputs	insecticides etc.	labour & inputs excluding tools		fertilizers only fertiliz	TOTAL COSTS includ. ferts.	marginal cost per hectare
	FMG'000	FMG'000	FMG'000	FMG'000	FMG'000	FMG'000	FMG'000	FMG'000
ZERO OPT.	235	26	0	3	264	0	264	264
OPTION 1	221	26	0	11	258	0	258	-6
OPTION 2	221	20	11	11	262	156	418	160
OPTION 3	222	20	11	11	263	192	455	37

EXCH.RATE FMG/$ 1,620.00

	FMG
farmgate value/kg paddy	331 D
farmgate value/kg NPK	519 D
framgate value/kg UREA	547 D

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TABLE A4.10

SCENARIOS FOR RICE PRODUCTION AND DEMAND 1988 - 2000

AND REQUIRED CHANGES IN FARMING SYSTEMS

(A) pop. millions	(B) rice consumpt. forecast tons'000	(C) rice culture surface hect-ares'000	(D) rice equiv. output ton'000 constant yield		(E) rice deficit ton'000	(F) required cumul. change from ZERO OPTION to OPTION 1 ha.'000	(G) alternate cumul. change from ZERO OPTION to OPTION 2 ha.'000	(H) required import of NPK to en-able(G). ton'000	(I) % of rice area to be in OPTION 1	(J) % of rice areato be in OPTION 2
1988	11.4	1,618	1,223	1,518	100	189	84	25	15%	7%
1989	11.7	1,663	1,236	1,533	130	246	110	33	20%	9%
1990	12.1	1,710	1,248	1,549	161	306	136	41	24%	11%
1991	12.4	1,758	1,260	1,564	194	367	163	49	29%	13%
1992	12.7	1,807	1,273	1,580	227	431	191	57	34%	15%
1993	13.1	1,858	1,286	1,595	262	496	221	66	39%	17%
1994	13.5	1,910	1,299	1,611	298	565	251	75	43%	19%
1995	13.8	1,963	1,312	1,628	336	635	282	85	48%	22%
1996	14.2	2,018	1,325	1,644	374	709	315	95	54%	24%
1997	14.6	2,075	1,338	1,660	414	785	349	105	59%	26%
1998	15.0	2,133	1,351	1,677	456	863	384	115	64%	28%
1999	15.5	2,192	1,365	1,694	499	945	420	126	69%	31%
2000	15.9	2,254	1,379	1,711	543	1,029	457	137	75%	33%