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AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

TO BE COMPLETED BY ORIGINATING OFFICE

1. TRANSACTION CODE (Check appropriate box): [X] Original [ ] Change [ ] Add [ ] Delete

DOCUMENT CODE: PP

2. COUNTRY/ENTITY: Mauritania

3. DOCUMENT REVISION NUMBER:

4. PROJECT NUMBER: 682-0204

5. BUREAU: a. Symbol: AFR b. Code:

6. ESTIMATED FY OF PROJECT COMPLETION: FY 80

7. PROJECT TITLE - SHORT (stay within brackets): Vegetable Production

8. ESTIMATED FY OF AUTHORIZATION/OBLIGATION: a. INITIAL mo. 7 yr. 8 b. FINAL FY 80

9. ESTIMATED TOTAL COST ($000 or equivalent, $1 =)

a. FUNDING SOURCE	FIRST YEAR FY 78 b. FX	c. L/C	d. Total	ALL YEARS e. FX	f. L/C	g. Total
AID APPROPRIATED TOTAL						
(Grant) FN	(1042.1)	(52.9)	(1095.0)	(1042.1)	(52.9)	(1095.0)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1. Peace Corps	105.0		105.0	315.0		315.0
Other U.S. 2.						
HOST GOVERNMENT		236.5	236.5		783.5	783.5
OTHER DONOR(S)						
TOTALS	1147.0	289.4	1333.0	1357.1	836.7	2193.5

10. ESTIMATED COSTS/AID APPROPRIATED FUNDS ($000)

a. Appropriation (Alpha Code)	b. Primary Purpose Code	c. Primary Tech. Code	FY 78 d. Grant	e. Loan	FY 79 f. Grant	g. Loan	FY 80 h. Grant	i. Loan	ALL YEARS j. Grant	k. Loan
FN	110	064	1095.0						1095.0	
		TOTALS								
11. ESTIMATED EXPENDITURES			829.0		159.0		107.0			

12. PROJECT PURPOSE(S) (stay within brackets) [ ] Check if different from PID/PRP

To strengthen the vegetable extension service within the Agriculture Directorate of the Ministry of Rural Development, and promote increased vegetable production through improved techniques among small rural farmers and cooperatives with direction and guidance from the established agriculture extension service.

13. WERE CHANGES MADE IN BLOCKS 12, 13, 14, or 15 OF THE PID FACESHEET? IF YES, ATTACH CHANGED PID FACESHEET

[ ] Yes [ ] No

14. ORIGINATING OFFICE CLEARANCE

Signature

Title

Date Signed mo. day yr.

15. Date Received in AID/W, or For AID/W Documents, Date of Distribution mo. day yr.

AID 1330-4 (7-75)

VEGETABLE PRODUCTION

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Part I. Project Summary and Recommendations

The proposed project was originally conceptualized as a vegetable production project to cover nine regions in Mauritania. Additional data gathered by the consultants, consultations with USAID/Nouakchott, and recommendations made by the Islamic Republic of Mauritania indicated that the project design be altered to include only three regions (3rd, 5th, and 6th) in the southern sections of the country. It became evident that, due to limited water resources and administrative and logistical capabilities in the remainder of the country, a change in project scope and design had to be facilitated.

A. Recommendations

1. Grant Funding

It is recommended that the Vegetable Production Project be authorized by AID grant funding as follows:

Life of Project Grant Funding for FY 78 through FY 80: $1,095,000

2. Waivers and Local Costs

a) Waiver of FAA Section 636(i) to permit Code 935 procurement of 5 vehicles;

b) Waiver of competitive selection procedures for contract services for technical service assistance;

c) Authorization for local procurement of up to $58,600.00 of POL products and minor commodities including those of local production

Total new AID Obligation: $1,095,000

B. Project Description

The proposed project will strengthen the vegetable production extension service within the Agricultural Directorate of the Ministry for Rural Development. The Vegetable Production Extension Service will assist the rural population in increasing vegetable production through the use of new and improved techniques developed through educational and training programs. This effort will increase vegetable production and consumption.

The basic goal of the Vegetable Production Project is to upgrade the welfare of the rural population by increasing small farmers' incomes, productivity and consumption. The measures proposed will improve the supply and demand for vegetables and increase per capita food production and consumption in the rural sector. The project is experimental in nature and proposes to strenghten the Mauritanian institutions so that they may respond to the development needs of the rural sector.

To achieve project objectives, GIRM personnel will be trained at national, regional and local levels to plan, coordinate and implement vegetable production projects directed at improving the standard of living of the rural farmer. Emphasis will be placed on organizing and coordinating cooperatives with local peoples to provide the information, techniques, services and commodity support required to support andexecute the vegetable production project. Demonstration vegetable production plots will be established to provide demonstrations for the rural farmer showing the techniques necessary to obtain maximum yields.

The project will be coordinated with the Cooperative Development Center in Boghe so that affiliated co-ops will have a focal point for training and educational purposes.

By the end of the project, a substantial body of information about, and knowledge of, new and adapted vegetable production techniques will be available for future planning and expansion. GIRM Vegetable Production Service personnel will have been trained and operational at national, regional and local levels. An estimated 3,000 additional families will be involved in vegetable production with 200 additional hectares under cultivation and 4,000 additional tons of vegetables produced and consumed. The establishment of a Cooperative Development and Educational Center, combined with three demonstration plots, will provide the organization, marketing, credit and technical components required for future expansion of projects of this nature. Increased production will result in increased consumption which will improve the nutritional diets of the affected populations. These populations will be made aware of the need for vegetables and vegetable preparation and preservation will have been taught through manuals and materials provided by the GIRM Vegetable Production Service and women's organizations.

C. Summary Findings

1. Conclusions of Analysis

As a result of studies and evaluations for this project, the conclusions are that the proposed vegetable production project should be undertaken. The need for an expanded and up-graded vegetable

production extension service to assist the rural farmer in improving vegetable production techniques to expand present production levels has been determined. Also, the need for peoples' cooperatives as a vehicle for project support and realization has been ascertained as vital to project implementation.

2. Various Findings

The vegetable production project covers a broad spectrum in order to reach various cultural groups in the southern portion of Mauritania. Based on recent social analysis, the people appear eager and willing to participate in the vegetable production project as long as information, training, materials, and commodities are supplied. Those farmers who grow vegetables eat them, although the proportion of vegetables devoted to auto-consumption as opposed to sale varies widely. Traditionally, the people living along the river have produced and consumed the most vegetables for over 50 years, but those at Kiffa (where vegetable production is relatively new) have become extremely fond of them.

The demand for and consumption of vegetables is increasing in Mauritania. The economic benefits that will be derived from this project are: 1) reduced cost in vegetables based on increased production levels are assured with free inputs; 2) less dependency on vegetable imports; 3) the addition of vegetable production along with the staple crops of millet and sorghum will serve to increase rural sector incomes; 4) increased income range will make vegetables an additional element of the populations' regular diet, thus improving the nutritional base of the rural population.

The basic approach of educating and training the GIRM officials as well as the rural populations along with the benefits derived from the knowledge and use of new, improved techniques will make future extension of such projects possible in Mauritania. Education in vegetable extension training techniques will provide the GIRM Vegetable Extension Service with the skills required to continue these efforts after the project is completed.

D. Project Issues

A number of issues were raised in the review of the Project Review Paper. One of the issues raised was that the project was overextended and did not sufficiently take into account water resources, administration, available markets, population density and the eating habits of those in the northern areas.

The project has been redesigned with these issues in mind. The regions for implementation have been reduced from nine to three.

The three areas selected are in the south near the Senegalese River Valley where water resources are available. Planned demonstration plots and training for farmers and technicians are in the same areas of concentration. Access to and from these areas can be accomplished on existing road networks. Markets for selling vegetables produced as an end result of this project's outputs are readily available in the three major population centers of Rosso, Boghe, and Kiffa. GIRM's capacity to administer and coordinate with these three regions is simplified by easy access and communication, since the three population centers are the capitals.

Part II; Background and Detailed Description

A. General Background

Mauritania, situated on the west coast of Africa between latitudes 15° and 25° N, has an area of approximately 1.1 million km^2. The population in mid-1976 was estimated to be 1.4 million and to be increasing at the rate of 2.3% per year. The northern two-thirds of the country is desert and sub-desert, and is virtually uninhabited. Some 80% of the population, including the farmers and livestock herders, are situated within a zone not more than 180 km in width along the southern border. About 24% of the population is oriented toward the modern and trading sector of the economy, with the remaining 76% dependent upon subsistence livestock and agriculture production.

Economic developments have been affected to a great extent by the 1968-73 drought, which resulted in crop failures and losses of livestock through starvation and premature slaughter. These events, along with the increasing sedentarization of the population, have put more emphasis on the production of vegetables as a substitute for decreased livestock. The gross percapita income in the rural areas is estimated to be less than $70, one of the lowest in the world. Trade patterns for Mauritania have relied heavily upon imports in the form of live animals, consumer goods and services, and food grains from Senegal and Mali.

Agricultural Regions

Mauritania can be divided geographically into four agricultural regions: the Saharan Zone, Sahelian Zone, Sudano-Sahelian Zone, and the Senegal River Valley.

Saharan Zone

The Saharan Zone (sub-desert anddesert, with rainfall less than 250 mm per year) comprises 70-80% of the land area of Mauritania. Agricultural production is limited to date cultivation, livestock production, and seasonal Nomadic grazing with sheep, goats, and camels in scattered oases.

Sahelian Zone

The Sahelian Zone (250-500 mm rainfall per year) comprises 10-15% of the land area. Transhumant livestock production by Maure groups is the primary economic activity. Wet season grain production, on a limited basis, does occur with the use of short season millets. Transhumant herds leave this zone during the dry season for grazing sites in the Senegal Valley and the Sudanian Zone.

Sudanian Zone

The Sudanian Zone of Mauritania (500-750 mm rainfall per year) comprises less than 4% of the land area of Mauritania. A large variety of locally adapted sorghum and millet varieties are grown with maturity dates varying from 90-180 days. Family subsistence production units are of three types: transhumant pastoralists (Maures and Peuls), livestock-dependent semi-transhumant groups (Maures and Peuls), and sedentary crop-dependent households (Toucouleur, Peuls and Soninkes). The zone is normally "self-sufficient" in food grain production, yet it does some trade with drier areas to the north. However, most cash income into the zone is generated by the export of live animals. The Project zone falls largely in the Sudanian eco-climatic zone.

Senegal River Flood Plain

The Senegal River Flood Plain, (250-750mm rainfall) is the most important agricultural region in Mauritania. The Mauritanian side of the valley extends back from the river 20 to 50 km. In addition to sorghum and millet, some rice and vegetables are also grown on seasonally flooded lands. According to the DAP, 20% of the population of Mauritania lives in the valley, and it produces 80% of the country's food grains. Several major irrigation schemes are in various stages of development planning. The valley is also an important dry season grazing area for the transhumant herds of central and western Mauritania.

B. History of AID Involvement

AID's role in providing extensive bilateral development assistance to the rural sector of Mauritania dates from early 1972. It became apparent at the time that substantial assistance from AID and other donors in the international community was needed in order to plan and implement national programs and projects that would lead to permanent economic, social and political stability in the face of the enormous difficulties resulting from the 1968-74 drought.

The initial AID efforts in Mauritania were confined to emergency measures undertaken in FY73. These bilateral efforts, which were stop-gap in nature, were initiated to prevent starvation and to reduce diseases stemming from nutritional deficiencies caused by

the drought. AID's commitment of foodstuffs was initially 15,000 metric tons, supplemented by 48,250 metric tons, 4,000 metric tons and 5,500 metric tons respectively, during 1974, 1975, and 1976. During FY 74, AID contributed non-food emergency assistance in the form of medicines and vehicles valued at $252,000. In the same time frame, AID negotiated the Sahel Drought Recovery and Rehabilitation Program with the Mauritanian Government, a total of $2.915 million dollars to support range management, livestock, water, agriculture production, storage, transportation, and health programs.

In 1974, the Government of Mauritania directed the Directorate of Agriculture to develop plans for implementing family vegetable garden projects around re-settlement centers for displaced nomads. The program goal was to assist these displaced persons in establishing a means of livelihood and a semblance of self-sufficiency. AID's grant assistance amounted to $600,000, used for purchase of water pumps, seeds, fertilizers, garden tools and vehicles.

In February, 1974, under the umbrella of the Sahel R/R Grant agreement, "Operation Vegetable Production," a short-term, high impact project was financed by AID for the sum of $600,000. The project targeted primarily the nomadic populace that had lost their means of livelihood - herding - due to the drought. Garden plots (family) were established to supplement losses and to attempt to maintain self-sufficiency. The project supplied water pumps, seeds, fertilizers, garden tools and vehicles. Though the project was short-term, it produced an awareness and desire to produce and consume vegetables and substantially increased vegetable production in areas previously limited largely to herding. This effort set the framework for the proposed vegetable production project.

A Project Review Paper Design Team was fielded in Mauritania during mid-1976 for the purpose of developing a logical long-term vegetable production project proposal. In March, 1977, the ECPR review of this project (PRP) raised certain issues concerning the technical and administrative feasibility of the project. These issues have been addressed; and, in some cases resolved, and are incorporated in this paper.

C. Detailed Description - Related to

A. Goal

The proposed project has as its sector goal the promotion of self-sustained development and welfare of the rural population by increasing the productivity, consumption and incomes of the small farmers while strenghtening Mauritania's institutional ability to respond to the economic and nutritional needs of the rural sector.

Measures of Goal Achievement

In order to achieve the stated goal, GIRM personnel must be trained and qualified to plan, perfect and implement programs to expand and improve vegetable production and consumption. In responding to the rural farmers' needs by providing technical and management in-puts, the goal of increased food production and consumption will be attained.

B. Purpose

Establish and strengthen the vegetable production extension service within the Agriculture Directorate of the Ministry for Rural Development. Promote increased vegetable production through the introduction of new and improved techniques among small rural farmers. The interventions to introduce pilot vegetable demonstration plots and organize peoples' cooperatives in order to provide additional direction and guidance will increase vegetable production and will provide the fundamental approaches required to expand future vegetable production.

End of Project Status

By the end of the project, a substantial body of information and knowledge dealing with new and improved vegetable production techniques will have been provided to the rural farmer for continued future implementation. GIRM vegetable production extension service personnel will have been trained (one Chief of Vegetable Production at the national level, three Regional Vegetable Production Directors, six Regional Vegetable Productin Extension Agents) and will be available to manage, plan and implement future projects. Vegetable production extension agents will provide assistance to rural farmers by introducing new and improved techniques in vegetable production through the support and use of cooperatives. These techniques, along with improved organization of cooperatives, will increase both productivity and consumption of vegetables in the rural sector. Increased consumption of vegetables, combined with the educational programs provided through women's groups and other organizations, will increase the local population's understanding of the need for vegetable preservation and how to use them to improve the family's nutrition. This effort will increase per capita consumption of vegetables.

Out-puts

The vegetable production service will be fully established with the expansion of personnel assigned to three regions as regional supervisors and six vegetable production extension agents assigned by the GIRM to work directly with vegetable production activities. In

addition, on the national level, the Mauritanian Chief of the Vegetable Production Service will be responsible for managing this service after two years of vegetable production training in a third country. This Vegetable Production Service will be responsible for the planning, development, administration and implementation of vegetable production activities throughout the country at national, regional, and local levels.

Training for GIRM personnel from national, regional, and local levels will be provided so that they may assume the responsibilities for directing, planning, and accomplishing future vegetable production. The new techniques and knowledge that will be gained by the rural farmer will enhance his ability to improve overall vegetable production. The Chief of the Vegetable Production Service will be responsible for all vegetable production activities and related country-wide programs. This individual will be subordinate to the Director of Agriculture, Ministry for Rural Development and will replace the incumbent upon his return from two years of training at Hassan II, Morocco.

The three GIRM regional vegetable production directors will be responsible for all vegetable production activities in the regions to which they are assigned. They will attend a three month intensive seminar on vegetable production techniques and on-the-job training at Cambérène, Senegal. The six vegetable production extension agents (2/region) will receive periodic training in vegetable production techniques and theory provided by the U. S. consultants in Kaedi with primary emphasis placed on training in the field. A long-term vegetable production plan will be developed initially for the three regions with appropriate regulations and guidelines covering defined goals of vegetable production in Mauritania.

Supporting activities, as related to increased vegetable production and establishment of the Vegetable Production Extension Service, will be the development of cooperatives and nutritional education. The use of the Cooperative Education Development Center in Boghe as a demonstration center for affiliated pre-cooperatives (peoples groups) is estimated to reach 3000 farmer families. These groups will provide information on technical concepts (crop rotation, composting, mulching, etc.) as well as inputs on fertilizer and pesticides.

In support of the cooperative effort, a workable agriculture credit scheme will be formulated to enable the vegetable farmer to become independent of outside commodity assistance. Primary emphasis along this line will be carried out at the pilot cooperative development project in Boghe. Three experimental/demonstration vegetable plots

(one per region) will be established by the GIRM regional directors and will be situated near the population centers of Rosso, Boghe, and Kiffa. These demonstration plots will be used to train local vegetable production farmers from pre-cooperatives in new and improved vegetable production techniques under actual field conditions.

Total vegetable production will increase significantly. Additional hectarage that will be under vegetable production by the end of the project is estimated at two hundred. Three thousand additional farm families will participate in the vegetable production project and, through local cooperatives, are anticipated to either consume or market an additional 2000 tons of vegetables per year. The target area population is 250,000 persons (estimated); and, with increased population levels, the average person would increase his vegetable consumption by 8 kg/year. This increase in consumption will have a considerable positive impact on the nutritional status of the affected population.

D. Inputs

1. U.S.

Total U. S. participation in the project includes long-term and short-term technical assistance personnel. Long-term U. S. consultants total 48 project months (long-term is 12 p/m or more.). Short-term technical assistance totals 12 project months (short-term less than 12 p/m). The Vegetable Production Project will be headed by a Horticulturist/Project Manager to be assigned for 36 project months. This individual will assist and advise his National Chief of the Vegetable Production Service counterpart on all project matters relating to vegetable production planning and project implementation at local, regional, and national levels. In addition, as team leader, the incumbent will be responsible for project support, logistics, administration, reports, and evaluation.

The other long and short term consultants will be accountable to the project leader for their inputs, reports, and evaluations. A long-term credit/cooperatives consultant will be assigned for 12 project months to work directly with the cooperatives in organization and credit related areas. The cooperatives/credit consultant will assist the Vegetable Production Service in planning and project execution.

Periodic evaluations and recommendations will be made to define and determine any changes required in project implementation or support that would benefit the project. A hydrologist consultant will be assigned for six project months and will assist the team leader in assessing water resources as related to present and future project realization or expansion. This individual will evaluate water management and conservation as it relates to water use in the various target areas where vegetable production projects are being implemented. The incumbent will work directly with the Vegetable Production Service (GIRM) and train and advise those local extension agents and farmers who require technical assistance in the use of water resources.

A vegetable production preservation specialist will be assigned to the project for six project months. A study will be made of the feasibility of preservation of local and new varieties of vegetables, and a manual will be produced and translated that can be used by the local rural family unit for the purpose of preserving vegetables. The consultant will work closely with the Vegetable Production Service and women's groups in evaluating and recommending the appropriate steps for realizing this aspect of the Vegetable Production Project.

Vehicle and commodity assistance will be provided in supporting project implementation. Four land rovers and one four-ton (four-wheel drive) stake bed truck will be used by consultants and counterparts in providing needed transportation to evaluate the project. The truck will be used to deliver commodities to project target areas. Commodities in the form of fertilizer, tools, seeds and pumps will be financed by AID and provided to support project objectives.

Other U. S. Donor Assistance

Seven Peace Corps Volunteers (three agriculture specialists, three nutrition specialists - female - and one cooperatives specialist) will be assigned to the project to assist in field project implementation. The three agriculture specialists will be assigned to work with the Regional Vegetable Production Director in establishing the three experimental demonstration plots in Rosso, Boghe, and Kiffa. They will provide technical assistance and training to the GIRM agriculture extension agents and monitor on-site AID inputs.

The three female nutrition specialists willwork with the Women's Education Centers (CEF) in assisting these centers in teaching and demonstrating vegetable preparation and preservation techniques. In support of this effort, they will develop audio-visual aids, brochures, and teaching materials necessary to assist in providing the local family unit with information needed to improve overall nutrition.

The cooperatives specialist will divide his time between the Cooperative Educational Center in Boghe and precooperatives (peoples groups) in the field and will organize and develop pre-cooperatives and cooperative farmers groups. The formation of these cooperatives is felt to be essential for efficient and effective operations of the Vegetable Extension Service.

GIRM Input

The GIRM inputs will be primarily for personnel. Eleven GIRM personnel will be directly associated with the Vegetable Production Project. The remaining personnel (five) will be drivers. The GIRM will provide fuel for the vehicles for the last half of the project (1 1/2 yrs.), while labor will be donated by the farmers groups. The GIRM will

provide facilities (office space, training at the PMI, CEF Cooperatives Development Center, Kaedi) in addition to land and water resources for the three experimental demonstration plots.

E. Assumptions

Ultimate project success and achievement of the purpose and goal are based on a series of assumptions. The first of these is that the GIRM will be committed and will continue to regard development of agriculture as a priority. It is further assumed that natural forces such as climate and drought conditions will not work against the project. The third assumption is that the political and security situation will remain stable throughout the life of the project.

Once the project has been established and implemented, it is presumed that the target populations will understand and respect the objectives of the vegetable production project. Without that understanding and respect, future expansion by the GIRM or other donors would be extremely difficult, if not impossible. It is also assumed that, once GIRM personnel have been recruited and trained and involved with project implementation, they will not leave their respective service and will remain available to direct similar and future projects of this nature.

The achievement of outputs and the provision of inputs rest primarily on the assumption that the technical personnel assistance personnel will be available and willing to work in Mauritania. This is a most critical assumption, not only for Mauritania, but for the Sahel in general. Not only are conditions extremely difficult in Mauritania, but there is the added requirement for language ability and, with recent changes in the tax laws, the uncertainties of how willing American contract personnel will be to undertake overseas employment.

Other important assumptions to outputs are that cooperatives will be willing to work with the small farmer and can be organized with the assistance of the extension agents so that they will be able to impart their knowledge and techniques. Also, the local population must respect the projects perimeters and accept the new and improved techniques if the project is to be successful.

It is further postulated, based on outputs, that markets will be developed through the use of cooperatives and that the greater monetary benefits will result in increased production and consumption of vegetables by the population. The provision of inputs assumes (beyond the availability of expatriate personnel) that the GIRM will have qualified Mauritanian candidates forthcoming and that other inputs included in the project will arrive on a timely basis.

Part III: Project Analysis

General

The proposed project interventions discussed in the Detailed Description are considered technologically feasible by the Project Design Team. There are some basic considerations, however, that should be discussed based on assumptions and findings that were made by the team during preparation of the project paper.

Emphasis in this proposed project will be placed on establishing and strengthening the vegetable production service at national, regional, and local levels, education and training of GIRM and the local population in new and improved vegetable production techniques. The first two interventions mentioned will lay the foundation for pilot experimental interventions in organization of cooperatives and pre-cooperatives, experimental/demonstration plots and nutritional activities in the proper use, preservation and preparation of vegetables.

Data derived through technical means and its interpretation are essential in implementing new and improved techniques required to increase vegetable production as well as management and conservation of natural resources. Training and education of upper and mid-level management personnel and extension personnel are considered essential for the management of present and future vegetable production efforts.

The investment of AID monetary support will not see normal "returns" as recommended in the short-term. Actual returns on dollars spent will be possible once the basic foundation has been laid and experimental intervention expanded to the country as a whole.

Each of the activities mentioned stresses the importance of cooperation of the people, and is designed to ensure their active participation. The PP Design teams traveled into the field and spoke with the population. They found enthusiasm and motivation, for the most part, from the local population to support the project and become directly involved with it. They need, however, both material support and technical guidance.

Technical Analysis - Including Environmental Assessment

1. Target Site Selection

All three regions selected have known vegetable production, and there has been enthusiastic support for it. But, aside from these considerations, each region has its own distinct characteristics that require a differing approach. Two of the regions border on the Senegal River, and therefore, include some of the most productive agricultural land in the country (Senegal Valley), with the highest

rainfall, soils ranging from sandy to clay, and a guaranteed water source (the river). The third Region (not on the river), although not as favorable, agronomically speaking, nevertheless has a positive potential for vegetable production. Success in this region could be of special consequence for the future expansion of the vegetable production program in other more northern areas -- because of intermediate soil, water, and social conditions. (For further clarification on soils and water see Technical Analysis, Part III, Section 6 and Social Analysis.)

6th Region

This region, with Rosso as the economic capital, has perhaps the greatest immediate potential. Vegetable growing, both subsistence and commercial, has been known for many years, and the people are highly motivated. The soil conditions in the Senegal Valley are favorable, and water for irrigation is available from the river. The upstream flow of salinity will restrict river-irrigated vegetable production to a period between November and March, thus limiting much of the region to a one-crop season. In certain backwaters of Keur-Macene (near the mouth of the river), wells have to be used for irrigation, because of year-round salinity in the river valley. Vegetable growing in R'kiz district will be limited to the "depressionary area of the R'kiz lake," due to a low water table. Mederdra district has been ruled out as a target area for the same reason.

A good road from Rosso to Nouakchott renders this region unique among the three. Villages near Rosso, Keur-Macene and along the road have access to the Nouakchott market, and therefore, an outlet for the surplus vegetables they produce above local demand. This will have an effect (and already does) on both the amount produced by individual farmers, as well as what kinds are grown. Villagers, who farm primarily for auto-consumption, will remain small scale (under 1000 m^2) and grow as large a variety of vegetables as possible. These latter will mainly be in villages too far removed from the Rosso-Nouakchott artery to reasonably take advantage of the marketing possibilities it offers.

Within the accessible range of the road, many cultivators will want to farm larger plots and market most or all of their produce. The salient characteristics of these relatively large-scale producers are:

1) They will specialize in one or a few crops that are suitable for marketing (potatoes, onions, beets);
2) They will probably use more production inputs (fertilizer, pesticides) than the average subsistence farmer;
3) They will be more likely to adopt improved techniques introduced by the agriculture extension agent, and hopefully, be more amenable to a credit scheme in which they pay back money -- or material -- loans at harvest time.

The greatest immediate increases in production will probably be experienced in this southwestern part of the 6th Region.

While the 6th Region has known both subsistence and commercial farming for some time, what has been missing, for the average farmer, is production inputs (seed, tools, fertilizer, pesticides) delivered at the right time. The Vegetable Production Service will provide the necessary materials and technical information on a timely basis. The logistics within this area will be the least complicated, the returns on project inputs, the most abundant.

Lastly, this region has had a varied experience in the realm of cooperative-farmer organizations, as reflected in divergent field trip reports prepared by the PP team and the Vegetable Production Mission Team that toured the area in January-February 1977. It would appear that the field workers (agriculture agents) will have to vary their approach to cooperative group formation, suiting it to the particular experience of each village. (see Cooperatives Report, Section IV, for strategy in 3rd and 6th Regions).

The target areas selected for the 6th Region are in the districts of Rosso, Keur-Macene and R'kiz. In R'kiz, only the immediate area of Lake R'kiz is targeted. Suggested villages in Rosso District are: Tezaya, Jedr Moghen, Chagara, Guidakhar, Medina Gaya, Keur Madis, Lkhoueat and Cheikh Niang. Within Keur-Macene district: Dar el Salaam, Sebekhat I and II, Khara I and II, Zire and Dara. Final, specific village selection should be made by the Horticulturist/Project Manager, along with the PCV agriculture extension volunteer, and their respective Mauritanian counterparts.

5th Region

Like the 6th Region, the 5th Region borders on the Senegal River and therefore shares with the former much of the best farming land in Mauritania, along with the river as anirrigation source. Aleg, to the north, is the economic capital, but due to water problems is of secondary importance as far as vegetable producing districts are concerned. The vegetable producing districts are Boghe, M'Bagne and Bababe.

The 5th Region does not have the problem of salinity back-flow as a limiting factor in river irrigation. Vegetables can be grown from October to May, with two full crops harvested per season. The problem, particular to the region, is an inadequate transportation infrastructure, hampering evacuation of produce to larger markets and timely provision of production inputs. Concomitant with this shortcoming are glutted markets during the peak production season, and a late and poorly planned planting schedule.

The problem of over-supply on the market can be resolved by:

1) Staggering the planting schedule to obtain a continual and balanced supply of vegetables throughout the season (December-May);
2) Managing the timing, quantity and kinds of seed distributed; and,
3) Introducing improved methods of preparation.

All three solutions are part and parcel of the project design. The first two will be addressed by the Horticulturist/Project Manager, PCV agriculturist and agriculture extension agents; the third, by the TDY expert on small-scale vegetable preservation methods, and the PCV women's extension specialist, with counterpart.

The 5th Region being the target site for the pilot cooperatives-development center (see Cooperatives Report), the extension personnel will be dealing primarily with farmer groups, rather than with individuals. This will facilitate distribution of materiel, transmission of technical information to farmers, and data collection for project evaluation.

Target areas are the districts of Boghe, M'Bagne, and Bababe. Suggested villages: Olo Ologo, Beilane, Ranere, Donnaye, Boghe, Dar el Barka, M'Bagne, N'Goral, and Louboudou. Again, final specific selection will be made, "sur place," by the project implementers.

3rd Region

The 3rd Region is unique in many ways:

1) Vegetable production is relatively new to area.
2) The extension service is especially inadequate; and,
3) Water shortage is critical (the only sources being wells or permanent ponds).

In addition, this region shares with the 5th Region the restriction of an inadequate transportation infrastructure.

Soils around ponds and oases are suitable for vegetable farming (sandy to sandy-clay) with appropriate fertility-management practices. Potatoes are particularly favored by the local population, although seed has been expensive and difficult to procure. Reasons include: storability, transportability, and taste preferences.

Presently, the only markets for vegetables are at Kiffa and at Kankossa. Therefore, in large part, the project should aim at production for auto-consumption and barter. The road being built from Nouakchott to Kiffa will have a sizeable impact on vegetable marketing, but that is in the indefinable future.

The water restrictions will limit target site selection to areas around permanent ponds and humid lowlands. The areas chosen at this point are: the humid depression around Kiffa, and around the ponds of Kankossa. Specific sites (villages) will be identified by the Horticulturist/Project Manager.

Summary Contents

The selected target districts in the 3rd, 5th, and 6th Regions claim a sedentary population of 187,612 (report of provisional results of the 1977 census), and a nomad tally of 62,500. That is 16.9% of the national figure. The respective percentages for each region are: 5.2%, 4.6%, and 7.1%

The target population of 3000 farmers, broken down on a proportional basis of the sedentary population of each target region, gives the following:

3rd Region	Kiffa	408 farmers
	Kankossa	345 farmers
5th Region	Boghe	495 farmers
	M'Bagne	336 farmers
	Bababe	243 farmers
6th Region	Rosso	486 farmers
	R'Kiz	534 farmers
	Keur-Macene	153 farmers
		3000 farmers

Of course, these figures are not iron-clad, but they might be useful as a general guideline, in the final planning and target group selection.

Using 200 hectares as the project-end production goal, the respective hectarge is:

		3 year total	Per year
3rd Region	Kiffa	27.2 ha	9.07 ha
	Kankossa	23.0 ha	7.70 ha
5th Region	Boghe	33.0 ha	11.00 ha
	M'Bagne	22.4 ha	7.47 ha
	Bababe	16.2 ha	5.40 ha
6th Region	Rosso	32.4 ha	10.80 ha
	R'kiz	35.6 ha	11.87 ha
	Keur-Macene	10.2 ha	3.40 ha
		200.0 ha	66.70 ha

2. Nutrition Education and Training

While a program of nutrition education is not essential to the success of the project in production terms, there is a clear need for extension advice on use of vegetables. This is especially true where vegetable cultivation is introduced for the first time. It was noted last year in the 6th Region that many newly sedentarized Maures (Moors) did not know how to prepare the vegetables they grew, and ended up feeding them to animals -- not because they didn't want the vegetables but because the ways they had improvised to prepare them (dried lettuce leaves, for example) were clearly unpalatable. If vegetable production and consumption are to be expanded to populations which are not traditional vegetable consumers (particularly former nomads), then some educational effort is needed.

Extension agents to be trained as part of this project should receive basic instruction on the nutritional properties of vegetables, and on how to store, clean and cook them for optimal nutritional value. This instruction could be given on the job, and would require no great technical knowledge on the part of the instructor or trainee. Simple USDA pamphlets written for laymen would suffice for texts. No additional personnel would be required for the effort. The rationale for such instruction is obvious. No agent should disseminate vegetable seeds without some idea of their value to the human body, and without some idea of what one does with them once grown.

However, the training of male agricultural extension agents cannot be the full answer to better use of vegetables. Women decide how to prepare the family's food. If vegetables are to be used properly, it is the woman one must touch. Given the sharp sex distinctions and restrictions of Mauritanian society, especially among Maures, it is unwise to depend on male agents to teach about cooking. (Many men would consider this subject below them. Women should be chary of accepting a man's advice in their domain. It would be a socially uncomfortable relationship. In existing nutrition education services, apart from male-dominated primary education, women are always taught by other women.)

Existing nutrition education services have little hope of touching the rural population. Maternal child health centers (PMI) in large towns provide cooking demonstrations aimed at mothers of small children. These practical lessons can be effective if women can afford the ingredients required. Unfortunately, no PMI has outreach capability. There is no transportation available, insufficient funding, and insufficient staff for work beyond the town limits. The sites chosen for vegetable production are likely to be so scattered as to require nearly full-time attention during the six-month growing season.

A new system of Centres d'education feminine has been set up by the national political party. In principle, these centers provide nutrition education and cooking classes to town women, and train women to become unpaid Party teaching representatives (monitrices in smaller towns). Unfortunately, the system is not yet operational, and little hope is given it by officials of other ministries (its history so far is not inspirational). However, given outside help (as is now present in the form of a French nun in the Rosso center) the centers can play a role in the education of town women. Unfortunately, the centers have no outreach power because of lack of transportation and staff. Adding to their staff locally is also not feasible, given the seeming inability to pay those already serving.

The primary school system is now instituting nutrition education aimed at girls. This is a worthy effort, but being aimed at very young girls, and being largely theoretical in nature, it can be expected to have little immediate effect.

A nutrition education component of vegetable production is a felt need, repeatedly brought up in discussions of the project on national and regional levels. Needed is a woman (one in each region) who would be able to travel (with the PCV agricultural agent) giving practical demonstrations in cooking, storage, and preservation methods. This women would need some prior short-term training in the concepts and techniques she will teach. She would also need language training. A Peace Corps Volunteer is recommended for this role.

3. Nutrition

Very little is known about the nutritional situation in Mauritania. There is little information on any aspect of the subject, and virtually no hard data(none that is particularly trustworthy and/or revelatory). Until recent years, GIRM showed no interest in nutrition. Since the drought, however, more attention has been paid to nutritional concerns, but mostly to the end of attracting food aid. However, this is a step in the right direction. GIRM officials now admit to a nutritional problem in Mauritania - one which is a threat to the future.

It is widely agreed that the major nutritional problem in Mauritania lies in caloric deficiency. There is not enough food to feed the population, or more precisely, food supplies are badly distributed among the population. It is estimated (on what basis is unknown) that the average Mauritanian takes in 1900 calories per day. There are unfortunately many who have difficulty reaching even this level.

It is generally agreed, as well, that vitamin deficiencies are increasingly seen in the Mauritanian people. Unfortunately, there has been little or no clinical testing and there exist differences of opinion over the extent of the problem.

It is certainly true that the traditional Mauritanian diet, based heavily on milk, cereal and meat, is gravely threatened. As a result of the drought and increasing sedentarization, herds have been greatly decimated (estimates of drought losses ran to 50%). It is unlikely that herds will ever re-attain their pre-drought levels, nor should they. Meanwhile, the population is growing with rapid urbanization. (The latest census estimates the urban population at 23%). Fresh milk becomes more and more difficult to find at all for town dwellers. Those with money buy powdered milk (generally called lait Kennedy); those with little money do with less. Squatters and the very poor keep a goat or two to supply basic needs, but the result is that for most people milk (once the major source of calories and nutrients) must diminish.

In Mauritania this is a shocking change. The typical Mauritanian diet calls for zrig (cool milk/water/sugar) as a beverage at all hours, as the first offering to a guest, as a preferred thirst quencher. Milk is also used in porridge, both for children and adults. And, milk traditionally was used to fatten Maure girls before marriage (a custom happily reported to be dying out).

Meat has also become prohibitively expensive for many people. A smallish sheep costs $44 in one provincial town -- far beyond the buying capacity of most citizens.

But, the drought did have some beneficial effects on diet. Hungry people will eat what they previously shunned. Many Maures (Moors), even nomads, now eat fish, both dried and fresh. And, more and more people are eating vegetables.

At the end of the drought, the GIRM started a vegetable promotion campaign, which has been assisted in various ways by international donors, including AID. Figures on vegetable production are wholly unreliable and none will be given here. But, from numerous interviews and personal observations, it is quite clear that every year more and more people are planting and eating vegetables, not just in urban centers but in areas far from any markets. Newly sedentarized Maures are themselves turning to vegetable production and consumption, again a break from tradition.

The subsistence consumer, then, is gradually adding new nutrient sources to his/her diet. The basic diet remains, of course, couscous or rice with sauce (if possible financially, meat or fish with or without vegetables), milk and sugary mint tea.

Mauritanian dietary habits are not identical to those of other Sahelian populations. Weaning, though it can be difficult, is considered less of a health danger here than in neighboring countries. Credit is given to milk consumption (camel, goat, cow) and to the fact that, if rations are limited, children are given all the family's milk supply. Children are, in principle, given preference in intrafamilial food distribution.

At the same time, however, undernourishment is seen in many children. Foreign observers report that cases are especially prevalent among White maures. Various explanations have been suggested, but none proven. The Maure social system, which provides that children be raised by servants rather than parents, has been suggested as an answer. Gastrointestinal disorders and other medical problems causally linked with infantile childhood undernutrition are reportedly quite prevalent in the country. Perhaps sanitary conditions among the Maures are inferior to those of other groups. Or perhaps poor Maures are more noticeable in this class and race-divided society than others. Perhaps cases among White Maures are not more common at all. At this point, it is impossible to say, there having been no impartial study made of the subject.

To improve the nutritional status of the subsistence consumer, one needs basically to increase income. He needs to be able to grow more grain (or other food crops) to eat or sell. Obviously, this is not an easy task, given Mauritania's climate, soils, water problems and economic situation.

An unfortunate trend is now taking place in southern Mauritania. Flood plains are more and more being given over to rice paddies. This is lamentable. Rice cultivation is expensive -- water must be pumped in hugh quantities from the river. It is labor intensive, meaning that farmers have little time for other work during rice seasons. It takes up the same land that once held millet and sorghum crops, effectively eliminating these crops in recession agriculture, and gradually eliminating them from the diet (rice growers interviewed often reported no time to grow other cereals, and no commercialization of their rice crop, therefore few purchases of other grains). Rice is consumed highly polished. This habit was learned from years of eating imported Asian rice. Now brown rice is considered unsavory. The whiter the better. Replacement of millet and sorghum by white rice is, nutritionally, a step in the wrong direction.

In theory, the rice grower can achieve high yields (more tonnage per hectare, more harvests per year, than other crops), but the cost seems too high economically (purchased inputs are high and many farmers are already having second thoughts in rice cultivation), environmentally (taking so much water out of the river

increases saline contamination risks), and nutritionally. Obviously, there is little AID can do to prevent this shift, especially since it is financially supported by FED and the IBRD. Nevertheless, this trend should be noted as significant.

To improve the nutritional status of the rural sedentary population, more effort needs to made in all fields. Better agricultural extension services are necessary, so as to improve farming techniques. A better distribution system for agricultural inputs is needed. A more efficient mobile health service is required. All services are now basically weak in their rural links.

The farmer and consumer both need to be better educated. Both formal and informal instruction is greated needed in agriculture, health, nutrition, and child care, but at this point official interest is slight.

Nutrition education is only now beginning on all levels of instruction. WHO has just stationed a nutritionist to instruct national nursing school students of midwifery in nutrition; primary school students are to begin studying nutrition using a manual put out by FAO (but as yet undelivered). Trained staff of centres d'education feminine are given practical nutrition education during their 3-year formation at ENECOFA training school in Nouakchott. All of these services are new, and therefore difficult to evaluate. They are to be encouraged, however, for perhaps at some point they would benefit from AID assistance, but they need more proving time first.

Additional Research

Virtually no research on nutrition has been carried out in Mauritania in recent years. The large majority of studies date from the colonial era, but with the massive demographic changes in the last few years (because of drought and increasing sedentarization) these studies are no longer valid.

Much is also written about Mauritania which is simply fictitious. Of the few sources available, two place the rainy season as much as six months off-schedule (somehow Mauritania has a winter rainy season, while bordering nations have a summer one).

There is a clear need for research on all aspects of nutrition in Mauritania. The nutritional studies envisioned as part of the AID Rural Sector Assessment should prove quite helpful.

Especially useful would be more detailed analysis of nutritional problems -- the extent of vitamin deficiencies, for example. Fortifying sugar with Vitamin A has been suggested, but there is need of better assurance that such a deficiency really exists.

Cooperative Development Center

The people are enthusiastic and, with proper encouragement, counsel and support, are ready and willing to form pre-cooperatives and co-operatives. To this end, the establishment of cooperative education centers is considered important, if not critical by the aforementioned Chef. These centers would train cooperative officers (2 years), provide consultation services for maybe 30-40 coops/centers, and eventually the education ministry willing, serve as a vocational school for the training of future coop extension agents or cooperative officers.

There is a cooperative education center being established in Boghe (5th Region), sponsored in part by the Ecumenical Council of Churches (of Upper Volta). The total cost for this project is 5 million Ouguiya ($112,000), 3.2 million to be contributed by the ONG(non-governmental organization), the national share being 1.8 million UM. This sum is to be used for the construction of a "Centre de Formation et d'Animation" at Boghe; the purchase of furniture (for office, kitchen, dormitory), vehicles (land rover and bus), and audio-visual aids (camera, portable generator, movie projector, slide projector, cassette recorders and a screen); provision of scholarships; hiring of personnel (director, teacher, secretary, drivers, cook and janitors); and, paying other operational expenses. The center will serve 37 cooperatives (agriculture, crafts, fishing) that are in the vicinity of Boghe.

Pre-Cooperatives

A publication, prepared by the "Division des Groupements Cooperatifs et des Mutuelles Agricoles," describes, in a visual format, the formation of a pre-cooperative in Mauritania. The pre-conditions for a "Groupement Pre-cooperatif" are: to have at least seven persons, who do the same work (agriculture, fishing, crafts) in the same locality, and who have the same needs. A board of directors (officers) is elected and the general membership meets at least once a month. The members contribute voluntarily toward the capital needs of the future cooperative, and begin work collectively. Regular meetings are held with the cooperative -- and agriculture -- extension agents. After three or four years, if the pre-cooperative group has evolved properly, it becomes a cooperative. Otherwise it is dissolved.

Description of a Pre-Cooperative

Name: Women's "Groupement Pre-Cooperatif" Tind Soueileme
Location: 3 kilometers outside Nouakchott
Funding Organization: "Couseil Oecuemique des Eglises"
Expert: IVS Volunteer/Horticulturist
Membership: 30 women and their families (Maures and Toucouleurs)

Attention should be given to urban consumption patterns, which are now in transition, and to urban nutritional problems. More study would be useful on weaning patterns, and the nutritional status of children 0-5. Anemia during pregnancy has been suggested as an endemic problem here, but no clear proof exists. Studies should consider all ethnic groups and all geographic regions, to the extent possible.

UNICEF has proposed a massive nutritional survey which would cover virtually all aspects of the situation. It is considered unlikely that this survey will materialize in this sweeping form. But, if a modified, more realistic survey is carried out, AID participation could be quite useful.

Any survey or research work done on nutrition in Mauritania will require foreign staffing. A limited number of surveyors could be trained as a part of the study project, but it is unlikely that GIRM could spare any trained personnel for this purpose. This limiting factor should always be kept in mind. The institutional capabilities of GIRM are low, and nutrition research is not given a very high priority at this point.

4. Cooperatives

Cooperatives, as functioning or efficient organisms, are virtually non-existent in Mauritania. Or, so says the "Chef de la section d'education et formation cooperative" of the agricultural directorate, who himself is very enthusiastic about the potential for cooperatives in the rural development plan for Mauritania. He blames it primarily on the lack of a national supportive program for cooperatives (lack of credit and material support), a state of affairs that he feels is unique to Mauritania.

He dates the cooperative program from 1960 (independence), when the "Service de la cooperation" was created, as he describes it, to "faire le cinema." People were encouraged to form pre-cooperatives and cooperatives in each village. But, they were mostly non-functioning entities registered as cooperatives, whose activities rarely exceeded viewing films. In 1967, with the aid of an expert consultant provided by the "Bureau International du Travail," a program of pre-cooperative development was instituted with a little better success; but, the idea of "faire le cinema" still persists in most cooperative farmer groups.

With the absence of a national program of support, the pre-cooperative and ultimately the cooperative must be auto-supportive. Or, it can solicit funds from self-help programs of various international agencies. However, without encouragement and knowledgeable advice and assistance, it is rare for a village group to succeed in establishing a functioning cooperative.

Permanent Installations: Concrete housing for chickens (approximately 80 m^2)
4 concrete basins fed by city water
1 concrete storeroom
mud-brick wall, 70 cm high, surrounding the approximately 1 hectare of garden space and which divides some parcels, serving as a wind-sand barrier

Vegetable Garden: 10 approximately 6-are-plots (3 women work each plot)

Production Inputs: seed, complete fertilizer, chicken feed (provided by funding organization), chicken manure

Production Units: approximately 60 ares of vegetables
180 laying hens
600 meat-chickens

Vegetable Varieties: tomatoes, eggplant, cabbage, carrots, turnips, cucumber, melons and lettuce

This pre-cooperative group has been in existence for one year, and a Haitian volunteer has been associated with it since its inception. He feels that the biggest problem is individualism. The women who are instructed to work plots in groups of three, subdivide the plot to work individually.

The produce from the whole garden, at the IVS volunteer's request, is consolidated, sold and the proceeds given to himself by an "animatrice." He then puts half in the bank and divides the other half equally among the members. This arouses the envy of members who have obviously produced more on their particular sub-plot than other members, who nevertheless receive the same payment. Both Maures and Toucouleurs are members, former herders dispossessed by the drought, which further aggravates the problem of not working well together.

Nevertheless, in the last year the pre-cooperative received 38,000 UM ($863) for vegetables, 342,000 UM ($7,772) for meat-chickens, and 32,000 UM ($727) for eggs. Over a 12-month period that gave each member an average of 572 UM ($13) per month or 6864 UM ($156) for the year, with 206,000 UM ($4,681) deposited in the bank.

The vegetables are grown in almost pure sand with only water, chicken manure and a complete fertilizer added. Last year, they planted their gardens four times without success, the seedlings being either scorched by the sun or buried by sand. The 5th seeding succeeded. They are direct-planting without the benefit of a shaded and wind-sheltered seedbed or nursery. Yields have been extremely low, but a subsistence level has been achieved with a little surplus for marketing. The situation in the vegetable production project area is significantly different, with soil and water conditions much more favorable. But, this says something for the persistence and

perseverance of Mauritanians in dealing with novel and trying circumstances, qualities of unquestionable value in the introduction of new social institutions such as cooperative farmer groups, that may take several years before producing appreciable improvements in the standard of living.

The Horticulturist projects that this pre-cooperative group will take another five years to evolve into a full-fledged cooperative.

Factors Governing Effective Cooperative Development

Cooperative farmer groups are formed for several and varied reasons, among which the principle ones are: to take advantage of economies of scale in the marketing of production outputs and the procuring of production inputs; to provide a means (channel) of delivering technical information to farmers; to broaden farmers' perspectives and understanding of economic options open to them; to provide credit in a more economical and affective manner (as compared to dealing with scattered individual farmers); and, to provide training in management skills ("developing individual farmers for rural leadership").Incentives for farmers are primarily economic, but for the government, they are usually political. For these reasons, cooperative development can be generally regarded both as an economic and an educational activity.

Cooperatives must be looked upon as long-term rather than short-term investments. This fact should be taken into consideration in evaluating the impact of a cooperative development program. Cooperatives are involved in an educational process (training of cooperative officers; teaching farmers to work together within cooperative guidelines); and, from this perspective, they should be evaluated on a same or a similar basis as other educational institutions (schools), rather than on the same footing as strictly production-oriented enterprises, such as an irrigation project. From this perspective, evaluation must be a continual, long-term process, integrated within the everyday, every week, every month functioning of the cooperative.

On the other hand, cooperatives are also involved in directly productive activities (vegetable farming). Therefore, any impact evaluation should consider both the productive and educational (organizational) aspects of the cooperative development program. The PCV cooperatives specialist (see recommendation in this section) should provide a regular assessment of the educational aspects, while the PCV agriculture extension agent would furnish the evaluation of the production element.

Experience has shown that few cooperative development programs have succeeded when initiated on a national scale. National organization is costly and largely ineffective if the local units are not strong. Most successes (e.g., the Comilla program in Bangladesh) have been started on a modest scale, perhaps in one region, with the establishment of pilot cooperative-development centers that can be replicated in other regions. Another element, essential to past successes, has been effective leadership and support on the part of the government.

Village cooperative units in isolation tend to be weak by themselves, but when affiliated with a strong regional or district cooperative branch (or development center), the basis for an effective pilot program is established.

Finally, homogeneity and "social cohesion" of cooperative membership plays an important role in the success of such organizations. That homogeneity can be at least in part guaranteed by the fact that the target population will all be growing vegetables, requiring the same inputs (seed, water, fertilizer, technical information) and sharing the same need for a market for their produce.*

Recommendations

The benefits to be derived from cooperative development are apparent. The question, then, in the light of previous experience in other countries, is how to integrate effectively such a program within the matrix of the present vegetable production project. Should we commit ourselves from the start to establishing an extensive network of farmer organizations (pre-cooperatives and cooperatives) in the three regions, which may well turn out to be a diffused and ineffectual use of limited resource inputs? Or, should concentration be on the setting up of or collaborating in the establishment of an effective prototype cooperative-development center in one region, such as the one to be built in Boghe, and fostering a manageable number of strong, affiliated cooperatives, capable of being replicated in other regions?

The latter course would appear to be the more profitable, least likely to fail, and easiest to implement, and is therefore the one recommended. The Cooperative Development Center in Boghe is to be the focal point for the cooperative development element in the vegetable production project. The center, which is planned for immediate construction, will serve as the hub of a pilot cooperative development program, that will ultimately be replicated in other

*Notes from this section were gleaned from the book, Credit for Small Farmers in Developing Countries, (Chapter 14, "Farmers' Organizations"), by Gordon Donald, Westview Press, Boulder, Colorado, 1976.

regions of Mauritania. Funding of the center has already been assumed by the Ecumenical Council of Churches, operating out of Ouagadougou (Upper Volta), and the Mauritanian Government. The latter will implement the construction and equiping of the center, and hiring of national personnel. As far as the center itself is concerned, U.S. participation would be two-fold.

First, the provision of a volunteer (PCV) cooperatives specialist to teach at least part-time at the center, training future teachers and cooperative extension agents, as well as officers from affiliated cooperatives. The volunteer specialist would spend the rest of the time in the field, organizing and visiting affiliated village cooperatives with a national counterpart, whom he/she will train. How the volunteer divides his/her time between the classroom and the field is to be worked out by himself/herself, the head of the cooperative education and training section (who will be personally involved with the Center's operation), and Peace Corps; taking into consideration the recommendations of the cooperatives-expert consultant.

The USAID input into the Boghe Cooperative Development Center will be the cooperatives/credit expert consultant (12mm) to further develop the cooperatives subsector (element) of the vegetable production project. This consultant should evaluate the effectiveness of the pilot cooperative-development project and recommend any necessary changes in the basic concept. Additional USAID inputs into the center might be recommeneded, e.g., enlarging the center, broadening its scope, furnishing equipment, providing for third-country training of center personnel, etc. Finally, the consultant would prepare an analysis of the impact of cooperative development on vegetable production.

Both the head of the cooperative section and other members of the PP team have expressed doubts as to the advisability, nay even the desirability, of having the same extension agent serve as both agriculture -- as well as cooperatives -- agent. For this reason, it has been recommended that a volunteer cooperatives specialist be provided who, although working closely with the agriculture volunteer, will nevertheless not be directly involved with vegetable production. Both the cooperatives volunteer and the agriculture volunteer will have counterparts.

In the other two regions (3rd and 6th), of necessity, and until cooperative-development centers can be established, the two agriculture volunteers and their counterparts will work with and organize pre-cooperative vegetable farmer groups. In these other two regions the stragegy might be as follows.

Among groups of sedentarized herders, to whom vegetable production is being introduced for the first time, unsophisticated pre-cooperative groupings of 20 or more cultivators can be formed by the agriculture agent (with PCV) to facilitate the diffusion of technical information, and to make distribution of material (seeds, tools, fertilizer, pesticides) easier. Such groupings should initially be informal in their organization and gradually evolve into the pre-cooperative group form described in the agriculture directorate's brochure described earlier in this paper.

The agent would have to use his judgment in deciding the actual constitution of these early groups. By beginning with a single piece of land, chosen by the agriculture agent, using agronomic principles in its selection, and subdividing it into individual garden plots, the farmers will be physically united; thus creating a favorable environment for the farmer group formation. The Tind-Souelieme pre-cooperative's experience notwithstanding -- the practice of collective cultivation of individual garden plots could be put to good use in fostering the cooperative spirit among the new farmers. Whatever the intrinsic worth of these early farmer groups, they will at least be of value in accustoming the members to the idea of working (if only part-time) in association.

Among farmers who have already been growing vegetables for some time, the constituting of pre-cooperative groups will vary with the particular circumstances. Where there have previously existed or presently exist pre-cooperatives, the approach will depend on the nature of the farmers' experiences with such organizations. If positive or neutral, their reorganization or improvement should present no insurmountable obstacles. But, in cases of a negative experience, immediate reformation of such groups would not be wise, and for a time at least, the agent should work with farmers individually. Any approach to farmer organizations in such villages should be gradual and cautious.

Among veteran vegetable farmers who have not formerly known farmer organizations, the approach depends upon their attitudes, how set they are in their ways, how individualistic, and how their traditional farming habits mesh with cooperative objectives. For example, collective cultivation of common gardens might not be feasible or desirable in areas where farmers year-in and year-out have cropped the same personal plot, and attach great importance to their ownership of the land.

Finally, this program of pre-cooperative group formation will provide a base for the future replication of the prototype cooperative-development center, at Boghe, should the pilot project prove successful.

5. Cropping Practices, Plantings, Seeds

The average vegetable garden in Mauritania varies in size from one to ten ares. Vegetable production is an off-season (dry season) exercise to supplement rainfed grain farming, primarily for auto-consumption. A typical garden has a fair variety of vegetable types: tomatoes, onions, carrots, turnips, beets, lettuce, eggplant, cabbages, etc. Irrigation is by watering-can from wells, ponds, or the Senegal River. Water is the limiting factor; as much so because of the arduousness in transporting it to the garden, as because of its relative scarcity in areas away from the river. With the exception of animal manure, no soil fertility amendments are made. Data on crop yields exist in the form of seasonal reports from regional agriculture-sector heads with accuracy being questionable (See attached Annex on 5th Region Vegetable Production).

Fundamentally, vegetable farming in Mauritania can be viewed as subsistence level, low-yield agriculture that has experienced little outside (or government) intervention. Virtually no system of modern technological inputs (fertilizer, pesticides, pump irrigation systems, etc) have been provided.

The present project proposes to establish a vegetable-extension service which will serve as a channel for the introduction of production inputs and a provider of technical information to farmers. Although the introduction of fertilizers and pesticides may prove essential to the future realization of high and sustained yields, just as important at this point is the familiarizing of farmers with good, sound gardening practices, to enhance soil fertility, efficient use of limited water resources, and to minimize the damage incurred by diseases and insect pests.

The extension agents will show farmers how to divide vegetables into their respective families (*cabbage family, potato family, bean family, cucurbit family, etc.) and design crop rotations to maximize soil fertility exploitation and lower disease inoculum levels; thus reducing the incidence of disease. Alfalfa seed will be distributed and planted as a green manure, doubling as forage for livestock. Composting techniques will be demonstrated to supplement animal manure as a source of plant nutrients and to increase the organic matter content of the soil (particularly important on light sandy soils or heavy clay soils). Mulching is to be used whenever feasible to reduce evaporative water loss from the soil surface, thereby economizing the water use. The farmer should be encouraged to observe his vegetables closely and on a daily basis in order to spot early symptoms of water stress, insect and disease attacks, and take the appropriate measures. Early diagnosis and a suitable response have saved many a crop from becoming a total loss.

The following is a listing, in a logical framework, of the various aspects of vegetable cropping and their problems, with their respective recommended cultural practices:

1. Soil and Water Management
   A. Soil Fertility
      1. Crop Rotation* (to fully exploit soil fertility)
      2. Soil fertilizer amendments
         a) animal manure (cow, chicken, goat, camel)
         b) compost
         c) green manure (alfalfa during rainy season)
         d) chemical fertilizer

   B. Soil Structure
      1. Crop rotation* (with fibrous rooted and deep rooted varieties alternated)
      2. Incorporate crop residues.
      3. Use manures and compost.
      4. Don't overtill fragile soils.

   C. Water Economy
      1. Neither apply too much nor too little water.
      2. Maintain optimum soil fertility (see above) as to obtain maximum yield per unit of water used.
      3. Maintain the soil. Organic matter level (especially on sandy soils), to improve water retention.
      4. Use mulch to forestall excessive evaporation loss from the soil surface.
      5. Apply water (with watering cans) only at the base of each plant (not between rows).
      6. Control weeds (that compete for water).
      7. Shading of the plants in some cases (e.g., lettuce
      8. Encourage deep rooting by plants.

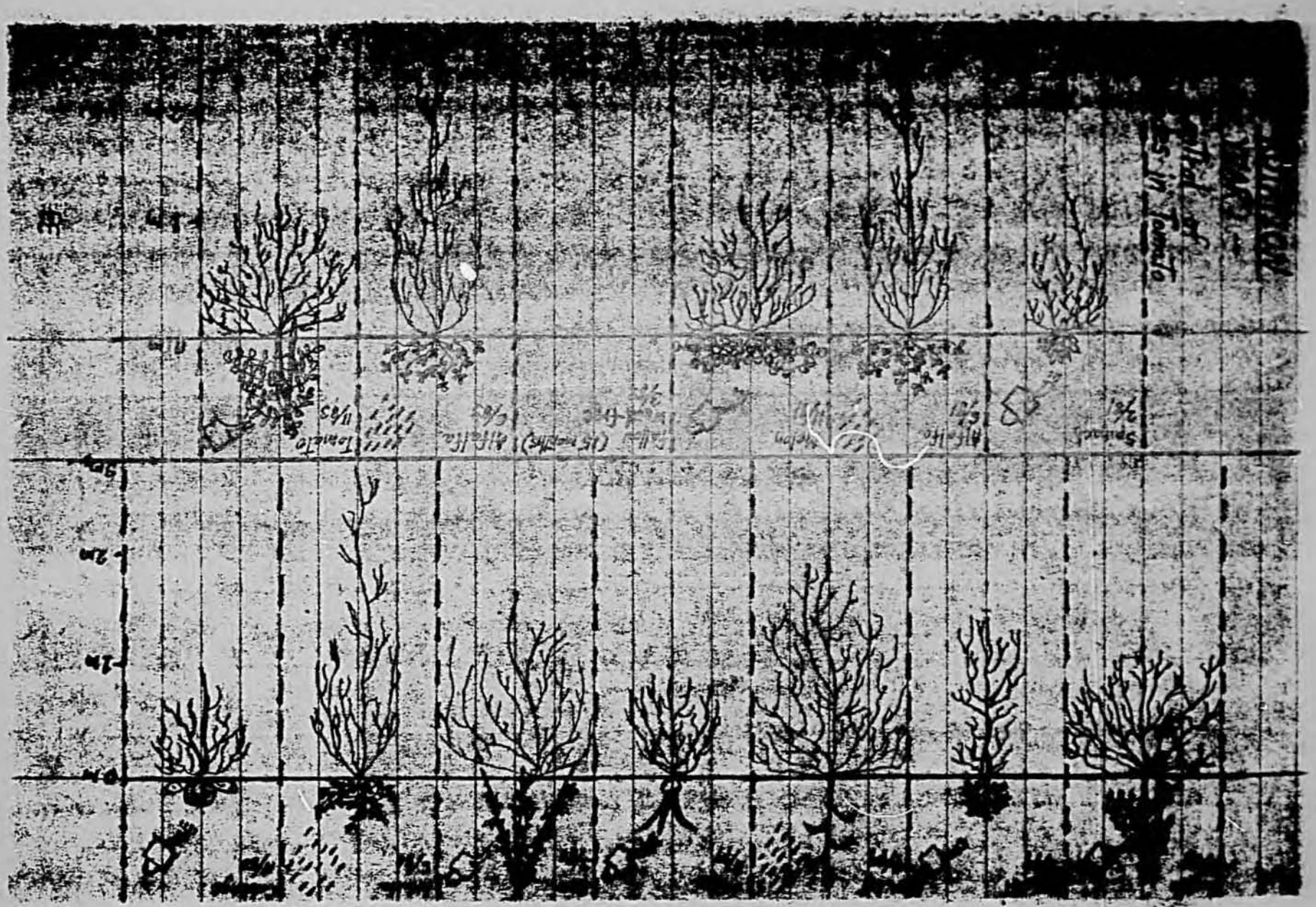
II. Pests
   A. Insects
      1. Prevention
         a) Crop rotation* (with non-susceptible crops).
         b) Close observation (twice daily)
         c) Encourage vigorous plant growth (strong plants less vulnerable)
         d) Use resistant varieties.
         e) Control weeds (alternate hosts)
         f) Be sure neighboring farmers are taking the same precautions.
      2. Control
         a) Mechanical (many insects can be controlled manually,if carried out on a daily basis (e.g. cabbage worms)
         b) Insecticide (malathion and HCH to be provided as a last measure).

B. Disease
1. Prevention
   a) Crop Rotation
   b) Close observation
   c) Use resistant varieties
   d) Encourage development of strong plants
   e) Control weeds (alternate hosts)
   f) Control insect vectors (in case of viral diseases particularly)
   g) Avoid wetting foliage when watering (especially true of beans and tomatoes)
   h) Avoid periods of water stress
2. Control
   a) Eradicate affected plants immediately
   b) Burn or deep-bury diseased plant residues
   c) Use fungicides

C. Nemotodes
1. Prevention
   a) Long crop rotations (with periods of fallow) (might try marigolds in the rotation)
   b) Use resistant varieties (a few exist for tomatoes)
   c) Control weeds (alternate hosts)
   d) Remove affected crop residues (including roots) and burn them
   e) Foster strong plant growth
2. Control
   a) Nematicide (vapam)
   b) Soil sterilization (impractical here)

D. Weeds
1. Prevention
   a) Use clean seed (weed-free)
   b) Encourage rapid and vigorous crop growth (to shade the soil and out-compete the weeds)
   c) Band the fertilizer under the crop row (to feed only the crop)
   d) Apply irrigation water directly in the crop row
   e) Use mulch to suppress weed growth
2. Control
   a) Kill weeds while they are young
   b) Mechanical (with hoe or hand pulled)
   c) Herbicide (costly and not necessary on small vegetable plots)

III. Crop Performance and Yield
   A. Key Factors
      1. Soil Fertility (see 1A)
      2. Water (see 1C)
      3. Pest control (see II:A,B,C,D)
      4. Crop Management
         a) Crop Variety selection (variety trials)
         b) Planting depth (3-4 times seed diameter)
         c) Planting density (spacing)
         d) Transplanting and pruning techniques
         e) Date of harvest (early as possible)



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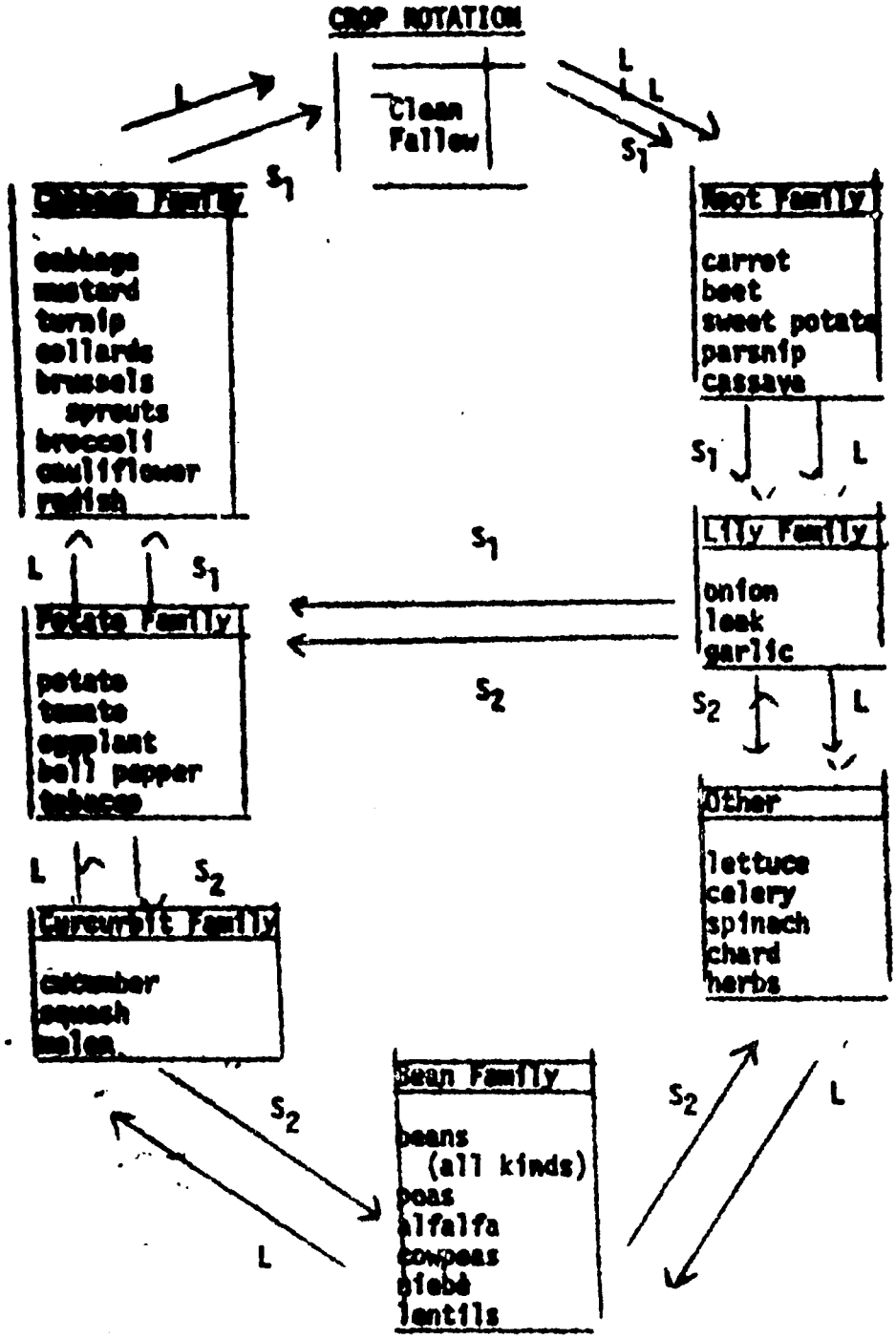

Explanation: Alfalfa-green-manure is planted every June and turned under in September, except during years of clean fallow.

Symbols: S_1, S_2 = short rotations (3 years in 2-crop/year areas)
L = long rotations (5 years)

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p	1st Year Hectares	1st Year Seed(kg)	1st Year Cost($)	2nd Year Hectares	2nd Year Seed(kg)	2nd Year Cost($)	3rd Year Hectares	3rd Year Seed(kg)	3rd Year Cost($)	Total Hectares	Total Seed(kg)	Total Cost($)
Onions	6.7	67	2680	13.3	133	5360	20	200	8040	40	400	16080
Carrot	6.7	42	840	13.3	83	1680	20	125	2520	40	250	5040
Tomato	6.7	3.3	231	13.3	6.7	462	20	10	693	40	20	1386
Green Bean	3.3	417	1251	6.7	833	2502	10	1250	3753	20	2500	7506
Watermelon	3.3	25	875	6.7	50	1750	10	75	2625	20	150	5250
Squash	3.3	20	400	6.7	40	800	10	60	1200	20	120	2400
Turnip	3.3	16.7	167	6.7	33.3	334	10	50	501	20	100	1002
Spinach	3.3	16.7	67	6.7	33.3	134	10	50	201	20	100	402
Beet	3.3	16.7	167	6.7	33.3	334	10	50	501	20	100	1002
Pepper	3.3	6.7	603	6.7	13.3	1206	10	20	1809	20	40	3618
Melon	3.3	5	300	6.7	10	600	10	15	900	20	30	1800
Cabbage	3.3	3.3	83	6.7	6.7	166	10	10	249	20	20	498
Eggplant	3.3	1.7	153	6.7	3.3	306	10	5	459	20	10	918
Leek	1.7	8.3	249	3.3	16.7	498	5	25	747	10	50	1494
Swiss Chard	1.7	8.3	42	3.3	16.7	84	5	25	126	10	50	252
Cucumber	1.7	5	225	3.3	10	450	5	15	675	10	30	1350
Lettuce	1.7	1	60	3.3	2	120	5	3	180	10	6	360
Total	60	663	8393	120	1325	16786	180	1988	25179	360	3976	50358
Potato	6.7	20000	6000	13.3	40000	12000	20	60000	18000	40	120000	36000
Total	66.7	20663	14393	133.3	41325	28786	200	61988	43179	400	123976	86358
falfa	66.7	1333	600	133.3	2667	1200	200	4000	[illegible]	400	8000	3600
AND TOTAL	133.4	21996	14993	266.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	800	131976	89958

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6. Water, Soils and Fertilizer
Evaluation of Soil Production Parameters for Vegetable Production in Mauritania

Mauritania exercises a unique set of conditions in the arid and semi-arid lands of the world. This also holds true with respect to West African Development Regions. Furthermore, its extensively varied climate, geology formation, sources of irrigation, and tradition make it difficult to apply the generalities to the specific locations. The different potentials manifested in Mauritanian natural resources are such, that it will require careful, painstaking study before their exploitation can take place, in order to ensure rewarding results.

Each of these factors is taken up under a separate title, as the agronomy consultant felt it essential before any development attempt could be made. Specifically, for vegetable production in the 3rd, 5th and 6th Regions, the following report is presented:

Part I: Productive Factors

6th Region Basic Characteristics

1. Climate
2. Soils
   - 2.1 Soil Groups and General Description of Profiles
   - 2.2 Physical Characteristics
     - 2.2.1 Infiltration Rate
     - 2.2.2 Water Holding Capacity
     - 2.2.3 Available Water to Plants
   - 2.3 Soil Chemical Characteristics
   - 2.4 Soil Fertility Levels
3. Waters and Irrigation
   - 3.1 River Senega
   - 3.2 Other Sources of Water
     - 3.2.1 Rainwater
     - 3.2.2 Well Water
4. Crops
   - 4.1 Rotation
5. Fertilizers, Manure and Plant Food Elements
6. Farming Practices and Tillage Management

Productive Factors in the 5th Region - Its Differences from the 6th Region

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Productive Factors in the 3rd Region - Its Differences from the 5th and 6th Regions

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1. Elevation, Topography, Climate
2. Water and Irrigation

Part II: General Planning

1. New Problems
2. Policy of Applied Development
3. Rainfall Distribution and Temperature
4. Soil Depth and Potential for Moisture Storage
5. Irrigation
6. Water Quality
7. Establishment of a Laboratory
8. Crops
   - 8.1 Variety
   - 8.2 Drought Resistance
   - 8.3 Time of Maturity
9. Land Management
   - 9.1 Land Levelling
   - 9.2 Tillage
     - 9.2.1 Timing of Tillage
   - 9.3 Planting
     - 9.3.1 Modifications
     - 9.3.2 Technique for Soils, and Methods
   - 9.4 Mulching Methods
   - 9.5 Fallowing
10. Application of Manure, Fertilizers and Amendments
11. Crop Rotation
12. Agronomic Considerations

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1. **Forms**

Waters

1. Collection Description of Water Sample Form (W-1)
2. Laboratory Sheet for Water Analysis (W-2)
3. Brief Report for Water Analysis (W-3)

Soils

1. Field Survey Soil Data Sheet for Collecting Profile Description
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3. Field Data for Soil Sample (S-3)
4. Laboratory Chemical Analyses (S-4)
5. Soil Classification Chart

Diagrams

1. Salt Distribution Under Furrow Irrigation
2. Laboratory Diagram for Soil Chemical Analysis
3. Diagram for the Classification of Irrigation Water
4. Monogram for Determining the SAR Value of Irrigation Water and Estimated ESP Value on Soils That Are at Equilibrium With It
5. Climatology of Mauritania
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7. Generalized Soil Map of West Africa
8. Target Regions

2. **Tables**

1. Vegetable Production in the 6th Region
2. Vegetable Production in the 5th Region
3. Relative Tolerance Scale for Plants to Salts
4. Relative Tolerance Scale for Plants to Boron
5. Amount of Fertilizer Needed for Different Crops
6. PH Preference of Vegetables, Fruits, and Field Crops
7. Water Analysis of River Senegal
8. Water Analyses of Different Wells
9. Soil Analyses: Fertility
10. Soil Analyses: Physical
11. Diagrams for Different Representing Soil Profiles
12. Fertilizer Conversion Factors

3. **Sketches**

1. Root Zone Systems of Different Crops

*For these tables, refer to Annex A.

6. Water, Soils and Fertilizer

Part I: Productive Factors
6th Region Basic Characteristics

1. Climate

The 6th Region has a micro-cycle within the macro-cycles of Mauritania. The temperature range varies from 30-34 C at maximum to 20 C as a minimum. The average relative humidity is in the range of 40% at noon. Maximum precipitation is in the range of 325 mm/year.

2. Soils

2.1 Soil Groups and General Description of Profiles

The soil of the 6th Region belongs to the brown and reddish-brown soils of the arid and semi-arid group, with different soil series and types. It can generally be described as flood plains and young alluvium with varying depth. Soil profiles show different phases of variable degrees of maturity. Some are darkish salty; others are light brownish and not salty. Baghdad soil phase is an example of a salty soil. Profiles in general are homogeneous with a slightly developed B horizon. Except in Wadis, the homogeneity goes all the way through, down to 5 or 6 feet.

2.2 Physical Characteristics

The physical characteristics are variable from clay loam (Senegal River Basin), clay loam, silty clay loam, loam, sandy loam, loamy sand, to silty loam. However, in the lower horizons, B and down, the texture tends to get coarser with higher percentages of coarse sand and increased porosity. This will result in good natural drainage if water can be managed well on the surface. Accordingly, one expects along with different particle size distribution, variable percentages for pore space that will be occupied by water and/or air within the layer as well as among the lower layers.

2.2.1 Infiltration Rate

Other water-related properties are likewise varied. Infiltration rate or the rate of water entry into the soil profile from the surface -- this is higher in the A horizon than the B horizon, and highest in the lower layers. Yet again the stratification of the soil will affect that. As is known, clay soils can show infiltration rate of .1 mm/hour in contrast to sand whose infiltration rate is 50 cm/hour.

2.2.2 Water Holding Capacity

This is described as the water which will be retained by the soil in the field, 72 hours after irrigation. It is described as that water which is held at equilibrium by the soil particles and neither drained by gravity as free water, nor evaporated from the soil surface as a function of climatic factors: temperature, relative humidity, wind, hours of daylight. It is from this field capacity-water, that the plants will draw their water requirements during the growing season. When a plant draws to the point where it cannot pull any further water from the soil, it wilts, and the soil is said to be at the wilting point. At that stage there will still be a percentage of moisture in the soil, but unavailable to the plants. This moisture percentage is held by the soil at a higher stress (due to soil particle surface, plus the osmatic pressure from the salts) than can be overcome by the pull pressure manifested by the plant through its roots trying to pick the water molecules up. Evaporation from the leaves, as affected by wind and daylight, affects the ability of the plant to pull up its water column within itself and draw away water from the soil.

Available Water to Plants

Plant available water of a soil is defined as the amount of water held at field capacity minus the amount in the soil at wilting point. It can be 50% to 25% or 10% of the field capacity depending upon the soil. The lighter its texture, the higher the percentage. The field capacity is higher for the finer textured soil, than the coarser sandier layers. Therefore, soil layers with the highest moisture storage capacity will be in the upper 50 cm for most of the soils, with more concentration in the subsurface layers. Excessive water or free water therefore will not be used by the plant; likewise, water in the upper soil layer beyond the reach of the roots will not be accounted for.

2.3 Soil Chemical Characteristics

The alluvium soil surface tends to be relatively at the lower level of balanced chemical properties. Probably, the intensive use of the land, coupled with tillage practices, temperature, and rainfall intended to alter the properties, forming a marginal soil zone in some areas. For example, there is the Baghdad type soil (opposite to Richard Toll of Senegal)...These soils will require reclamation, due to the salinity and alkalinity conditions that exist. (See Diagrams 1 and 2.)

2.4 Soil Fertility Levels

The fertility levels are low. Nitrogen is required, as is phosphate, sulphate, calcium, and potassium. The soils are exhausted for lack of replenishing what little fertility there is, after it has

been taken up by cropping or farming. The plant bed must be enriched by adding nutrient elements. They should remain available for plant use: protected from surface loss by evaporation, or downward loss, dissolved in the excess free water moving through the soil. Therefore, different soil management techniques are needed for different soil types; and, their physical and chemical properties have to be known in order to be able to take adequate measures to ensure their productivity and ability to supply plants with their nutritional and moisture requirements.

3. Water and Irrigation

3.1 River Senegal

The main source of irrigation is the Senegal River where water is pumped by various local or mechanical means (pumps); either into small canals, or ditches, or directly to the head of the fields. This dependable source of water is available all the year round. Its water shows good quality and a good neutral pH value. However, in the low yearly seasons, the water level drops down and thus invites the salty ocean water to advance up the river towards the east, almost to Podor. The water samples taken from the river at different localities -- such as Bren, Baghdad, and Sabaria -- showed different pH values, on the high side, sometimes even Alkali (8.4 value). The total soluble salts are variable and very high -- the electrical conductivity is as high as that of the ocean water and more. The sulphate content is double and its chloride content three times normal levels, while the calcium content remains the same. Therefore, the water taken from the Senegal River, along its last 100 km, should be monitored for quality changes:

a) Water regimes should be adopted.
b) No restriction needed on the use of River Senegal water above Podor.
c) Reclamation of soil will be needed, and teaching requirements have to be determined.

3.2 Other Sources of Water

3.2.1 Rainwater

Rain water is good.

3.2.2 Well Water

So far the analyses show good quality. However, due to the proximity of the ocean, the water quality should be monitored. Otherwise, it might draw up water from the shell salty water seeping from the ocean.

4. Crops

In the 6th Region all crops and vegetables are grown. Examples of some good fields are to be seen where they are supplemented with fertilizers. No crop pattern is apparent.

4.1 Rotation

No crop rotation, using crops with differing root systems to complement each other with respect to moisture and nutrient requirements, is practiced. This should be considered seriously, following Sketch 1 (Annex A).

5. Fertilizers, Manure, and Plant Food Elements

Farmers don't use manure here. This is an important factor in building up the soil to increase its storage capacity, for both the macro-nutrient and micro-nutrient elements (boron, iron, zinc, manganese, copper). It will also increase the water holding capacity and improve soil structure. Little is known about the nutrient levels in Mauritanian soils. Analyses indicate low or negligible levels. Therefore, adding manure to the surface soil will be of great value. Encouraging the farmers to make compost and spreading it on the farms is a positive step. Regarding the macro-nutrients (especially nitrogen, phosphorus, sulphate, calcium, and magnesium): soils seem to have an adequate supply of calcium and magnesium. But, all show a low to inadequate stock of the remaining ions. Therefore, the agronomy consultant encountered farmers who use 10-10-20 or 10-10-10 or Amonium phosphate in some cases, or Amonium sulphate -- as on the "Sy farm", where the application of Amonium sulphate showed good results. Nitrogen is needed for the vegetative growth while phosphorus is for ripening and maturing (fruits).

It appears, then, that the addition of fertilizer, especially at the start of the project, will replenish the depleted soils and raise their minimal nutrient stock to a fairly good starting level. Meanwhile, introducing crop rotations with legumes, such as inoculated alfalfa, will assure a supply of nitrogen that can be fixed later on.

6. Farming Practices and Tillage Management

Farmers use traditional methods and tools for plowing -- intervals for irrigation -- types of seeds -- variety -- planting time -- fertilizer application -- timing and placement.

To ensure good results and superior yields, and to avoid certain losses, all of the above subjects will have to be addressed when

the time for fertilizer application and the various field operations comes, in order to keep the soil productive. The soil bank pays dividends in a rewarding manner. The goal is to achieve a good soil profile that will support plant growth. Therefore, disturbing the soil bed more than necessary in sandy soils, will tend to loosen its nutrients for subsequent loss by leaching, and ruin the structure of the surface layers. Also addition of fertilizers when the plant cannot reach them and does not need them is another example of poor soil management.

Productive Factors in the 5th Region - Its Differences from the 6th Region

The field visit to the 5th Region (Aleg and Boghe) included towns and over 15 earth dam sites. The factors involved are modified by changes in topography and elevation, which ranges from 40-120 meters above sea level. This of course has its bearing on climate and evaporation, which is less than that at Rosso. The relative humidity is lower and the temperature is better.

The soils show the same characteristics as those in the 6th Region. In Boghe, alluvian deposition overlays sandy profiles -- profiles are homogeneous and permeable. The two distinct types are the Aleg soil type which is mainly loamy sand over sand, with loose and fragile soils -- the other is silt loam over sand. Both show variable degrees of thickness depending upon the location. So, the root zone is from thin to as much as three feet deep. Productive potential and fertility is less at Aleg than at Boghe.

Water sources are still the River Senegal at Boghe, and rain and wells at Aleg. Water quality is good in both the river and the wells (pH, total salts, salt distribution); but, water quality at Aleg depends upon rain and recharge of wells. Some of these are 4.5 meters and others are 45 meters deep. Indications lead one to the conclusion that the water at the bottom of the basins is shallow, and that is why there is no change in the types of salts found in the different waters. All other features and factors play their own role with different degrees of depth.

Therefore, the factors for successful crop production are the same as in the 6th Region, which, along with the additional two factors, (topography and slope) govern the selection of crop rotations, and field management. At Aleg a third and limiting factor outweighs all others: the quantity of water available for irrigation, and the method of farming used, i.e., recession. Water management here will determine how large an area can be cultivated , and the yield produced. Once these factors are understood and evaluated, successful vegetable production can be anticipated.

Productive Factors in the 3rd Region - Its Differences from the 5th and 6th Regions

In this region, Kiffa resembles Aleg, in the sense that it is inland and desert land; and, the role of each factor in the agriculture and development, and/or vegetable production, should be interpreted within this framework.

1. Elevation, Topography, Climate

Elevation and topography are different in this region. The climatic factors are: about 300 mm average rainfall;average maximum temperature is higher than 35 C; relative humidity is about 45%. Average evaporation is 350 mm/month, and sandstorms occur 19 days within the year (1974 data).

The soil has a different geological parent material than the other regions, and the agricultural land shows different formations. The enclaves filled with alluvian deposits from the rain have formed richer soils, which in turn depend upon irrigation from the lowest part of these depressions. Soil types are loamy silt, dark in color, sometimes reaching down to four meters -- where roots can be seen; profiles are deep. Baum Lana is a characteristic soil. It has a good structure, being crumbly and granular. Another soil type is the Hassey Bekaye. This shows more homogeneity all the way through than the previous one. It is lighter in texture on the surface and gets relatively heavier with depth. A third type is Doud Rhoda, where the soil is finer and shows more clayey material on the surface; and, the texture gets coarser with depth. These variations have their bearing on the productive capacity and fertility levels of the soil. They will require management that differs greatly from that required for the soils in the 5th and 6th Regions.

2. Water and Irrigation

Waters from wells in Kiffa and vicinity are high in pH, have moderate total salts (with the exception of the administration well used mostly for domestic purposes -- the chloride content of that particular one is over seven times the average value of the area). The sulphate maintains its level and the calcium is very high. Water from Baum Lana is available all year round. It has a good quality. The pH value is 7.6 with low salt content: the chloride is low, moderate in sulphate and moderate in calcium.

Hassey Bekaye well water shows a moderately good quality with a higher content of chloride and pH 7.8. Total salts are more than Baum Lana water. Finally the water from Doud Rhoda is intermediate

in quality between Baum Lana water and Doud Bokaye. Obviously, the usage of any of these waters will produce differing reactions on different soils. Therefore, these three water types should be taken into consideration, and treated independently and apart from the waters from Kiffa wells. (Kiffa palm plantation water sample was also analyzed, and it shows similar characteristics and quality to the administration well, used for domestic purposes.

Rain is the other source of irrigation, in areas that recession cropping can be practiced.

Part II; General Planning

The general planning for putting soils into cultivation in Mauritania should first be done in well-identified, analyzed, and described areas.

1. New Problems

Upon putting soils under cultivation, fertility problems will be created and encountered. These problems must be identified, diagnosed, and evaluated. Then, solutions will have to be outlined, adapted and applied to the corresponding locality.

2. Policy of Applied Development

The direction taken by agriculture programmers in the field in Mauritania is governed by factors totally different from those of other areas, as well as on specific experimental sites. Climate, evaporation, temperature, length of day (sunlight for photosynthesis), manpower, local farming equipment, lack of machinery, availability and quantity of water, soil texture, and inherent fertility status of soil profile -- are factors that determine the success of agriculture. Therefore, the resulting developments in agriculture and production will depend upon the interaction of these factors and the technical ability to recognize and exploit this interaction at a given time, on a specific land.

New conditions that affect productivity can develop at any time, but they must be recognized and addressed at the time of occurence; for example, unbalanced salt content-induced salinity, and reduction of production capacity.

3. Rainfall Distribution and Temperature

Diagram 5 summarizes the available data for the country (Annex A). It should be understood, that the amount and distribution of rainfall, combined with both winter and summer temperatures, have the most desirable interaction when using a summer-fallow system of farming. A dust mulch can reduce the rate at which moisture is lost from the soil; but, it does not stop moisture loss by

evaporation completely. It is estimated that if the dry season is 5-6 months long, and the summer temperatures are high (30-40 C), the rate of moisture loss by evaporation will be high; and, most of the moisture that might have been stored in the surface 60 cm of soil will be lost.

The use of a deep furrow drill where soil moisture is adequate for seed germination and establishment is probably the single most critical factor that will affect crop yields in Mauritania.

4. Soil Depth and Potential for Moisture Storage

Adequate soil depth is essential for moisture storage. In many parts of the tested area an effective root depth in excess of two meters was found. Soils of these depths will allow for 10-20 cm of moisture storage for the crops. In spots where soil depth is shallower than 1 meter, the soil moisture storage will be greater, and thus useful, to the following crop. Nevertheless, evaporation from shallow soils should not be overlooked depending upon the length of the dry winter season. On the other hand, the moisture storage capacity of the shallow soils can be recharged with no more than 15-20 cm of rainfall the following summer.

Soil fertility needs can be met thus: organic matter decomposition should be encouraged by the summer fallow in order that the nitrogen and phosphorus available could be released for the succeeding crop . However, whenever possible, small does of nitrogen and P_2O_5 should be applied. In the crop rotation, nitrogen fixing legumes are essential, especially when the crop is turned under. Supplements of commercial fertilizer are needed and imperative in the first years to build the soil fertility level.

5. Irrigation

Irrigation comes from the River Senegal, and water is of good quality. Pumps should be furnished to facilitate irrigation.

In areas where earth dikes are constructed, irrigation is done by filling the soil profile with water and no further water is supplied. This usually simulates a relay cropping environment and could be consistently used with a large number of varieties; providing a large area of uniform soil could be obtained. Suitable soils are formed in Wadis, Oases, and Gullies from the land adjacent and bordering the River Senegal in the 5th and 6th Regions, respectively.

6. Water Quality

Quality of water measurements have meaning only in relation to the particular use being made of water. In agriculture, quality of water is related to its effects on soils, crops, and the kind

of management necessary to compensate for any problems. Although not all agricultural problems are related to water quality (salinity, soil permeability, toxicity, etc.), it must be placed in the right perspective with all other factors affecting productivity.

Water analysis is essential to water quality improvement efforts, and the most common determinations carried out on a water sample, are for electrical conductivity, calcium, magnesium, sodium, carbonates, bicarbonates, chlorides, sulfates, boron, nitrates, and pH.

Generally, quality of water can be classified as no problem, little problem, medium, severe. Also, with respect to sodium content, water has four classes. Diagrams 3 and 4 (Annex A) give these four classes (according to the USDA Handbook No. 60).

Crops also vary in their tolerance to poor quality waters, and therefore the suitability of a water for irrigation will vary with the crops. Tables 3 and 4 can give the relative tolerance of different crops to salts and boron suited to different location.

To prevent potential problems is just as important as problem correction. Guidelines must be used to evaluate problem potential (such as lack of nutrients or crop compatibility to the area). A water user must be able to recognize and understand the potential problems -- for instance, water with a high sodium absorption ratio presents a problem to its use for irrigation of crops. It turns soil to a sodic one and may kill plants at toxic levels. Sometimes, toxicity can be formed. In cases of toxicity of sodium, boron, chloride -- management corrections are needed. (See Diagram 4, Annex A.)

Excessive vegetative growth crops due to nitrogen will require management alternatives. Therefore, water quality will mean different things in Mauritania, depending upon its usage. For domestic use: evaluation is for taste, hardness, possible effect upon health, food, drink, clothes, fixtures. For industrial use: evaluation is for corrosion, scaling, other adverse effects upon manufacturers. For irrigation: quality is related to effect on soils, and compensations necessary.

7. Establishment of a Laboratory*

A small laboratory should be established at Nouakchott. It will serve all projects, and will perform the following services:

a) Water analyses of monthly samples from: irrigation wells, drinking wells, River Senegal at critical areas where excessive salinity shows.

* Laboratory to be established as a part of the Rural Land Reclamation Project. Meanwhile, portable laboratory field kits should be used.

b) Monitoring quality of these waters as an index of flow, to advise on use before harm takes place.
c) Routine soil analyses and fertility tests: for soil chemistry, production capacity, study of the role of nutritional elements, soil effect upon plant and animal nutrition during life of the project.
d) To serve as a training center for field technicians and prepare a GIRM cadre of workers in soil and water analyses.
e) Study comparative values of soils before putting them to agricultural use.
f) Use of the laboratory as a tool to identify and diagnose soil fertility problems, and prevent their spread.

8. Crops

High variability of rainfall is an important feature of the arid and semi-arid environments.

8.1 Variety

Crop varieties with different growing cycle lengths will be needed to make full use of the growing season, which varies from 60 to 120 days in the northern Sahelian and the Sudanian Zones. Varietal tests should be conducted in the 3rd, 5th and 6th Regions.

8.2 Drought Resistance

Horizontal and vertical root zone development is important in respect to drought resistance. Deep root zone growth will enable plants to make use of water conserved deep in the profile. (Cowpea roots can grow down to 2 meters deep, and alfalfa roots can reach three meters deep.) This will help build the soil profiles.

8.3 Time of Maturity

Time of maturity is important. Short cycle varieties that could be harvested 60 days after sowing would be useful as a main crop or relay crop are recommended.

9. Land Management

9.1 Land Leveling

Land leveling will help the build-up of a homogeneity in the soil profile and help to form a good soil structure. Land leveling is a safeguard against land deterioration.

9.2 Tillage

Local ploweing tools are good and should be encouraged, until the soil profile shows a better degree of development. Too deep plowing will distrub the formation of the horizons, and remove whatever wealth of fertility is accumulated in the soil strata.

9.2.1 Timing of Tillage

This is usually practiced before sowing of each crop, and is preferable executed before irrigation or heavy rainfall. It helps restore moisture in the soil and prevents excessive evaporation from the surface.

9.3 Planting

9.3.1 Modifications

The lighter the soil surface texture, the faster it loses water, if not by evaporation then by percolation. Planting techniques have to be modified to overcome excessive exposure to sun, reducing evaporation and evapotranspiration from plants, and thereby minimizing surface water loss. Along with water movement is the nutrient movement, and soluble nutrients will move up or down accordingly. Therefore, planting on the side of a sloping bed is recommended, or, in the irrigation furrow.

9.3.2 Technique for Soils and Methods

Broadcasting or drilling of seeds on flat fields followed by heavy irrigation can be practiced (with precaution) more securely in the Senegal River Basin. Planting on top of a single row bed and near the edges of a double-row bed should be avoided in the Sahelian and desertic lands, as well as in the River Senegal land, where there is a tendency for soil to become saline (as in Baghdad area of the 6th Region). (See Diagram 1, Annex A.) Keeping records of the amount of seeds, percentages of emerging seedlings, and time of emergence is a recommended practice.

9.4 Mulching

One of the very important factors to reduce water losses from the surface by evaporation is mulching. Disruption of capillary continuity hinders upward movement to the soil surface and its flow as vapors. Surface tillage is recommended here. It can be very valuable when done at an early stage, while the evaporation rate is high, and not after there has been considerable surface drying by evaporation, which reduces the beneficial effects of mulching. The effectiveness of maintaining or spreading crop residues on soil surface depends on the rate and method of application and mixing with the soil.

9.5 Fallowing

Under most conditions in Mauritania farming, water is the limiting factor for the crop production. The land may be left fallow for some time to increase the soil water reservoir. During fallowing, measures to reduce evaporation such as mulching are to be recommended. Evaporation from a dry surface of fine sandy loam (like many soils in the 5th, 6th, 7th, 9th and 3rd Regions) would be higher, or almost nine times the amount evaporated from a similar surface, if the water table is less than 1 meter deep, as opposed to little over 1 meter in the second case. However, if the water table is in the vicinity of 2 meters, this rate can be reduced to almost one mm/day. Therefore, monitoring water table depth will be important in water and cropping management.

10. Application of Manure, Fertilizers and Amendments

The soil analyses have shown little and sometimes no fertility, therefore productive capacity is very limited, or at a minimum. Its structure and physical properties confirm this fact. In order to put most of these soils under cultivation, it is important to add nutrients to the soil layers, where plant roots will spread. Even for normal productive soils, manure and fertilizers are frequently added to improve productivity.

Manuring, apart from its nutritional value, improves the physical condition of the soil. It helps to form good soil structure, better moisture storage, and improved texture. Enormous quantities of manure can be added to the soil if a successful program with the farmers can be carried out. There are spots where animal manure can be collected and a compost made and spread out in the fields.

Fertilization is important and essential to the initial steps of production. There is already much information on characteristics, availability, methods of application, crop response to fertilizers, and environmental effects.

Fertilizers with balanced nutrients are very important, and are best suited for the area. Addition of sulfate should prove to be favorable, especially in areas where saline symptoms exist such as the area from Baghdad and west towards the ocean shore. In general, residually acid fertilizers will better help crops than the residually alkali ones when alkai waters are used.

11. Crop Rotation

The selection of a crop rotation will be governed by the availability and adequancy of soil and water resources, suitability of crops or vegetables to prevailing climatic conditions, and expected economic

returns. Under high evaporation conditions, especially in the north more than the south, crops and vegetables should be selected on the basis of their degree of tolerance to salts: type and length of roots, and total cumulative water requirements -- the lower the better. Having a green manure in the crop rotation is of incalcuable value.

12. Agronomic Considerations

Crop management should be considered -- such as plowing and partial fallow which strongly influences strategies for optimal water use. Nitrogen, phosphate, and sulphur nutrition are known to be important in semi-arid zones.

The effectiveness of symbiotic organisms such as rhizobia for supplying nitrogen and mycrorrhiza for improving the supply of phosphate should be examined.

Possibly, if annual rainfall is greater than 200 mm, useful quantities of water may be conserved in the soil by weed-free, 1-year fallow. Water may be conserved in the soil after wetter years (having rainfall greater than 540 mm), which could be particularly useful to supplement a 90-day crop,if the following year had less than 400 mm of rain.

More soil moisture would be conserved with a shorter cycle crop (25 days), but longer cycle crops (90 days) would gain the greatest benefit from it, indicating the possible advantage of a rotation using a short cycle crop with partial fallow following by a longer cycle crop. The advantages of short cycle cereal and legume varieties, and the crop characteristics needed for stable crop production in semi-arid zones, are important factors to take into consideration.

B. Financial Analysis and Plan

Financed Project Costs and Financial Plan are summarized and detailed in Table I of this section. Summary cost estimate and Financial Plan figures are summarized in Table II of this section.

The proposed project is primarily a technical assistance project with a series of pilot interventions and a study of nutritional needs. Emphasis will be placed on strengthening the Vegetable Production Service through the assignment and training of GIRM personnel necessary to provide the local rural population with the knowledge of new and improved techniques in vegetable production. Pilot interventions to establish a series of experimental/demonstration plots and the organization of cooperatives to support vegetable production are planned. The project costs can be considered as an investment for the future with the return of the investment anticipated after project completion with the expansion of vegetable production. As experience and knowledge are gained in vegetable production supported by an operative and organized cooperative system with credit established investments will be regained and similar projects of this nature expanded and duplicated.

Project Budget

The project budget calls for a total AID contribution, including inflation and contingencies, of $1,095,000. This figure is broken down as follows:

Table I

AID Contribution ($000)

60 pm for technical assistance staff	$454.0
Vehicles and equipment	$146.5
Commodities	$274.0
Training and education	$ 26.8
POL (Fuel, Oil and Lubricants)	$ 51.0
Sub-total	$951.5
Inflation and Contingencies	$142.6
TOTAL AID CONTRIBUTION	$1,094.1

GIRM Contribution

The GIRM contribution has been calculated to reflect salaries of GIRM personnel directly involved, contributed labor of the local population if payment were required at present rates, land and water, facilities for training, and commodities to include an agreement with GIRM for a portion of the POL products that will be assumed by the GIRM during the last half of the project for vehicles.

a) Personnel and Labor:

Personnel costs are calculated on the basis of the GIRM National budget for personnel at the levels of education and experience anticipated for the project. These salaries range from approximately $6,000 annually for a National Service Chief to as little as $1,500 annually for a beginning service field cadre. Labor costs have been calculated based on actual present figures at $75 per month with drivers receiving $2,000 per year.

b) Land and Facilities

The land provided for in the project will cover 15 acres of land for the three nursery experimental demonstration plots to be established near the population centers of Rosso, Boghe, and Kiffa. The land value based on GIRM estimates has been given a dollar figure of $150,000 for the life of the project. Other land that will be used from cooperatives and pre-cooperatives is approximately 193 hectares. Three classrooms at Kaedi, the Cooperative Development Center in Boghe and the PMI facilities for nutritional classes have been given a dollar GIRM contribution figure of $75,000 per year.

c) Water

Water is considered gold in Mauritania. When it must be bought, the average person pays exorbitant prices. Water, both metered and unmetered, sells for 4.5 UM per liter ($.10). The project will be using large quantities of water to support the three experimental nursery plots mentioned. To assure that vegetables thrive it has been estimated that each nursery will require a minimum of 500 liters of water per day. Water estimates and value (costs) are as follows: 500 liters/nursery/day x 365 = 182,500 liter of water/nursery/year x 3 nuseries =547,500 liters of water for three nurseries per year x 3 years = 1,642,500 liters of water for life of project x 4.5 UM/liter = $164,250 U. S. dollars

d) POL

The GIRM will provide POL (fuel, oil, lubricants) for the support for five vehicles during the last half of the project. An agreement will be made to ease the GIRM into assuming POL requirements. It was calculated that their contribution, based on $.25/liter would cost them $75.0 to support five vehicles for 1 1/2 years.

e) Refer to Detailed and Summary cost tables I and II on the proceeding pages.

3. Total Project Costs

The total project costs, which include GIRM and AID contributions, plus inflation and contingency, amount to $2,194,000 U.S. dollars. The GIRM contribution in personnel, facilities, commodities, land and fuel amounts to $783,500 U.S., which is 71.5% of the AID contribution and 35.7% of the total project cost. The greatest portion of the GIRM contribution is in facilities and land used for training and experimental plots. The AID contribution in long and short-term consultants, commodities, POL, training and vehicles amounts to $1,095,000 U.S. The greatest portion of AID project contribution, amounting to $274,000 U.S., is in commodities required to support project objectives.

4. Rural Development Budget Analysis

The GIRM National Budget for 1977 totals approximately 7.9 billion Ouguiyas (UM)or $175.8 million U.S. This is a 42% increase amounting to 2.3 billion UM (50.9 million U.S.) compared with the 1976 budget. This 42%, amounting to 21.4 million dollars, has been budgeted for defense or defense-related purposes.

In 1975 and 1976 the Ministry of Rural Development, which includes the Agriculture Directorate, controlled 3.4 and 3.2 percent of the National Budget respectively, but in 1977, with less emphasis placed on development and more spent for defense purposes, the Rural Development segment only controlled 2.[illegible] of the National Budget. Even with this increase in expenditures by the GIRM for defense, the government still supports development and is not unduly diverting resources from development efforts. These expenditures should have minimal impact on the proposed Vegetable Production Project.

5. Profitability of Project for Project Participants

As noted in other sections of the, this Project involves a number of pilot interventions. As a result, there is not enough specific data available to make precise farm plans or budget for individual project participants. The main thrust of the project is to develop family vegetable plots. In order to give some indication of the potential of the project, an estimated income statement has been prepared based on the available data.

The attached projected income statement indicates that if the project achieves its goal of having 3,000 families produce an additional 4,000 tons of vegetables, the revenue generated will be more than enough to cover the costs to individual participants and provide an adequate return.

The statement was developed by taking the projected increase in vegetable production of 4,000 tons, dividing it by the number of families and multiplying the resulting figure (which is an average production per family) times the average market price per kilogram of a representative group of vegetables in Nouakchott. From this the gross revenue per family was derived. After deducting the known project expenditures per participant, an estimated profit per participant of $1,425. per participant was derived. This amount does not include transportation costs or profits for middlemen and retailers. These are an unknown quantity at this time. However, the attached statement indicates that even if the transportation costs and profit for middlemen and retailers is 50% of the present market prices, the project participants would still realize a net profit of $300.00 per family.

6. Conclusion

In conclusion, in broad economic terms, overall crop production has been shown to be cost-effective in Mauritania. Vegetable production has not been cost-effective to date since so few farmers have benefitted due to present production levels with the major emphasis on strictly self-sufficiency. Further clarification on project cost benefits are described in the Economic in Section III, D, "Economic Analysis."

SUMMARY COST ESTIMATE AND FINANCIAL PLAN TABLE II

($000)

SOURCE	AID		GIRM		OTHER U.S.		TOTAL
	FX	LC	FX	LC	FX	LC	
Technical Assistance	454.0				315.0		769.0
Vehicles & Equipment	146.5						146.5
Commodities	272.2	1.7					273.9
Training	26.8						26.8
Personnel & Labor				169.5			169.5
Land & Facilities				375.0			375.0
Water				164.0			164.0
POL	51.0			75.0			126.0
TOTAL	950.5	1.7		783.5	315.0		2050.7
Inflation Factor	95.1	.2					95.3
Contingency	47.5						47.5
GRAND TOTAL	1093.1	1.9		783.5	315.0		2193.5

TABLE I

DETAILED COST ESTIMATE AND FINANCIAL PLAN

($000)

OURCE	COST/UNIT	3YEAR TOTAL			FY 78			FY 79			FY 80			FY 81			TOTAL
		AID		GIRM	AID		GIRM	AID		GIRM	AID		GIRM	AID		GIRM	
		FX	LC	LC	FX	LC	LC	FX	LC	LC	FX	LC	LC	FX	LC	LC	
II. VEHICLES AND EQUIPMENT:																	
A. VEHICLES																	
1. Four 4x4 All Terrain	15/vehicles	60			60												60
2. One 3-Ton Stake Bed Truck	20/truck	20			20												20
3. Six 125cc Motor Bikes	.750/Bike (Motor)	5			5												5
TOTAL		85			85												85
B. EQUIPMENT:																	
1. Five 200 GPM Water Pumps (Motor Driven)	4.8/pump	24			24												24
2. Back-Pack Sprayers (Two Hundred)	.025/ sprayer	5			5												5
3. Spare Parts for Vehicles and Pumps	10/yr	30			30												30
4. Five Hundred Maintenance Tool Kits	.500/kit	2.5			2.5												2.5
TOTAL																	615

TABLE I

DETAILED COST ESTIMATE AND FINANCIAL PLAN

($000)

OURCE	COST/UNIT	3YEAR TOTAL			FY 78			FY 79			FY 80			FY 81			TOTAL
		AID		GIRM	AID		GIRM	AID		GIRM	AID		GIRM	AID		GIRM	
		FX	LC	LC	FX	LC	LC	FX	LC	LC	FX	LC	LC	FX	LC	LC	
III. COMMODITIES:																	
1. 4000 Kg Veg. Seed (See Detailed List in Annex)	.012.5/Kg	50			50												50
2. 120 Tons Potato Seed	.300/Ton	36			36												36
3. 8000 Kg Alfalfa Seed	.00050/Kg	4			4												4
4. Fertilizer, 400 Tons (200 Tons 6-6-18, 200 Tons 10-10-20) on AID Approval Listing	.250/Ton	100			100												100
5. 1000 lbs. Rodenside and Insectide (AID Approved)	.016/lbs	16			16												16
6. 700-8 Liter Watering Cans (Metal)	.014/Can	10			10												10
7. 1000 Hoes	.0131/Hoe	13.2			13.2												13.2
8. 1000 Rakes	.005/Rake	5.6			5.6												5.6
9. 1000 Trowels	.003/Trowel	35			35												3.5
10. Malathion 1000 Liters (AID Approved)	.034/Liter	34			34												34
11. 10,000 Dusting Sacks 10,000 x 8 Umf = 80,000 Um ÷ 45 Um = 1.700	8 UM/Sack		1.7			1.7											1.7
TOTAL		272.2	1.7			1.7											274.0

TABLE I

DETAILED COST ESTIMATE AND FINANCIAL PLAN

($000)

SOURCE	COST/UNIT	3YEAR TOTAL			FY 78			FY 79			FY 80			FY 81			TOTAL
		AID		GIRM	AID		GIRM	AID		GIRM	AID		GIRM	AID		GIRM	
		FX	LC	LC	FX	LC	LC	FX	LC	LC	FX	LC	LC	FX	LC	LC	
IV. PARTICIPANT TRAINING:																	
A. LONG TERM																	
1. Chief Veg.Prod.Serv. 4 Yr 3rd Country Trng.	6/5Y	24			24												24.0
B. SHORT TERM																	
6 Agext Agents	.400/sm																
1 Coop Ext Agent (3 mos 3rd Country)		2.8			2.8												2.8
TOTAL		26.8			26.8												26.8
V. OTHERS:																	
1. Peace Corp (Donor) 7 PCV's	15/PCV/Yr																315
2. POL (Gas, Oil, Lubricant) 5 vehicles x 20,000	.00017/Km U. S.	51			51												51
Km/Yr = 1,000,000 Km/Yr x 3 Yrs = 3000,000 Km	.00025/Km GIRM			75						75							75
3. Land Facilities 6 Hectares + 3 Class Rooms	125/Yr Land = 50 Facilities 75			375			125			125			125				375
4. Labor (15 Nurses)	.075/Mo			40.5			13.5			13.5			13.5				40.5

TABLE I

DETAILED COST ESTIMATE AND FINANCIAL PLAN

($000)

SOURCE	COST/UNIT	3YEAR TOTAL			FY 78			FY 79			FY 80			FY 81			TOTAL
		AID		GIRM	AID		GIRM	AID		GIRM	AID		GIRM	AID		GIRM	
		FX	LC	LC	FX	LC	LC	FX	LC	LC	FX	LC	LC	FX	LC	LC	
5. Water: 3 Yr. Rep. for 3 1,642,500 Liters x 10¢/ liters = 164,250				164			55.0			55			55				164
TOTAL																	
VI. INFLATION AND CONTINGENCY:																	
A. INFLATION (10%)		95.1	.2		71.9	2		13.8	1.6		9.3						95.3
B. CONTINGENCY (5%)		47.5			354			6.9			4.6						47.5
GRAND TOTAL		1093.2	1.9	783.5	826.8	1.9		148.7			106.9						2193.5

1) TOTAL PROJECT COST = 2194

2) AID Contribution = 1095.0

3) GIRM Contribution = 783.5

4) GIRM Contribution is 35.7% of Total Project Costs.

5) GIRM contribution is 71.5% AID Project Costs

Project Procurement List

No.	Item	Source	Estimated Cost
I.	Technical Assistance		
2	Long-term (AID/PSC)	U.S.	$364,000
2	Short-term consultants	U.S.	$ 90,000
II.	Vehicles and Equipment		
4	4x4 all-terrain vehicles	935 waiver	$ 60,000
1	3-ton stake bed truck	935 waiver	$ 20,000
6	125 cc motor bikes	U.S.	$ 5,000
5	200 gpm water pumps (motor driven)	U.S.	$ 24,000
200	back-pack sprayers	U.S.	$ 5,000
	spare parts for vehicles & pumps	935 waiver	$ 30,000
5	vehicle maintenance tool kit	U.S.	$ 2,500
III.	Commodities		
4000 kg	vegetable seed (onion, carrot, tomato)	U.S.	$ 50,000
120 tons	potato seed	U.S.	$ 36,000
8000 kilogram	alfalfa seed	U.S.	$ 4,000
200 ton	fertilizer	U.S.	$ 80,000
1000 lbs. ea.	rodenticide and insecticide (AID approved)	U.S.	$ 9,000
700	3-liter watering cans(metal)	U.S.	$ 10,000
1000	hoes, long-handled garden	U.S.	$ 13,200
1000	rakes, regular	U.S.	$ 5,600
1000	trowels	U.S.	$ 3,500
10000	dusting sacks	935 waiver	$ 1,700
1000	liters malathion liquid (AID approved)	U.S.	$ 34,000

Notes

Note 1. See attached calculation at Representative Price Per Kg of vegetables

Note 2. $\frac{4{,}000 \text{ tons}}{3{,}000 \text{ families}}$ = 1,333 Kg of vegetables per family per year

Note 3. $\frac{\$44{,}979 \text{ (Annual Seed Cost)}}{3{,}000 \text{ Families}}$ = $15.00 per family each year

Note 4. $10.00 per month x 12 months = $120.00

Calculation of Representative
Price of Vegetables per Kg

U.S. Cost Per Kg

Potatoes	.77
Onions	.84
Carrots	1.33
Tomatoes	1.33
Cabbage	1.55
Cucumber	1.33
Lettuce	1.11

$$\frac{\$8.26}{7} = \$1.18 \text{ per kg}$$

Prices of Selected Vegetables in Nouakchott on 10/13/77

	Price per Kg	
	UM	U.S.Dollars
Potatoes	35	.77
Onions	38	.84
Carrots	60	1.33
Tomatoes	60	1.33
Watermelon	60	1.33
Squash	60	1.33
Beets	1.00	2.22
Pepper	90	2.00
Melon	70	1.55
Cabbage	70	1.55
Eggplant	40	.88
Leek	50	1.11
Cucumber	60	1.33
Lettuce	50	1.11

C. Social Analysis

Vegetables grown include potatoes, tomatoes, onions, carrots, turnips, beets, lettuce, squash, green beans (in small quantity), cabbage, eggplant. Also melons of various descriptions, including watermelon. Potatoes, tomatoes and onions are especially valued. The Mauritanian government introduced Irish potatoes after the drought. Farmers and consumers very quickly developed a great enthusiasm for this vegetable, despite the many problems involved with its cultivation. The GIRM is now less interested in the dissemination of the potato, having found the seed problem difficult, but farmers still want to grow them, and will do whatever necessary to acquire seed potatoes.

Indigenous vegetables are rarely grown with European. Sweet potatoes and niebe are grown near the river. Some plants are grown with millet (beref for example) and others are grown next to the house. Local vegetables are thus totally divorced from the government effort.

For the grand majority, vegetables are eaten fresh only. Some traditional vegetables (okra, various leaves, piment) are sun-dried. A few people pickle vegetables with vinegar and piment, but this practice was said to be not widespread and not commercialized at all. The Moor population will not eat piquant food, this was given as one reason that pickling is not seen (although it is a known custom among the Wolofs).

It was stated by several contacts that for most of the year all the vegetables raised in the 6th Region are consumed. However, in the peak season, there is an oversupply problem. This problem is aggravated by the influx of cheaper vegetables from the SAED plantations on the Senegalese side of the river. The Senegalese vegetables, being government grown and sold, are dumped on the Rosso market cheap. This is seen as a major problem by farmers wishing to sell their extra vegetables. It is recognized as a problem by the government of the region as well, but control seems difficult, if not impossible, at this time. (It was stated that the GIRM has no meaningful policy on food importation, whereas the Senegalese government has very strict controls on its side).

Vegetables are most commonly eaten as additions to traditional sauces, boiled with rice, couscous or other cereal. Raw vegetables are eaten as hors d'oeuvres or salad during the season by some people. French fried potatoes are also added to meat/fish and sauce dishes. Purchased tomato paste is especially relished for rice dishes, and is used even during the tomato season.

It can be stated unequivocably that vegetable production in the region is largely for the consumption of farmers and their villages. Production for the local European market is not the major aim of this cultivation. There are a few prosperous farmers who grow largely for sale. These men have their own trucks for transport of produce. There are also merchants with trucks who will buy farmers' excess production at a very low price and resell in Nouakchott for a tidy profit. But, for the most part, local consumption is the aim of the farmer.

Although the original scope of the project has been reduced from nine regions to three (the 6th, 5th, and 3rd), a significant population will still be reached. The PRP speaks of 70% of the population of Mauritania as being nomadic; but, according to the 1977 census, roughly two-thirds of the population is now sedentary. The vast majority of these recently settled people are eager to grow anything that will feed them; and, if possible, earn them some money. The government is concerned to help these people and it does not seem unreasonable to assume that their recent support for vegetable production is directly related to this fundamental shift in the population.

Whether or not it will be possible to focus the project primarily on these recent nomads, it is not only a tactical but a technical problem, since the production of vegetables is dependent on an adequate supply of water. Most vegetables (and grain) are grown by long settled people who occupy the best land and have developed the best water sources (the best of all, of course, being the Senegal River). They are in a position to profit most from the kinds of aid proposed in this project. Obviously, everything should be done to help the recent settlers (and they will need more help than the others), but what can be achieved will be dependent to a large extent on the amount of water that can be depended upon. This poses a delicate political problem in that it is just these people that the government most wants to help. Hence the requests for aid at such places as Aleg and Maghta-Lahjar, Maure territory well in the interior of the fifth region.

The difficulties arise, moreover, not only in favoring one group over another, but one village over another in the same region. Although the establishment of an effective agricultural extension service would ultimately benefit all the villages and towns within the regions proposed, inevitably efforts in the first few years will have to be concentrated in only a few in order to be effective. The rationale for their choice will have to be political as well as technical and economic, and the governmental authorities in each region should be consulted before the final selection is made.

The support of the regional government in each case is indeed crucial. Some of the services can function without their support, and instances of such services being rendered almost totally inoperative by the withholding of material support are not lacking.

The interests of women in vegetable production vary. Among the Toucouleurs of the 5th Region, women tend to form cooperatives separate from the men. Such a cooperative was also tried at Aleg. In Kiffa, however, men and women tend to be associated in the same cooperatives, with men constituting the majority of the membership. In the 6th Region, cooperatives are less popular and successful; but, as at Kiffa, men and women grow vegetables with the former dominating.

Generally speaking, there is no problem in convincing any of the people in the areas concerned of the desirability of growing vegetables. For some it provides the only source of income; for others, it supplements the grain crops they grow in the rainy season. Generally speaking also, those who grow vegetables eat them, though the proportion of vegetables devoted to auto-consumption as opposed to sale varies widely. Although traditionally it has been the people living along the river who have produced and consumed the most vegetables, other people, such as those at Kiffa, have become extremely fond of them.

Is the introduction of "European" vegetables leading to the abandonment of "traditional" vegetables?

No evidence of such a trend was found, either in interviews or in site visits. In most cases, traditionally grown vegetables (e.g., cow peas, okra, beref, sweet potatoes, sorrel) are grown separately from so-called European vegetables. Niebe and sweet potatoes, for instance, are grown in rainfed or recession agriculture with millet. Beref (melon from which seeds are eaten like peanuts) is grown as a rainfed crop. Other vegetables are grown next to the house or collected wild (leaves from various bushes, for example).

European vegetables are generally seen as supplementing, offering variety from traditional vegetables. They are not viewed as a replacement of these vegetables.

Note: in some cases (with niebe, for example) planting traditional and European vegetables in the same plot in rotation might be advisable. The government might also involve itself in dissemination of improved seed varieties for traditional vegetables. These questions need to be addressed by the Agronomist/Project Manager.

Conservation of vegetables is widely seen as a significant problem which needs to be addressed. During peak periods (December-February) there tend to be more vegetables than can be consumed fresh. This is especially true in the Rosso area, where cheap vegetables are dumped on the market by SAED (Senegal) during the winter months. During summer months, however, there are few, if any, vegetables to be found. A guaranteed supply of vegetables, fresh or preserved, would be especially appreciated during the "hungry months" before the first rainfed crops are harvested, when grain supplies are short. As part of a nutrition education component of the project, simple methods of home preservation can be taught. Sun-drying techniques are especially recommended, as they require no expensive equipment (only cooking pots, mats, cloth, storage pots which women would normally have), are easy to teach and to use, and sun-dried vegetables are known already. For example, okra, piment, cow peas and various green leaves are traditionally sun-dried in Mauritania (although hygenic and nutritional qualities leave something to be desired). Additional vegetables that could be sun-dried include corn, onion, carrots, pumpkin, beets, sweet potato, green beans, peppers, squash, and tomatoes.

Simple home preservation methods can be taught by a mobile worker in the field. They can also be taught to town women in centres d'education feminine as part of their nutrition education program. If a Peace Corps volunteer is assigned to the project, she could handle both aspects of this instruction. She herself would need only slight technical training to be able to perform and teach these techniques.

In Rosso there is a possibility of using slightly more advanced preservation techniques on an organized basis. The government of the 6th Region is anxiously searching for ways to conserve what is now wasted over supply.

Any new vegetable to be introduced should be judged on the basis of several factors: soils, water quality and quantity, climatic resistance, timing, pest problems, nutritional value. At the present time a wide variety of vegetables are planted (among them: tomatoes, potatoes (Irish and sweet), carrots, turnips, onions, squash, green beans, eggplant, cabbage, beets, peppers, leaf lettuce, okra, cow peas, pumpkins, oilseed melons (beref).

Rather than introducing new vegetables, it would probably be better to improve use of known vegetable varieties. Additional varieties (e.g., legumes, lima beans, chick peas) or "improved" varieties (American sweet potatoes have previously been mentioned) could be distributed on a small-scale, experimental basis to interested farmers to test their success both as plants and in consumer acceptance.

Immediate beneficiaries of the project will be vegetable cultivators and their families. These will be rural small-holders, men or women working in village or cooperative groups. They will be from various ethnic groups, notably Wolof, Toucouleur, Moor. This group will benefit directly from the increased food harvest available for auto-consumption, barter or sale.

It is expected that vegetable production will be largely, as it is now, for auto-consumption. Farmers queried in the field repeatedly stated that they could not now (because of lack of materials) grow enough vegetables for local demands. With the exception of some first-time vegetable growers, all those who grow vegetables eat them. And almost all vegetable growers plant as many kinds of vegetables as they can find varieties of seeds. This wide range of plantings helps insure against failure of one vegetable crop, it allows some spacing of harvest time, satisfies taste demands, and provides varied source of nutrients.

Villagers who produce and eat vegetables will benefit nutritionally from a better well-balanced diet. Vitamin deficiencies, an increasing problem in Mauritania, should diminish markedly among target groups. Consumers should also benefit calorically as vegetables are viewed as supplements, not replacements, of cereal and meat/fish dishes and vegetable production supplements, rather than replaces, cereal cultivation.

Through practical nutrition education efforts in the field, the positive impact of vegetable production can be expected to be enhanced. Improved methods of vegetable preservation, more hygenic and less vitamin destructive than traditional methods, can be introduced and applied to vegetables now wasted in peak periods. Nutritionally better ways to serve vegetables can be taught. Those unfamiliar with vegetables can be helped to use their produce, thus encouraged to grow and consume more. Vegetable production can be a source of extra income if excess production can be sold. Home preserved vegetables might also prove marketable and provide an extra income source for women.

D. ECONOMIC ANALYSIS

In Mauritania, as for other Sahelian countries, vegetable consumption represents a small percentage of total consumer expenditure on food in household budgets. The relative prices for vegetable produce, reflecting high supply costs, have tended to limit regular consumption to groups at the upper end of the income scale - those whose income is derived from employment in urban areas and in industrial enclaves. The limited range of agricultural production in the traditional sector ties the vast majority of the population to a diet of millet and sorghum, supplemented, on an irregular basis, by milk and meat products. The 1976-80 Five Year Plan outlines in general terms the objective to extend the range of output in the traditional sector to include vegetable products as well as cereals. Vegetable production would be developed in the region of the Senegal River Valley, around oases, watering points, and in the proximity of urban and industrial conglomerations.

The objectives of financial and technical assistance in vegetable production is to increase the amount of hectarage allocated to the output of vegetables by small farmers in the 3rd, 5th, and 6th Regions and to permit cultivators to achieve maximum yields through the introduction of technological improvements in vegetable production. Several goals and indirect results might be attributed to this project:

a) Reduce the cost of vegetable production and increase output. This is assured by free inputs to cultivators.
b) Broaden the income range of vegetable consumption and encourage additional elements of the population to include vegetables in the regular diet. This would result partly from an increase in on-farm consumption. Further, as the supply of vegetables increased, surplus production above the needs of subsistence producers would be sold on local markets - at prices within the reach of a broad segment of the population.
c) The addition of vegetable production to that of millet and sorghum would serve to raise rural sector incomes. Vegetable production would provide the opportunity for farmers in the subsistence sector to earn cash income through sale of surplus produce. In addition to its contribution to the monetization of the subsistence sector, the activity is expected to increase the marginal returns to labor employed in traditional agriculture.

We are concerned here with the conditions required to meet these multiple objectives and the constraints which will influence expected results. As noted above, efforts to change traditional production patterns and to extend the traditional sector's range of food output can be viewed from the standpoint of its impact on rural dietary patterns and on rural income levels. The impact on food diversification depends on such factors as the extent to which farmers would grow a new crop for their own consumption; the probability of changing established dietary habits; or perhaps, the feasibility of building a nutrition componenet into the technical extension framework.

For this analysis it is assumed that monetization - the introduction of the exchange of agricultural products for generalized purchasing power, i.e., money - is a key element in seeking to expand the range of output to the traditional sector. It is concerned, therefore, with the relative impact on rural income and, more specifically, the marketing of small-farmer vegetable production.

In this case, we can first concern ourselves with the nature of the product market, i.e., the size and composition of the market for small farmer vegetable output. Some knowledge of the effective demand for increased supplies of vegetables is called for since increased output is being promoted. The demand side of this market is critical for it raises the question of the quantity that can be sold at prices that will continue to be remunerative to farmers who have responded to the initial stimulus of a project that involves free inputs. Price effects are significant since they affect farmers' return, and in turn, production incentives.

Secondly, there is the question of market channels for sale and distribution of products. What is at issue here are weaknesses in the vegetable marketing chain from the farmer's point of view. The operation of market channels encompasses a number of factors. First, there are physical facilities which affect the flow of products, as, for example, the availability (and cost) of transport. A second factor relates to market organization. This refers to buyers monopsony power vis-a-vis the farmer and the influence on marketing margins - the share of final consumer price that reaches the farmer. Finally, marketing channels include the performance of small-farmer organizations - the cooperative - in promoting the sale and distribution of output and in reducing marketing costs. The systematic analysis of market institutions and sale of traditional sector output in African LDCs presents many problems and in the final analysis involves a great deal of guesswork.

Vegetable production is, at present, a relatively small activity in the Mauritanian agricultural sector introduced under external financial assistance. It is probably regarded by most farmers participating under project schemes as an "off-season" activity, this analysis treats of conceptual problems, taking a longer view of what might be anticipated as the activity increases in scale.

I. The Vegetable Production System[1]

Geographical distribution: There is vegetable production activity in practically all regions within those areas where average rainfall meets a minimum requirement or ground water resources are able to be tapped. That is, vegetable production occurs in all regions except the 8th, 11th and 12th located in the country's northern section. Production is not dependent 100% upon an official system of input assurance. In some instances, farmers are using their own resources to purchase seed. In the 1st and 2nd regions of the Southeast, one finds in the proximity of Aioun and Nema, small-scale production of potatoes for the local market in addition to the traditional subsistance crops of millet and sorghum. In the 7th and 9th regions, vegetable production activity occurs around oases. In fact, in the years before the drought, the Adrar area of the 7th region had a tradition of small-scale vegetable farming. The 10th region, with nomadic and semi-nomadic populations, carries on little agricultural activity apart from the production of millet and sorghum. But even here some vegetables, such as cabbage, are grown for household consumption, and some production of tomatoes takes place as well. Vegetable production is concentrated in the 3rd, 4th, 5th and 6th regions,[2] representing the agricultural areas of the River Valley and around the permanent mares, bas fonds, and oases of the 3rd region. These regions represent the focal points of the traditional agricultural sector - millet and sorghum production - but all to some degree have a tradition of small plot vegetable production. The objective then, has been to extend acreage under production, to bring in new village entrants and to introduce improved cultivation methods. This to increase the quality and variety of production as well as output per hectare.

[1] Note on Sources : The Direction de l'Agriculture has issued a summary of activities on vegetable production, by region, which provides in some detail information gathered in the course of field interviews with the Chef du Secteur and field personnel on the progression of vegetable production projects in each region. (GIRM, Direction de l'Agriculture, Mission de Marichage, January-February, 1977. The report derives from the IBRD-financed project: Continuation and Extension of Vegetable Operations). The report evaluates the prospects for increasing acreage under cultivation, provides a qualitative assessment of yields, variety of vegetables produced, the level of on-farm consumption, marketing potential, scale of local markets, ability of a given region to export to the national market given its transport situation. It attempts to evaluate also the performance of local cooperatives in marketing surplus produce and the effectiveness of the extension system (and to some extent the performance of local officials in program implementation). It provides, in sum, an overview and description of the existing system of vegetable production.

In addition, the Direction de l'Agriculture issues reports which review developments following the Annual Campagne Maraichere. Such reports sketch major problems and give such price and yields information as are available.

[2] These regions include the towns of Kankossa, Kiffa, Kaedi, Aleg, Boghe, and Rosso respectively.

Organization of small-farmer production: The range in scale of holding planted to vegetables starts from the small household garden - "le petit jardin villageois" - where vegetables are grown primarily for home consumption and are limited to those varieties which reflect local dietary preferences and tradition (e.g., okra, peppers). The household garden is a small plot located within the village compound. Seed is preserved by the household and planted during the rainy season. At the other end of the range are private, commercial operations located in the 6th region. Here individual farmer entrepreneurs operate vegetable farms of about 4-10 hectares. Owner -management and the employment of somewhat higher production techniques (e.g., motor pumps for water supply, sprayers for the distribution of pesticides) enhances the profitability of these operations. A considerable variety of vegetables are cultivated for market, including onions, tomatoes, lettuce, beets, carrots. Between these two extremes lies the target group of small-farmers with which vegetable production projects are concerned.

The range in the size of small-farmer vegetable holdings runs, on the average, approximately 300-500 square meters. Holdings one hectare in range are relatively large scale and appear with diminishing frequency. The general cropping pattern is that the extent of diversification in output tends to vary directly with the size of holdings. That is, smaller holdings tend to concentrate on production of one type of product, or perhaps a maximum of two (e.g., potatoes, onions, turnips). On relatively larger holdings, several kinds of vegetables may be produced.

Factors affecting scale of production: There are limitations on the amount of land that a single farm unit will put under vegetable production. The individual farm unit faces a constraint in terms of labor-time available to be allocated to any given output, and vegetable production may compete with millet and sorghum production for labor-time. It has been observed, in fact, that years of abundant millet and sorghum harvests tend to coincide with a diminishing interest on the part of farmers in vegetable production. An expansion in the level of production (measured in terms of hectarage cultivated) can be expected to occur in areas where substantial unemployment or under-employment of agricultural labor exists.1./

In addition to limitations on the scale of farm facing the individual farmer, physical and technical constraints will set an upper limit on the total land area that can be brought under cultivation in a specific georgraphic zone. A major constraint on the total hectarage that can be supported within a given area is the availability of water so that a given area the scale of vegetable farming and, hence, the number of farmers producing for market, will depend upon water supply conditions. In some areas (e.g., R'Kiz and Medredra in the 6th Region), water conditions are such that new producer entrants into vegetable production have been limited to the production for home consumption. 2./

1The concept of underemployment refers to a situation where additions of a variable input (labor) to a fixed quantity of land drives the marginal production of labor towards zero.

2Report op. cit. Recently, under a scheme which involved the redistribution of land in the 5th region, vicinity of Boghe, farmers were allocated four hectares of land for vegetable production. This action was taken unilaterally by the District Prefet and unfavorably viewed by the Direction de l'Agriculture. Water supply in the area is not sufficient for a substantial number of farmers to put four hectares of land into vegetable production.

II. The Marketing of Small Farmer Production: Potential and Problems

Scale of the Market: For the present there are two principal means of absorbing increments in vegetable output:

a) Through an expansion in the amounts demanded on local markets;
b) Through a reduction in the volume of imported vegetable products, with replacement by locally produced output.

Vegetable exports may occur over the longer term, but under existing supply, cost, and price conditions, the primary market for surplus vegetable production will be the internal market. The internal market for vegetable produce is defined here to include (i) local markets, those in the principal towns in each region and (ii) the national market, or the industrial and urban enclave markets of Nouakchott, Zouerate, Akjoukt, Nouadhibou.

To date these enclave markets have been largely supplied by fresh vegetable imports from Senegal and from France and processed vegetable imports from France, other EEC countries and Spain. The estimated value of imports of fruits and vegetables, by country of origin in 1976 are as follows:

C.I.F. Value in UM Millions

Total	Senegal	Spain	Other Countries
92.0	21.0	5.7	41.4

Source: Banque Centrale.

In volume terms, vegetable imports average about 1,300 tons per annum. However, it is not only the enclave sectors which receive substantial imports of vegetables. The Rosso market is reported to be heavily dominated by vegetable imports from Senegal. 1./

In principle there is potential for growth in the internal market for domestic output, given properly organized production, distribution and marketing systems. The widening of the internal market will be traced to such factors as the gradual sedentarization of nomadic populations, movement of rural residents to urban areas, and increased employment in urban complexes. The latter implies a gradual growth in the proportion of wage earners and salaried personnel in the population - both in the informal and modern sectors. 2./

The recent demographic survey issued by the Planning Ministry (May 1977) indicates that a fairly significant percentage of the country's total population can be classified as town-dwellers, with roughly 20 percent residing in towns of 5,000 or more. Local market towns, as a group, therefore, offer an impressive amount of potential buyers of domestic vegetable output. The provisioning of these markets could provide a substantial source of cash earnings to rural producers. The issue is the probability of realizing this marketing potential.

1./ The reliance upon imports for a range of basic commodities typically occur in industrial enclaves in developing countries where management - as well as private traders - are concerned to insure supplies in the face of undertain local food production and distribution systems.

2./ Employment in these sectors is currently estimated at 10 percent.

In varying degrees, the critical problem facing all local producers is the internal transport system. For all the Sahel countries, the costs of transport loom large in the total structure of marketing costs. The factors affecting transport costs, directly and indirectly, are fairly obvious: an absolute low population density, long distances between towns and settlements, harsh climate, and poor road-making soils which make the provision, maintenance, and operation of a transport system extremely costly. Mauritania faces a virtual absence of a basic transport infrastructure linking, on a year-round basis, food-exporting and food-importing regions of the country. Regional isolation constitutes a major obstacle to an efficient internal marketing system. The existing transport system has been described by the IBRD as simple, decentralized, and non-integrated. 1./

The relationship between transport and marketing activities is to bring about a change in the location value of goods: that is, to move goods from areas where they are produced, andprices are low, to distant areas where prices are higher. The regions of the River Valley are poorly equipped with road transport. From the small town, Tekane, in the 6th Region for the length of the distance to the southeast, "roads" are tracks, and impassable for parts of the year. However, given current levels of planned investment in road transport, the World Bank is "cautiously" optimistic of prospects for improved conditions and greater movement of goods south to north over the coming decade.

But a minimum standard of road transport will only be realized over the long-term, and the immediate issue is whether the farmer can adjust to the exigencies of the transport/marketing situation. The vegetable production season is short, for most regions 3-4 months of the year. (For example, in the 6th Region, the growing season is December-April. It is longer in the 3rd Region, extending from October to May). The limited transportability of commodities, lack of access to national markets and the seasonability of production - the "bunching-up" of marketing production - reinforce each other. This means that problems of local market saturation arise and sharp swings in the prices of vegetables on local markets tend to occur (See Annex B., Table I).

1/With respect to road transport, the latest IMF Report shows that the present road network consists of 7,100 km., of which 11 percent is bituminous; about 50 percent represents improved gravel and earth roads. The remaining two-fifths consists of dirt roads and tracks passable during certain periods of the year. The Report provides the following data on road surface conditions as of 1976:

Paved national roads	765 km
Unpaved national roads	3,940 km
Unpaved regional roads	1,730 km
Unpaved secondary roads	655 km
Total:	7,090 km

Source: IMF Mauritania: Recent Economic Developments (1976).

While the flow of supplies to markets is partly determined by technical production factors, such as the length of the growing season, the problem of the saturation of local markets and the uneven rate of flow supplies are subject to some degree of control.

1. One means is to sacrifice diversification of output to the cultivation of crops which are able to support longer and rougher shipment. There is evidence that farmers removed from direct access to markets have tended to concentrate on such crops. This explains the monoculture which prevails in some areas for such crops as onions, turnips, and potatoes.

2. As in the case where farmers grow relatively less perishable types of vegetables to facilitate longer distance transport, these same types could be grown with a view to storage for a time after harvest and gradually marketed. This would permit farmers to benefit from a change in the temporal value of out-put.

3. A staggered schedule of input distribution to farmers located in the same area is another possibility. Although it is administratively convenient to distribute inputs to all farmers in a given area according to the same schedule, it would be possible to spread out the distribution of seed, for example, so that all producers would not plant and harvest identical products at the same time.

III. Estimating Project Benefits

On the assumption that there are at present approximately 15 hectares under small-farmer production in each of the three regions (including cooperative or pre-cooperative workings), and on the assumption that the project goal is to bring about a doubling of hectarage allocated to vegetable production, a crude and tentative measure of the relative margin of benefits over costs has been estimated which yields a ratio of 1.33. It would be incorrect to attach a great deal of significance to this computed value for the underlying basic data are extremely sketchy and a great number of simplifying assumptions have been called for. The real worth of the exercise is that it provides the opportunity to make explicit certain assumptions and judgements which have been formed with respect to small-farmer vegetable production over the near term. The major ones are discussed below.

Agricultural projects commonly yield benefits in the form of an increase in the value of output, which arises from greater physical production. An increase in the value of output will occur provided that market and price relationships are such that greater physical production does not trigger a more than offsetting fall in price. We are dealing here with a project where there may be a rapidly growing supply of output relative to the existing market, and this raises an issue of the interrelationship between future prices and production increases. Thus, output has been valued at existing prices; but it is assumed that as to the distribution between marketed output and on-farm consumption, a larger proportion of the increase in vegetable production output of small farmers will represent an increase in on-farm consumption.

The economic value of home-consumed food represents a real return to the economy as much as if production has been sold in the market. Home-consumed production is part of total wealth available to the country. Failure to take full account of it would understate the value of the project relative to investments elsewhere in the economy. At the same time, because we are concerned with the farmer's ability to earn a return to cover costs in the absence of free inputs, net farm benefits - the value of home-consumed produce plus money earned from off-farm sales - is important. While home-consumed output increases enough so that the return to the economy as a whole may be sufficiently high, we cannot state with certainty that small producers' money return will be large enough to cover input costs if these were required to be purchased at current market prices. (Fertilizers, pesticides, farm implements).

It has also been assumed that important secondary benefits will be attributed to the project. The major secondary benefit will be the creation of employment opportunities in the 3rd, 5th, and 6th regions where substantial unemployment and underemployment of agricultural labor are known to exist.

IV. Role of Cooperatives in Vegetable Production

Rural sector development projects tend to relay heavily upon the cooperative form of organization as a means of channeling technical assistance to a diverse group of small producers. Because this system is in place, it has appeared logical for development planners to make use of it. Yet, little is known about the actual operation of the cooperative system in Mauritania or the milieu in which it operates. In a developing country, a cooperative may be defined as any formal association of rural producers established to carry out certain economic functions and which has the potential for assuming certain financial responsibilities. In general, the cooperative in African LDCs is a western institution, imposed from the outside (and more significantly from the top, down, i.e., it has an official status, and has not resulted from the voluntary association of individuals who view their interests in the same light). Thus, it does not necessarily bear a close relationship to those western institutions from which the term is derived. The global experience of "cooperatives" in developing countries has been mixed, and those who have promoted the rural cooperative concept have, in general, been disappointed with results. This may be due, in part, to a failure to appreciate differences in the western concept of a cooperative and the organizations which go by the same name in developing countries. Since neither the origins or the purposes are exactly the same, their standards of performance will differ.

The cooperative form in Mauritania was introduced under the French in connection with schemes for the promotion of cash crops. It has been averred that from the outset the cooperative form of organization was presented as a mechanism through which certain activities could be subsidized. The larger roles of cooperatives, such as the mobilization of rural savings, the distribution of credit, disseminating technical information, or as a vehicle for lowering the marketing costs of members' production, have never been fully exploited. An even larger role of cooperatives, that of generating local leadership and managerial talent has probably been even less effective.

Of course, it is recognized that cooperatives take a considerable time to grow in order to become effective by any criterion. This organizational form was introduced only in 1963, so that Mauritania's experience with cooperatives is relatively short-lived. When, in 1967, a new national law was formulated, an innovation was introduced to permit the creation of pre-cooperatives. Under this scheme, organizations must be in existence for a period of at least two years, undertaking some productive activity, before a full cooperative status is recognized.

The pre-cooperative has been the primary instrument in vegetable production projects. For example, the 3rd Region has a reported 30 Groupements Precooperatifs in operation, with 42,000m^2 under vegetable production. The Direction de l'Agriculture is concerned to expand the use of the Groupement Precooperatif under any vegetable production scheme. The reason for this appears to be a concern that "cooperatives" presently organized may tend to overrepresent the interest of the limited number of family units. The Groupement Precooperatif may represent a better means of reaching a wider segment of producers.

E. Environmental Assessment

The vegetable production project will directly affect 200 hectares of crop land. It is hoped that these activities proposed in the project will eventually have a profound positive effect on the cropland used for vegetable production. Potential environmental effects will be paramount in the consideration of techniques, approaches and commodities used to increase vegetable production in the 3rd, 5th, and 6th Regions of Mauritania.

Water:

There will be a negligible impact on water. The water is already used; the project sites are scattered over a large area. Introduction of means to facilitate bringing of water from river to fields (pumps) affects neither quality nor quantity of water used.

Soils:

Vegetable production will be on land already under cultivation. There will be no alteration of the environment as a result of using the same soil--impact negligible.

Fertilizer:

These plant nutrient elements are added to the soil and dissolved in the water, and will be picked up by plants from the soil. A portion of it will be fixed by clay particles; another portion leached by infiltrated water through the profile.

Pesticides:

Pesticides are used as safeguards for crops. Their use is not anticipated within the lifetime of the project. Target sites are so scattered, and total land area involved so small, that even if used, the effects will be micro and therefore negligible.

Impact on Social Environment:

Given the nature of the interventions proposed, impact on the social environment should be minimal. In any event, no negative consequences are expected. Care has been taken in selecting the project sites (see technical analysis on site selection), so as not to disrupt either the local populations or government authorities. The nature and scope of the proposed activities were discussed with the local populations and the interventions and techniques proposed were welcomed and well-received. The number of persons directly involved with the project is relatively small since the project is focused on only 3 regions in Mauritania.

The long-term aims of the project are to demonstrate to the region's population the best means of improving vegetable production while preserving and improving the physical environment in which they live. Increased vegetable production in the off season will greatly reduce soil erosion and water runoff. This effort will produce a positive effect on the physical environment.

Different sectors of the population will undoubtedly benefit in varying degrees by the introduction of these techniques and interventions proposed. The benefits on both the social and economic aspects of the project and the impact anticipated have been assessed and covered in the "Social and Economic Analyses" of the PP, Part III, Sections C and D.

The impact on the human, physical and biological environment has been considered and discussed and it has been determined that the proposed project will not have a significant negative effect and neither the environmental assessment nor an environmental impact statement is required.

Part IV: Implementation Arrangement

The project will be implemented by contract personnel (long-term 110 pm, short-term 12 pm) selected on the basis of a competitive selection procedure. Because of the lack of administrative capability within the Ministry of Rural Development, Directorate of Agriculture, this contract will be a direct contract with AID. The contractor is to have considerable latitude in project matters: such as procurement of project commodities, vehicle maintenance, personnel support which are legitimate project costs, etc. The USAID role will be primarily one of monitor and evaluator. This approach is taken to avoid burdening an already overburdened AID/Nouakchott with additional details concerning project implementation once the contract is in effect.

A. Analysis of the Recipient's and AID's Administrative Arrangement

1. AID

In preparation for the arrival of the project contractors, USAID will carry out several activities. The first activity concerns housing arrangements. Two long-term consultants (Project Manager/Horticulturist and Agriculture coop/credit consultant)will require permanent housing. Contract TDY specialists can use anticipated USAID guest housing facilities. Vehicle support is covered in more detail under this section, Part C, "Other Logistical Considerations."

2. Project Implementation Team

In order that project objectives are met with minimal demands placed on the CDO/AID/Nouakchott, a project team of four persons will be required within the first 24 months after project authorization and the signing of the project agreement. General scopes of work for the team members are as follows:

(1) Horticulturist/Project Manager (36 months)

a) As Project Manager, the Horticulturist will have overall responsibility for assuring that the team members and TDY consultants are meeting project objectives as well as overall responsibility for project reporting and administration.
b) Possesses a speaking command of French, S-3/R-3 level.
c) Prepares documentation, assists in negotiating grants, submits reports and evaluates performance.
d) Provides professional counsel, advice and guidance on program and policy strategy.

e) Is able to work effectively with ministries, organizations and institutions in formulating specific Vegetable Production projects and programs involving informal education and training, on-the-job training, and improving and up-grading existing manpower levels.
f) Manages AID's inputs and monitors project operations, giving particular attention to the role of each implementing entity and promoting realistic measures to enhance coordination and project operations at all levels.
g) The incumbent of this position, as a minimum, must have a Masters Degree in Horticulture, have three years successful experience in Horticulture as it relates to vegetable production and soil-water management in arid regions, along with management and administrative exposure to less developed areas, preferably Africa.
h) Will be responsible for developing curriculum for formal/non-formal education.

(2) Agriculture Cooperatives/Credit Consultant (12 months)

a) The Agriculture Coop/Credit Consultant will assist the Directorate of Agriculture, Cooperatives Section, in compiling credit data concerning cooperatives, identifying and planning the overall Cooperative Credit and Marketing Scheme, and completing overall vegetable production plan during Phase I of project implementation.
b) He will assist in selecting specific cooperatives and establishing Credit and Marketing arrangements, training, and plans during project implementation.
c) He will prepare written reports and summaries on Vegetable Production Coops and Credit as it pertains to small vegetable production farming and cooperatives.
d) He will coordinate and work with the Ministry and Directorate of Agriculture officials concerned with coops and credit and management of vegetable production.
e) This consultant will prepare and submit to the Project Manager evaluation reports concerning Agriculture Coops and Credit.
f) The person will assist the Project Manager in managing inputs and monitoring program implementation in vegetable production planning, training, extension and field implementation.

(3) Hydrologist (6 months)

a) Evaluates the technical aspects of water use, quantity, quality, management and conservation.
b) Prepares written reports and summaries on training and technical findings on water management and conservations.

c) Reviews Project implementation as it relates to water resources.
d) Assists the Project Manager in managing AID inputs (water pumps, well equipment, etc.) and on-site project implementation.
e) Minimum B. S. Degree in Hydrology, with 5 years experience in developing countries, S-2/R-2 level in French.

(4) Vegetable Preservation Specialist (6 pm)

a) Evaluates program needs and recommends improvement of existing preservation methods along with new interventions.
b) Trains local family members in preparation, preservation, and use of vegetables.
c) Develops a manual of instruction showing preservation and preparation of vegetables.
d) Prepares written reports and summaries on vegetable preservation.
e) Minimum B. S. Degree, Agronomy/Soils with 2 years experience in developing countries' nutrition with emphasis on preservation techniques. S-2/R-2 level French required.

B. Implementation Plan

The project performance network chart (Annex E) requires little additional explanation.

Monitoring of implementation should be overseen by a member of the AID/CDO/Nouakchott staff assisted by the Vegetable Production Project Manager. It is recommended that the CDO officer convene a quarterly progress meeting which will bring together the Mauritanian and American representatives responsible for the project's implementation plus any short or long-term consultants assigned to the project during these months.

Implementation actions and responsibilities are presented on the attached 1) Critical Performance Indicator (CPI) Network and 2) Critical Performance Indicator (CPI) description.

C. Other Logistic Considerations

1. Vehicles

Transportation needs of the team can adequately be handled by four 4-wheel drive Land Rovers. The remaining vehicle (truck) will be used to support GIRM in distributing commodity inputs to vegetable production sites. Strict scheduling of these vehicles using a motor pool arrangement will be needed during the life of the project. Gasoline and lubricants will be stored and purchased in Nouakchott. Refer to budget tables for clarification of amounts provided by GIRM for vehicle support.

D. Evaluation Arrangements

Continued evaluation of all technical aspects of the project is of critical importance to the achievement of project purpose. This is especially true, given the fact that the vegetable production program is limited in scope and area, and that it is anticipated that the principal outputs and practices will be used in the future for continued vegetable production expansion.

1. Annual Work Plans

Detailed evaluations will be required from each long and short-term consultant on those portions of the project to which they are assigned. The results of these evaluations will formulate work plans that will form the basis upon which project direction and trends will be calculated and further programming developed. Each work plan should produce specifically measurable goals and detailed methods to be used to determine project success.

The Project Manager, Agriculture Cooperatives/Credit Consultant, Hydrologist and Vegetable Preservation Specialist must provide details of interventions in vegetable production they proposed during that year. The evaluation will include testing of intermediate results and the final successes accomplished during this interim period. Results of these tests will form the basis of the following year's work plan consisting of what will and should be done. These annual work plans will be combined into an overall evaluation with appropriate recommendations, changes in practices, and direction required to complete the Vegetable Production Project.

This information will be included in the final evaluation report for AID/W. This annual work plan from the technical consultants will provide information required for specific goals and methods for determining the success of the project.

2. Quarterly Progress Report

In addition to annual work plans, the project manager will be responsible for coordinating with the other consultants and GIRM officials and submitting a Quarterly Progress Report covering details of the program and action towards achievement of projects in relation to annual work plans.

3. Project Appraisal Report

The CDO and Project Manager will submit, based on inputs from Consultants and GIRM personnel, annual project appraisal reports consisting of details of project progress towards meeting goals, purposes, outputs, and inputs of the project. These evaluations, made after thorough consultation with GIRM officials, will assist in making sound budgeting, management and program decisions concerning the project.

4. Special Evaluation

Prior to termination of the Vegetable Production Project (6 months), an evaluation team from AID/W should be fielded to determine whether the project was sufficiently successful to warrant an additional design team to implement follow-up projects of this nature. The evaluation team will develop terms of reference required for further technical support in the areas of vegetable production. It will be the Project Manager's responsibility to assist the evaluation team in establishing terms of reference in consultation with USAID resident staff and other consultants and technicians concerned with vegetable production.

E. Conditions, covenants and Negotiating Status

1. There are no further actions required by GIRM prior to execution of the project agreement. In principle, the terms and conditions of the proposal, including scope and commitment of the GIRM for providing personnel and resources required to support and implement projectives have been fully discussed and agreed upon by the Minister of Rural Development in coordination with the Directorate of Agriculture. Understandings that have been reached between USAID and the GIRM are fully sufficient to proceed to approval of this proposed project paper.

2. Other conditions, such as POC support for last half of project life by GIRM have been detailed and are supported. Further agreements in writing from the GIRM are anticipated.

3. Peace Corps/Mauritania, has concurred in the participation of Peace Corps Volunteers and appropriate requests required to arrange for, and secure their services as described in the project paper, have begun in anticipation of project approval.

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number: Vegetable Production 682-0204

From FY 78 to FY 80
Total U. S. Funding
Date Prepared: Sept. 15, 1977

PROGRAM OR SECTOR GOAL:

The broader objective to which this project contributes:
To promote the development and welfare of the rural population by increasing small farmers incomes, productivity, and consumption, while strenthening Mauritanian institutions to respond to the development needs of the rural sector

MEASURES OF GOAL ACHIEVEMENT:

1. Increased per capita food production.
2. Increased per capita food consumption

PROJECT PURPOSE:

To strengthen the vegetable production extension service within the Agriculture Directorate of the Ministry for Rural Development, and promote increased vegetable production through improved techniques among small rural farmers and cooperatives with direction and guidance from the established Agricultural extension service.

CONDITIONS THAT WILL INDICATE PURPOSE HAS BEEN ACHIEVED: END OF PROJECT STATUS (EOPS):

1. Improved vegetable practices and techniques established.
2. Long-term Vegetable Program Plan developed.
3. Cooperative Organization and credit program developed.
4. Viable marketing system for vegetable production established.
5. Vegetable extension services fully operational.
6. Per capita vegetable production and consumption significantly increased.

MEANS OF VERIFICATION (GOALS):

1. Statistics and surveys of vegetable production and consumption by other donor agencies.
2. GIRM statistics and reports where available.

NOTE: Compare the above with baseline data or statistics (develop if necessary)

ASSUMPTIONS FOR ACHIEVING GOAL TARGETS:

1. Continued GIRM priority support in this sector.
2. Population growth rate remains the same or decreases.
3. No major natural disasters occur.

MEANS OF VERIFICATION (PURPOSE):

1. Previous contractor and project reports, results and evaluations.
2. Same as #1 above.
3. Plans produced.
4. Recommended plans and designs submitted by contractors.
5. Field trip reports based on field trips and site visits
6. GIRM records and files based on current data and field conditions.

ASSUMPTIONS FOR ACHIEVING PURPOSE:

1. Farmers responsive to new techniques.
2. GIRM provides full support towards vegetable production.
3. Resident staff and agents can be found recruited, trained and assigned.
4. The political situation remains stable

OUTPUTS:

1. A nationally organized Vegetable Production Extension Service with trained Mauritanian personnel at every level.
2. Expansion of small-scale subsistence farming of vegetable plots under production which provide for increased profits derived from the income based on augmented crop production.
3. Small farmer units, pre-cooperative groups and cooperatives organized and working in cooperation at Regional and National level.
4. A pilot cooperative development center established and operational at Boghe in the 5th Region.
5. GIRM Agriculture agents trained in agriculture extension techniques and vegetable production.
6. Nutritional status of target group significantly improved.

MAGNITUDE OF OUTPUTS:

1. One fully trained (African University) Mauritanian assigned and established as the Director for the Vegetable Production Extension Service at the National Level; Three Regional Vegetable Extension Supervisors trained (third-country) and operational in each of the three target regions on a full-time basis; Six vegetable production extension agents trained with two assigned and working in each region.
2. Vegetable production expansion amounting to 400 hectares by the end of the life of the project (three years) with 3,000 additional families involved in vegetable production.
3. One prototype cooperative development project established in Boghe with 40-50 affiliated cooperatives operational.
4. Local pre-cooperative farmer groups organized and strenghtened to facilitate production inputs, distribution, transmission of technical information to farmers, as well as marketing produce in the 3rd and 6th Regions.
5. 4,000 additional tons of vegetables produced and consumed.

OUTPUT MEANS OF VERIFICATION:

1. Staff reports and site visits.
2. Same as #1 above.
3. Staff and GIRM reports.
4. Reportes submitted to AID.
5. Reports submitted to AID/W
6. Joint reports of AID and GIRM.

ASSUMPTIONS FOR ACHIEVING OUTPUTS:

1. Small farmers will continue to show an interest in vegetable production.
2. Farmers will accept new techniques introduced to increase production.
3. Cooperatives will work in cooperation with the small farmer and increase information and interest in expanding vegetable production.
4. Marketing of produce will provide greater monetary incentives towards increased production and consumption.
5. Commodities and vehicles supplied will be used for intended purposes.
6. GIRM will continue to budget and to support the vegetable production effort.

TARGETS:

U. S.

1. 36 pm for one project manager/horticulturist services.
2. 12 pm for agriculture coop/credit consultant.
3. 6 pm for hydrologist consultant.
4. 6 pm for vegetable preservation consultant.
5. 7 Peace Corps Volunteers to assist in project implementation.
6. Vegetable production inputs (seed, fertilizer, etc.)
7. 4 Land Rovers and 1 4-ton truck
8. Nutrition education materials and demonstration equipment.
9. Training, local, OJT, in-service, 3rd country

GIRM:

1. 1 Mauritanian to head vegetable production service.
2. 3 regional vegetable production supervisors.
3. 6 agriculture extension (agents)
4. 1 cooperatives agent.
5. Drivers, laborers, and mechanics.
6. 3 demonstration plots (1/region) plus training facilities

INPUTS:

AID

1. Technical assistance
2. Vehicles and equipment
3. Commodities
4. Training
5. POL

Other U. S.

1. Peace Corps (7 PCVs)

GIRM

1. Personnel and labor
2. Land and Facities
3. Water
4. POL

IMPLEMENTATION TARGET ($000):

	AID	FY78	FY 79	FY80
AID	1.	223.0	138.0	93.0
	2.	146.5		
	3.	274.0		
	4.	26.8		
	5.	51.0		
		721.3	138.0	93.0
Other U.S.	1.	105.0	105.0	105.0
		105.0	105.0	105.0
GIRM	1.	56.5	56.5	56.5
	2.	125.0	125.0	125.0
	3.	55.0	55.0	55.0
	4.			75.0
		236.5	236.5	311.5
Inflation &Contingency		108.1	20.8	13.9
GRAND TOTAL		1170.9	500.3	523.4

Implementation Schedule

MAURITANIA 682-0204 VEGETABLE PRODUCTION Sept. 15, 1977

Project Purpose (From PP Facesheet)

A vegetable production extension service within the Agriculture Directorate of the Ministry for Rural Development, to promote increased vegetable production through improved techniques among small rural farmers and guidance from the established Agriculture extension service.

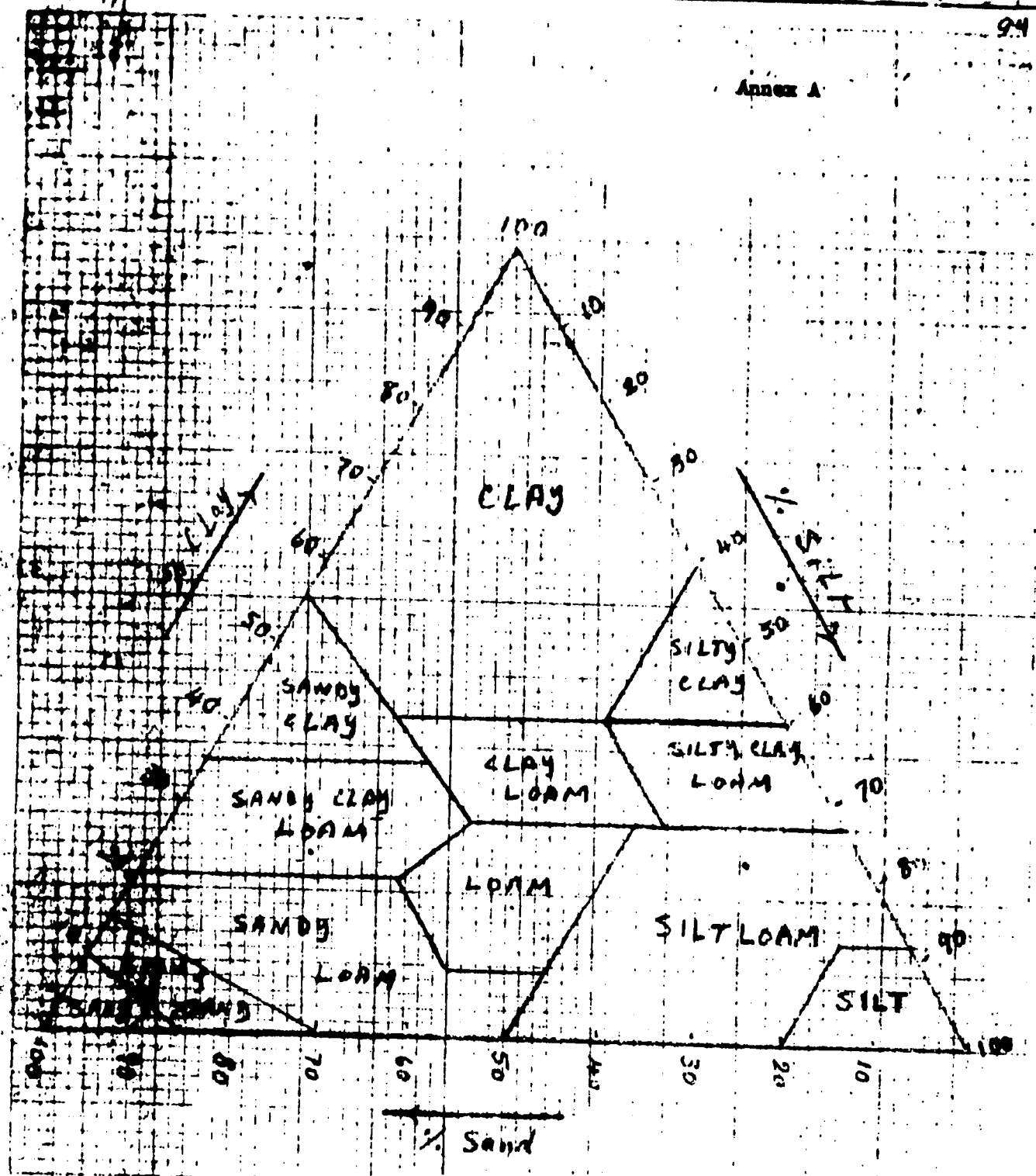
Months

0-3 PP begun-Project Paper drafted, USAID/Nouakchott, consultant technicians make appropriate changes and comments.
0-2 PP completed. Project Paper finalized and submitted to AID/W
0-1 PP approved by AID/W
0 Project Agreement signed.
1-3 Conditions precedent met.
2 Contracts and PIO/Cs approved and implemented
3 Recruitment of Project Manager/Horticulturist completed.
4 Project Manager arrives in Nouakchott
4 Commodities ordered under PIO/Cs
5 Vegetable Preservation Specialist arrives.
5 PCVs arrive for in-country training
5 Training needs assessment for vegetable production extension agents, OJT Kaedi, completed by Project Manager
6 Cooperatives/Credit Consultant arrives.
6 OJT and classroom training begins for Ag Extension Agents. Training will be rotated with 3 attending classroom theory while 3 are OJT (three month intervals).
7 Project implementation with first crop planting at nursery sites established by Ag extension agents with PCV assistance.
9 Project participant training for 3rd country participants begins. (Vegetable Production Service Chief departs for Morocco and Regional Supervisors depart for Senegal
11 Project Evaluation and Assessment of project progress completed by Project Manager with other consultants making in-puts
12 Commodities arrive
13 Hydrologist arrives.
14 First and second harvest from first planting completed.
15 Cooperatives/credit assessment and recommendations on organization and credit procedures made by consultant.
18 Credit/cooperatives consultant departs
19 Hydrologist departs after completing Water assessment
20 Organized nutritional classes pertaining to the use and preservation of vegetables operating at PMIs and women's centers (CEF)
21 Three nursery experimental/demonstration plots begin second planting season with Ag extension agents providing training to cooperatives and local farmers assisted by PCVs
24 Third planting season begins with expanded vegetable production
28-29 Third and 4th harvest completed with marketing of vegetables.

ANNEX A.

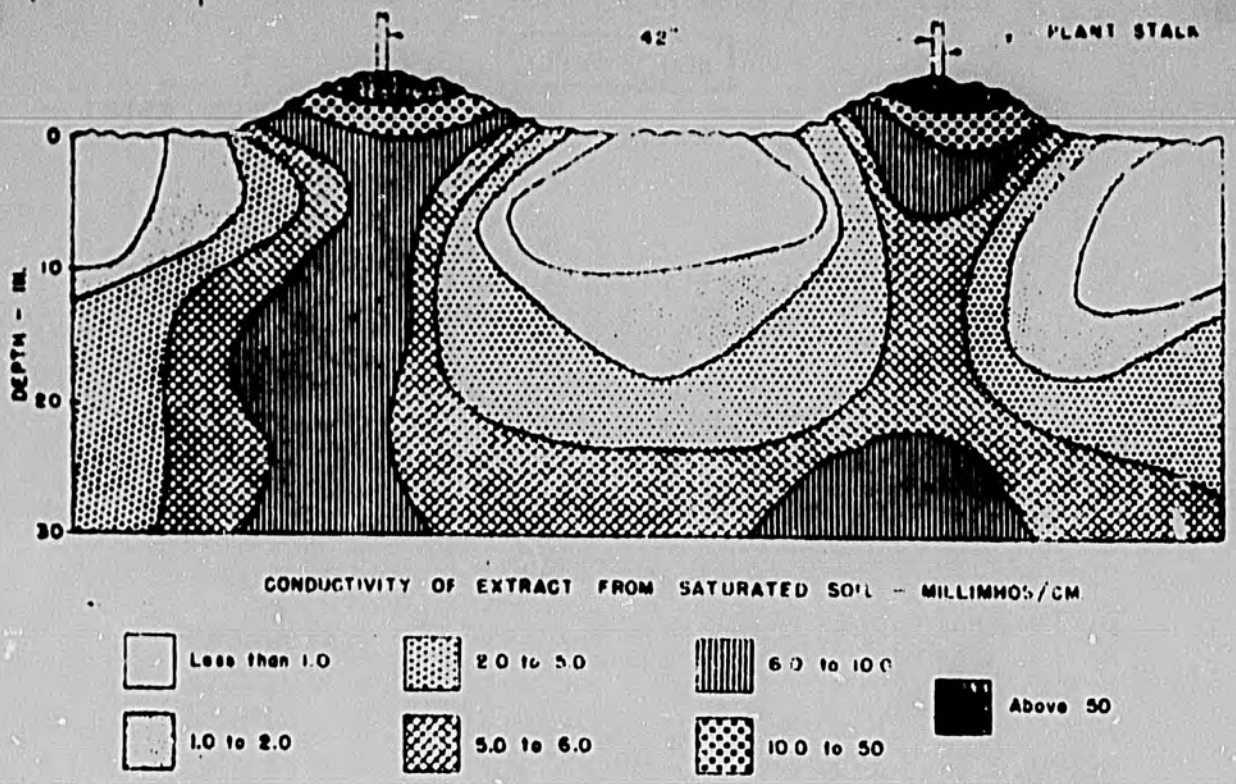
References for Technical Analysis

(Part III, A, 1-6)

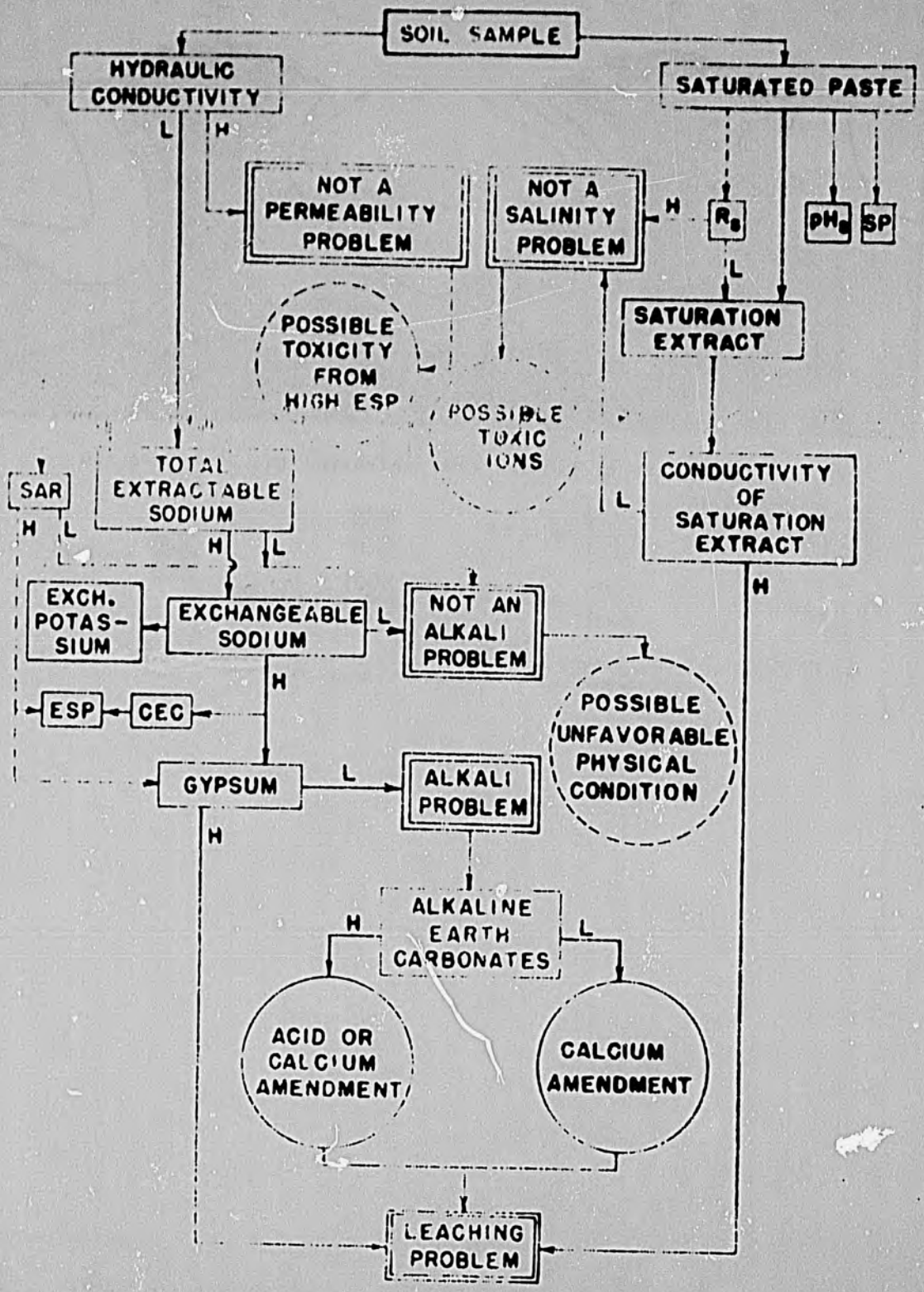


Soil Classification Chart

AGRICULTURE HANDBOOK 60, U. S. DEPT. OF AGRICULTURE



D-1 Salt distribution under furrow-irrigated cotton for soil initially salinized to 0.2 percent salt and irrigated with water of medium salinity (Wadleigh and Fireman, 1949).



D-2 Sequence of [illegible] for the diagnosis and treatment of some [illegible] soils: *H*, High, *L*, low, *R*, [illegible] of [illegible], *SAR*, [illegible], *ESP*, [illegible] percentage, *CEC*, cation [illegible]

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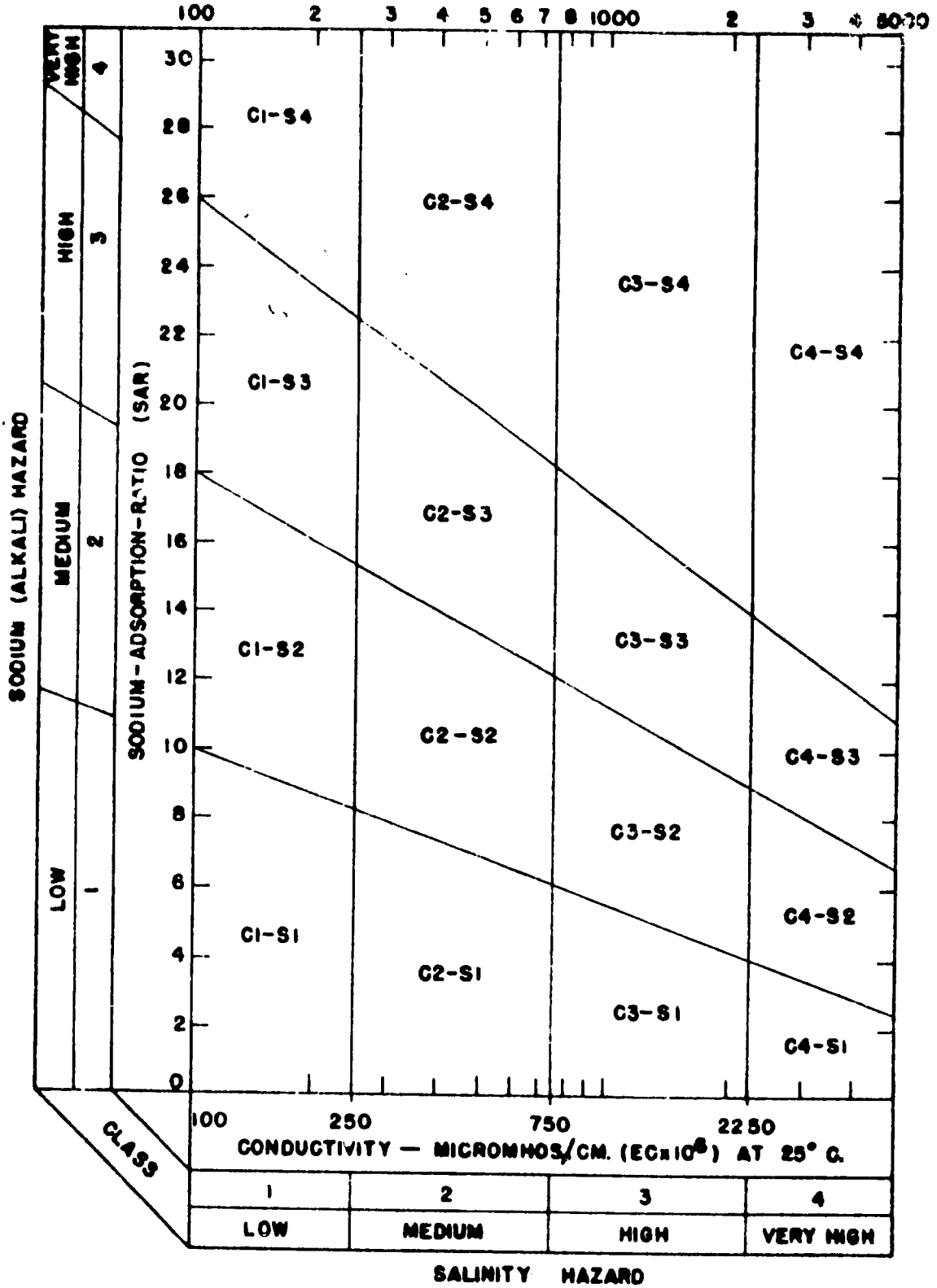
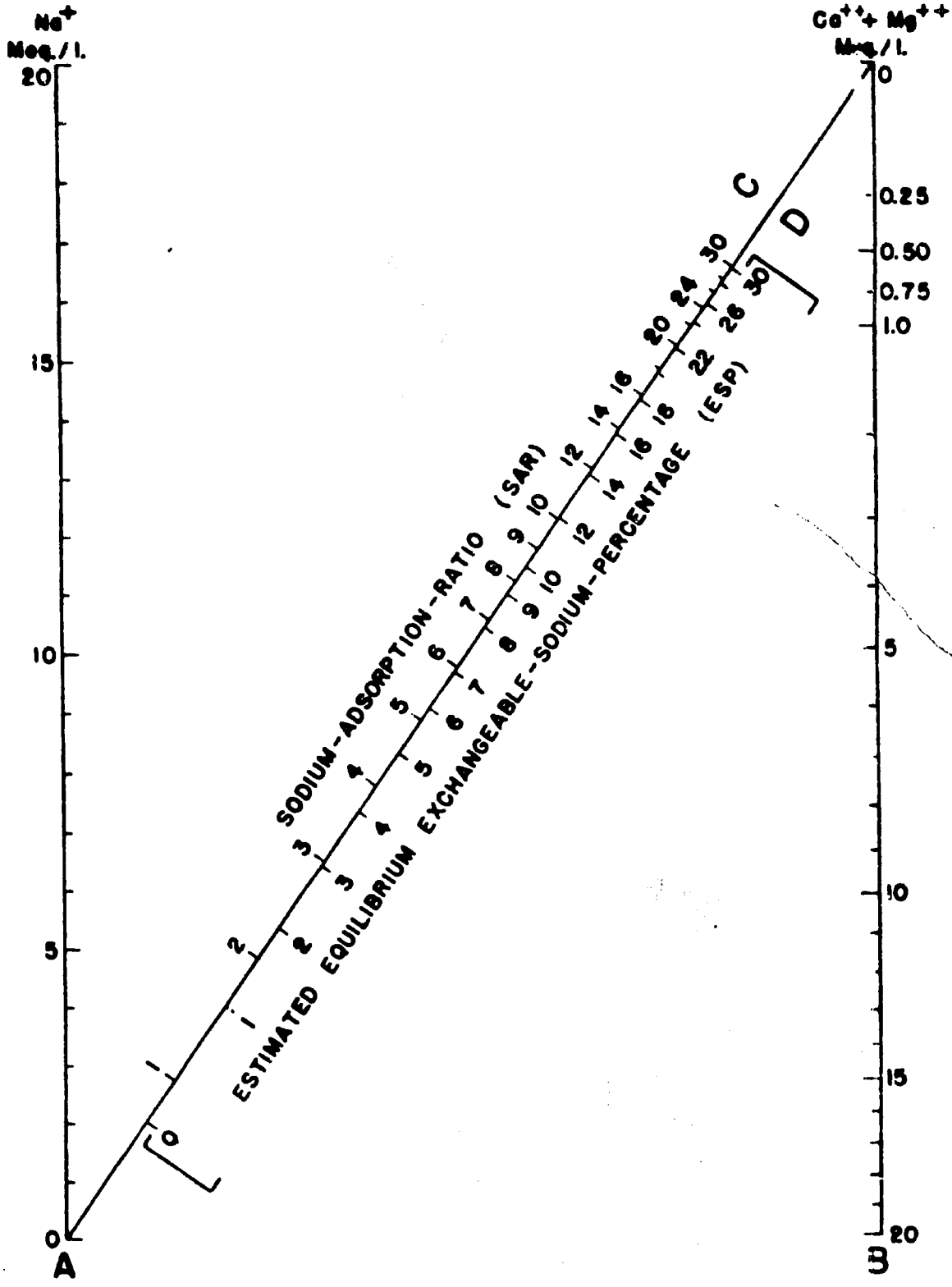


D-3 —Diagram for the classification of irrigation waters.

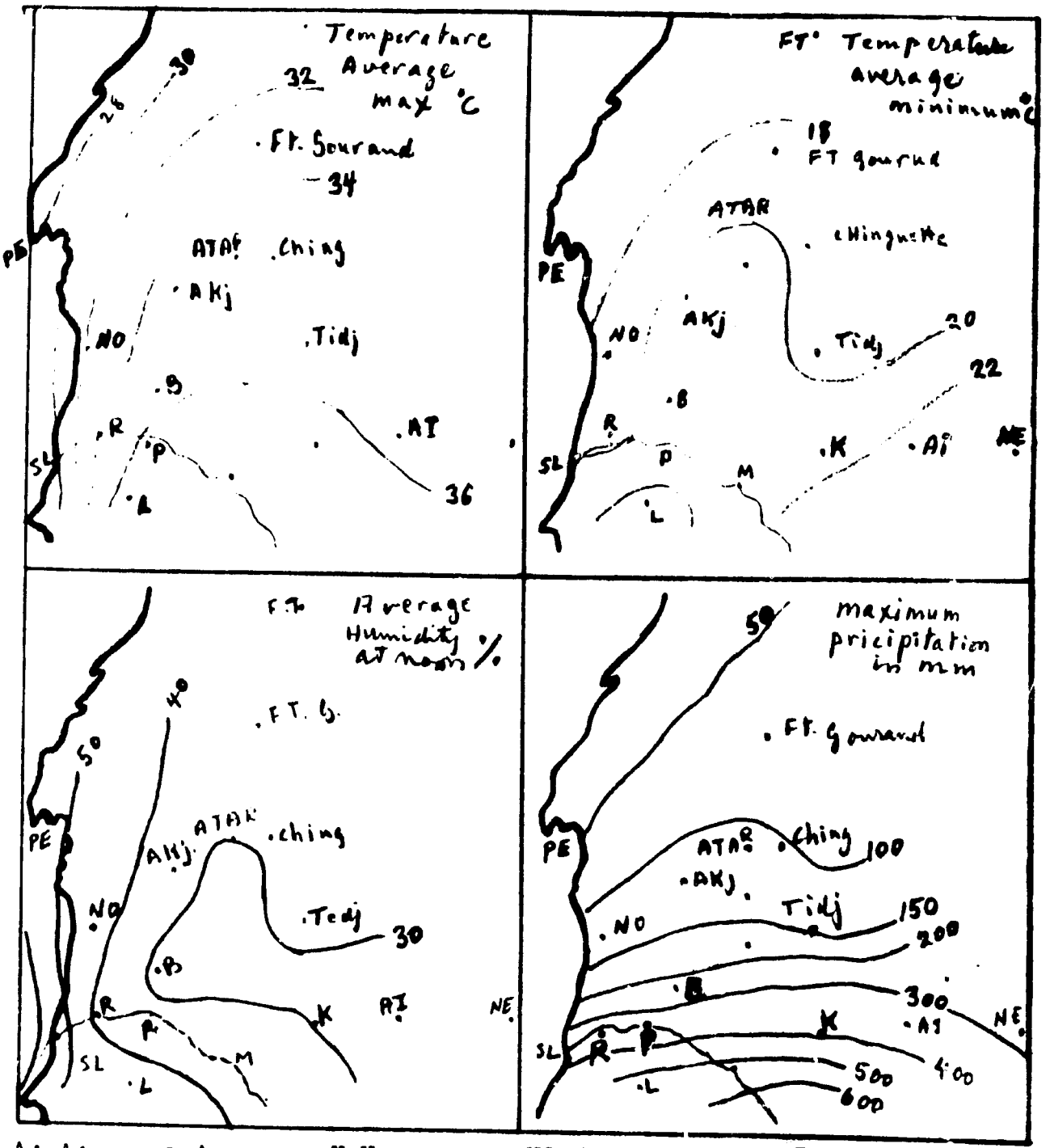


D-4 —Nomogram for determining the *SAR* value of irrigation water and for estimating the corresponding *ESP* value of a soil that is at equilibrium with the water.

From U. S. D. Handbook No. 60

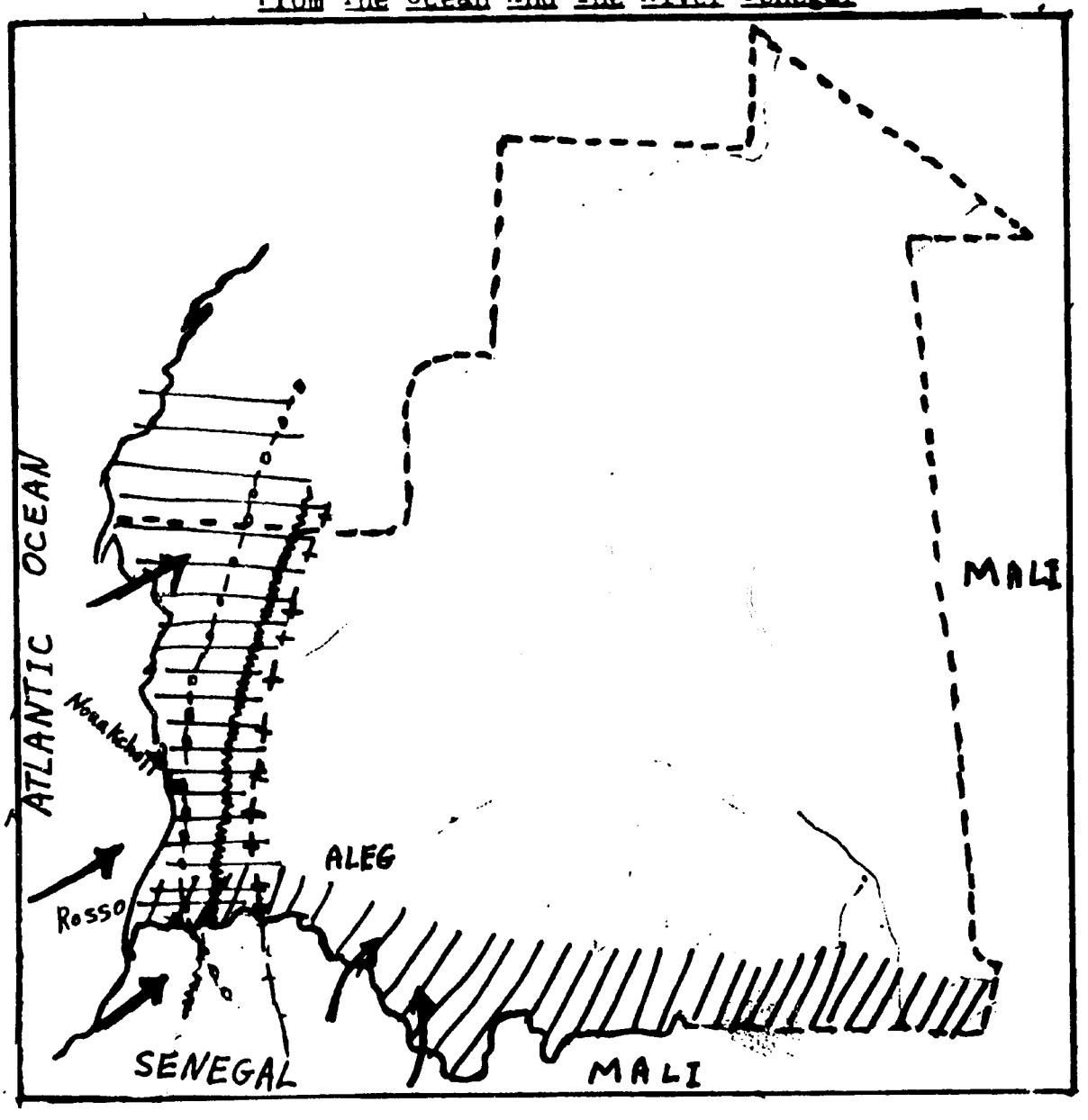
Diagram 5 Climatology of Mauritania

(temp.-rel. humidity-precipitation)



Ai-Aioun el Atrous K-Kiffa NO-Nouakchott R-Rosso
B -Boutilimit M-Mattam P -Podor SL-St. Louis
FT-Fort Trinquel NE-Nema PE-Port Etienne T-Tidjikja
L -Linguire

Diagram 6 Zones Of Salty And Fresh Water Invasions From The Ocean And The River Senegal



Zone of River Senegal Fresh Water Seepage

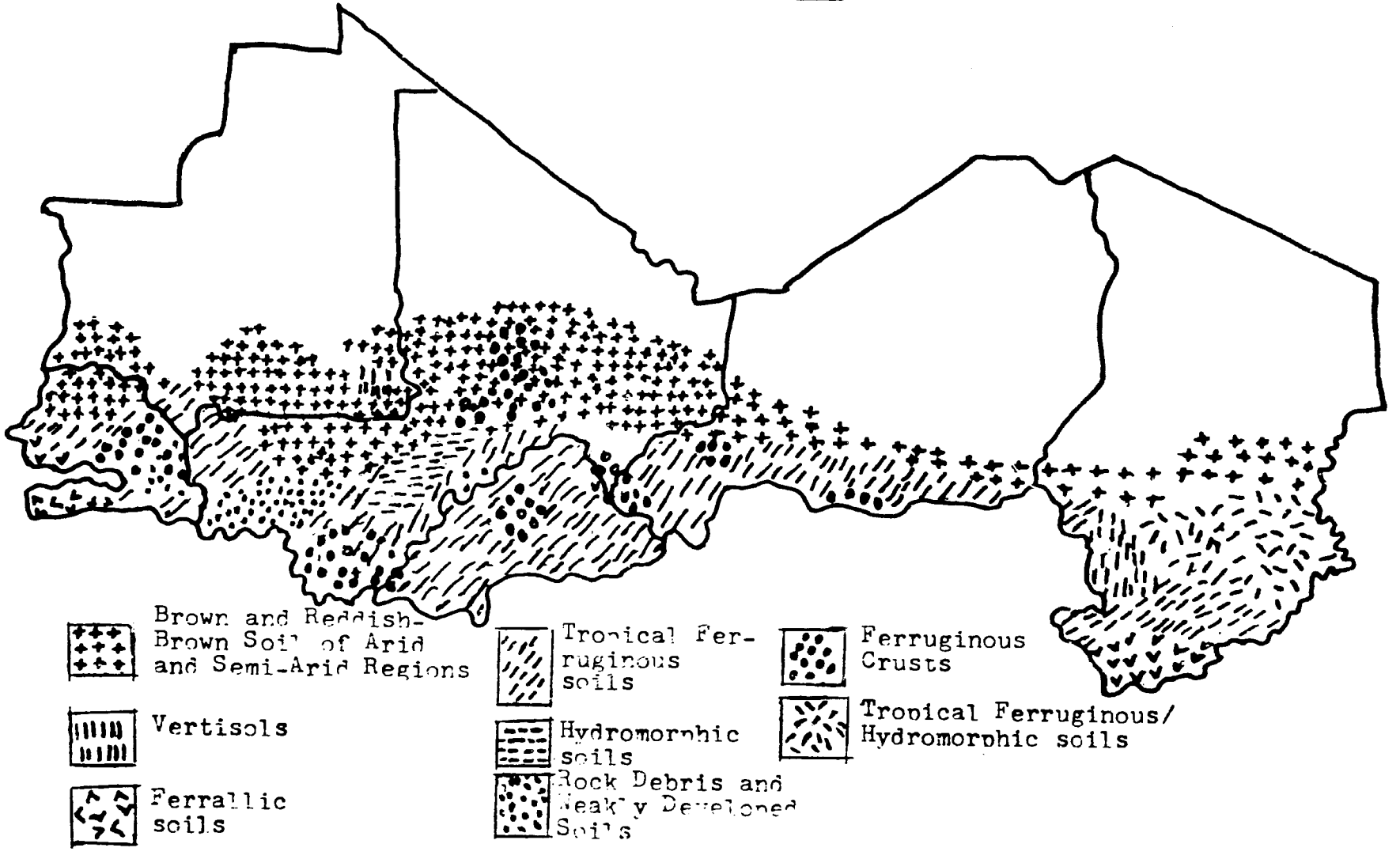
Zone of Ocean Salt Water Seepage To Deep Soil Strata

Schematic Position of Salty and Fresh Water Contact

Schematic Position of Salty and Fresh Water Contacting Fronts at Deep Level

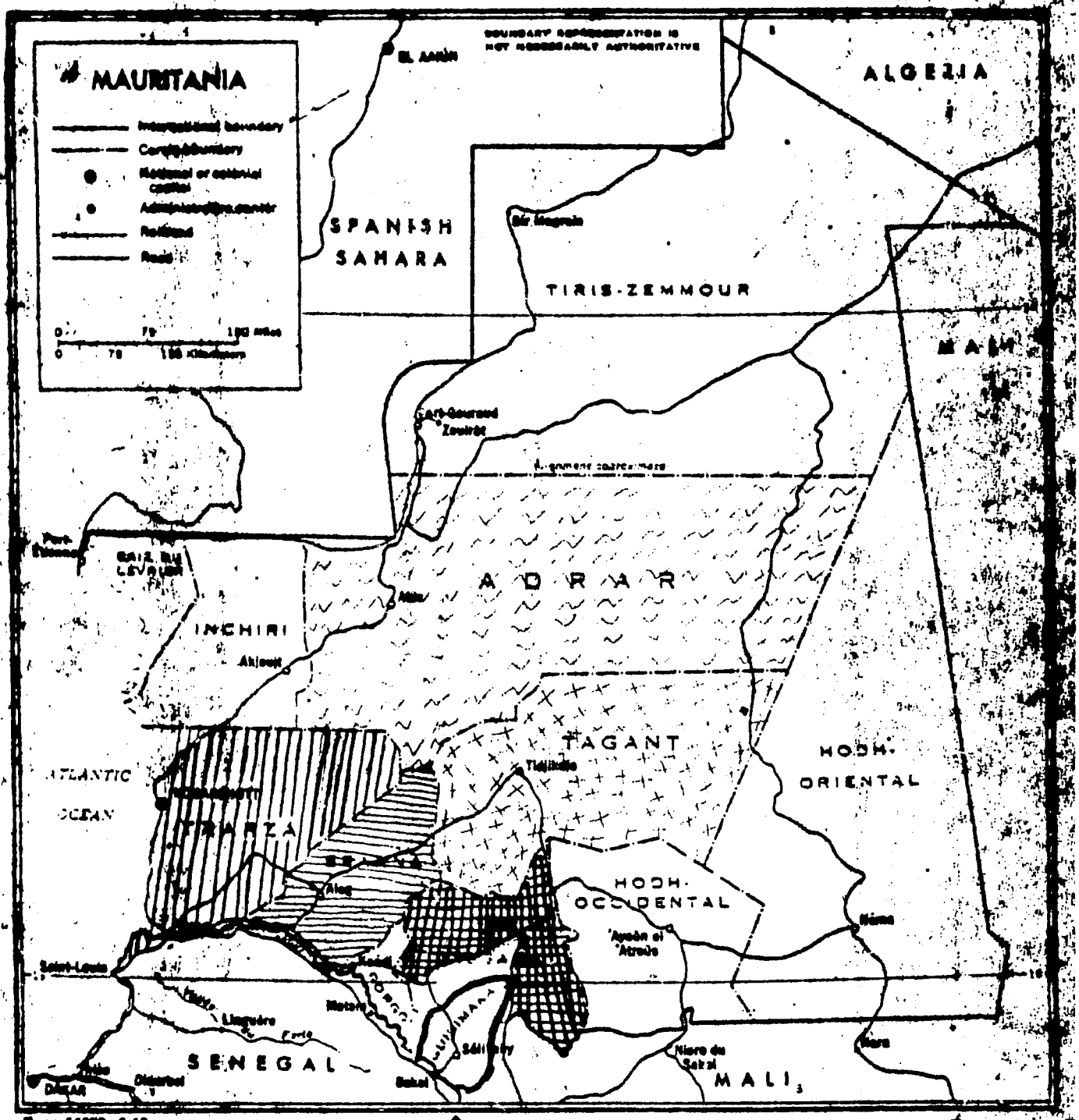
Back Edge of Old Terraces

Diagram 7 Generalized Soil Map Of West Africa



TARGET REGIONS

DIAGRAM : 8



10th REGION

6th Region

5th Region

3rd Region

7th Region

7th Region

Form 1

101

United States
Agency for International Development

W-1

Nouakchott

COLLECTOR'S DESCRIPTION OF WATER SAMPLE

Collector's No. _____ ; Lab. No. _____ ; Date _____ ; Collector _____

Name and/or owner _____

_____

Spring, Stream, Lake, Well? (circle one)

County _____ Miles—distance nearest town _____ USGS sheet _____

Location _____ ¼ Sec. _____ ; T _____ ; R _____ ; _____

Distance and direction from section corner or landmark

Other description _____

Depth _____ ; Depth to upper perforation _____ ; Casing diameter _____

Discharge _____ ; Static level _____ ; Draws down to _____

Temp. _____ °C. or °F. ; Odor _____ ; Gas _____ ; Color _____

Use: Irrig., Municipal, Ind., Stock, Domestic _____

Approximate acreage served, crops _____

Condition or symptoms of land or crops _____

Owner's opinion of water quality _____

Collector's remarks _____

_____

_____

Report to _____

_____

_____

(Please draw a map on the reverse side, if necessary, to show the exact location of the sampling site).

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Form 2

United States
Agency for International Development/Nouakchott

W-2
102

Water sample No. _____. Date _____

pH	Dissolved Solids	Boron	Sum of Cations
Conductivity at 25°C.			Sum of Anions
T°C.			EC x10⁶ Anions
$\frac{k}{R}$ = ____			Percent Na
EC x10⁶ @ 25° C.	D.S. p.p.m.	B p.p.m.	
Calcium	Magnesium	Sodium	Potassium
Ca meq./l.	Mg meq./l.	Na meq./l.	K meq./l.
Carbonate and Bicarbonate	Sulfate	Chloride	Nitrate
CO_3 meq./l.			
HCO_3 meq./l.	SO_4 meq./l.	Cl meq./l.	NO_3 meq./l.
			Received laboratory:
			Analysis completed:
			Reported.
			Reported to:

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Form 3

United States
Agency for International Development

Agriculture Research Service

W-3

REPORT OF WATER ANALYSIS

Description	

Conductivity, ECx10⁶@25°C.		Dissolved Solids: tons per acre-foot parts per million	
Percent Sodium		Hydrogen-ion activity (pH)	
Boron (B) parts per million		Silica (SiO_2) parts per million	

Cations	Milligram equivalents per liter	Parts per million	Anions	Milligram equivalents per liter	Parts per million
Calcium (Ca)			Carbonate (CO_3)		
Magnesium (Mg)			Bicarbonate (HCO_3)		
Sodium (Na)			Sulfate (SO_4)		
Potassium (K)			Chloride (Cl)		
			Fluoride (F)		
			Nitrate (NO_3)		
Sum		X X X	Sum		X X X

Analyzed by:

Reported by:

Reported to:

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United States
Agency for International Development
Nouakchott

Soil type		Date	Soil No.
Classification	Area		
Location			
N. veg. (or crop)	Climate		
Parent material			
Physiography			
Relief	Slope	Elevation	
Drainage	Gr. water	Permeability	
Moisture	Salt or alkali		
Stoniness	Root distrib.		
Remarks			

A

Horizon	Depth	Thickness	Boundary	Color (Check, Dry or Moist)	Texture	Structure	Consistence	Reaction	Spec. Feat.
				D					
				M					
				D					
				M					
				D					
				M					
				D					
				M					
				D					
				M					
				D					
				M					
				D					
				M					
				D					
				M					
				D					
				M					
				D					
				M					

B

FIGURE 23.—Outline for standard notebook pages for soil descriptions; A, front side of sheet; B, reverse side of sheet.

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United States
Agency for International Development
Nouakchott

Survey No. ..... Field No. ..... Laboratory No. .....

Locality .....

Soil type ..... Depth .....

MECHANICAL ANALYSIS

U. S. DEPARTMENT AGRICULTURE CLASSIFICATION

Diameter (mm)	Conventional Names		Percent
2–1	Very coarse sand	=	
1–0.5	Coarse sand	=	
0.5–0.25	Medium sand	=	
0.25–0.1	Fine sand	=	
0.1–0.05	Very fine sand	=	
0.05–0.002	[1]Silt	=	
Less than 0.002	[1]Clay	=	
TOTAL (Calculated on basis of organic-free oven-dry sample)		=	

OTHER CLASSES

Less than 0.005 mm	=	
Greater than 2.0 mm	=	
Organic carbon	=	
pH	=	

[1] NOTE.—Prior to Jan. 1, 1938, 0.05–0.005 mm. was called silt, less than 0.005 mm. clay, and less than 0.002 mm. colloid.

GPO 16—27733-3

INTERNATIONAL CLASSIFICATION

Fraction	Diameter (mm)		Percent
I	2.0–0.2	=	
II	0.2–0.02	=	
III	0.02–0.002	=	
IV	Less than 0.002	=	
TOTAL (Calculated on basis of organic-free oven-dry sample)			

REMARKS:

Date reported .....

MECHANICAL ANALYSIS LABORATORY

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Form 6

United States
Agency for International Development
Nouakchott

Soil Acc. No. ___

Temporary No. ___

FIELD DATA FOR SOIL SAMPLES

Sampled by _____ Mail address _____ Date _____

State _____ County _____ Nearest settlement _____

Site location _____ ¼ _____ ¼, Sec. ____; T _____, R _____

Station or farm _____ District or valley _____

Directions for finding site: (Use reverse side for a sketch of roads showing nearest settlement and distance from local landmarks.)

References (Soil Survey Bul., other publications, or correspondence):

Profile description (color, texture, structure, horizons, hardpan, origin, parent material, water table, drainage, and soil series if known):

Topography _____ Surface slope _____ Percent topsoil erosion _____

Microrelief at the sampling site, furrow, ridge, etc. _____

Disturbance from land preparation, leveling, filling, etc. _____

Sample: Depth _____ No. sacks _____ Approx. total wt. (lb.) _____

Composite sample: Depth _____ No. holes _____ Sampling method and pattern _____

_____ Approx. total wt. (lb.) _____

Undisturbed structure sample: Depth _____ No. of replicates _____

Yrs. of cultivation _____ Yrs. of irrigation _____ Source of water _____

Crop data (rotation, yield history, detailed description of plant condition at time of sampling):

Management practices:

(It is expected that not all the above blanks can be filled for every sample but the usefulness of laboratory determinations depends on the completeness and accuracy of the field data.)

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Form 7 United States Agency for International Development S-4

Soil sample No._____. Description:

Moisture in air-dry Soil	Saturation Percentage	
Can No._____	From Water Added	By Drying
Air-dry / Oven-dry	Can No._____	Can No._____
Gross		Wet / Oven-dry
Tare	Air-dry soil, gm.	Gross
Net	Oven-dry soil, gm.	Tare
CD/AD	H_2O, ml.(±)	Net
P_w (Oven-dry basis)	P_w at sat. (Oven-dry basis)	P_w at sat. (Oven-dry basis)
pH of Saturated Soil Paste	Electrical Conductivity Saturation Extract	Alkaline-earth Carbonates (Lime) (Scale: low, medium, high)
	T°C.	Lime
pH of Saturation Extract	k	Boron _____ ml.
	R	_____ %T. _____ p.p.m. B
pH of Suspension		
Soil _____	Millimhos/cm. at 25° C.	B p.p.m.
Water _____		
Calcium plus Magnesium (Versenate titration)	Sodium	Potassium
	Standard _____ meq./l.	Standard _____ meq./l.
	r = _____ = _____ meq./l.	r = _____ = _____ meq./l.
Ca+Mg, sat. ext. meq./l.	Na, sat. ext. meq./l.	K, sat. ext. meq./l.
Ca+Mg, dry soil meq./100 gm.	Na, dry soil meq./100 gm.	K, dry soil meq./100 gm.

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Table 5 Amount of Fertilizer Needed For Each Crop

Crop	Nutrient Element in Kg/ha	
	N	P_2O_5
Sorghum (grain or forage)	100-150	50
Barley/Wheat		
Dry Land	50	50
Pasture	150	75
Grain or Hay	100	75
Cabbage	100	50
Carrot	100	70
Cauliflower	125	80
Garlic	100	75
Onion	100	50
Potato, sweet	100	50
Potato, white	150	75
Tomato	100	75
Radish	90	-
Watermelon	100	50
Orange, Kg/tree	1-2	-
Lemon, Kg/tree	2-3	-

$$\frac{\text{Kg of Nutrient Needed}}{\text{Kg of Nutrient Contained in 100 Kg of Fertilizer}} \times 100 = \text{Kg of Fertilizer Needed Per Hectare}$$

For Project Inputs, Average Calculation Should Be Based Upon 100 Kg N and 75 Kg P_2O_5.

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Table 6 pH Preference of Vegetables, Fruit Trees And Field Crops

	pH		pH
Alfalfa	6-8.0	Peanut	5.3-6.6
Banana	5-7.0	Pepper	5.5-7.0
Barley	6.5-7.8	Potato	4.8-6.5
Beet	6.5-8.00	Sweet Potato	5.2-6.0
Cabbage	6-7.5	Sorghum	5.5-7.5
carrot	5.5-7.0	Spinach	6-7.5
Cashew	5.0-6.0	Tomato	5.5-7.5
Cauliflower	5.5-7.5	Turnip	5.5-6.8
Corn	5.5-7.5	Watermelon	5.5-7.5
Cowpeas	5-6.5		
Cucumber	5.5-7.0		
Eggplant	5.5-6.5		
Garlic	5.5-8.0		
Grape	5.5-7.0		
Grapefruit	6-7.5		
Lemon	6-7.0		
Lentil	5.5-7.0		
Lettuce	6-7.0		
Millet	5-6.5		
Mushroom	6.5-7.5		
Okra	6-7.5		
Onion	6-7.0		
Orange	6-7.5		
Peas	6-7.5		

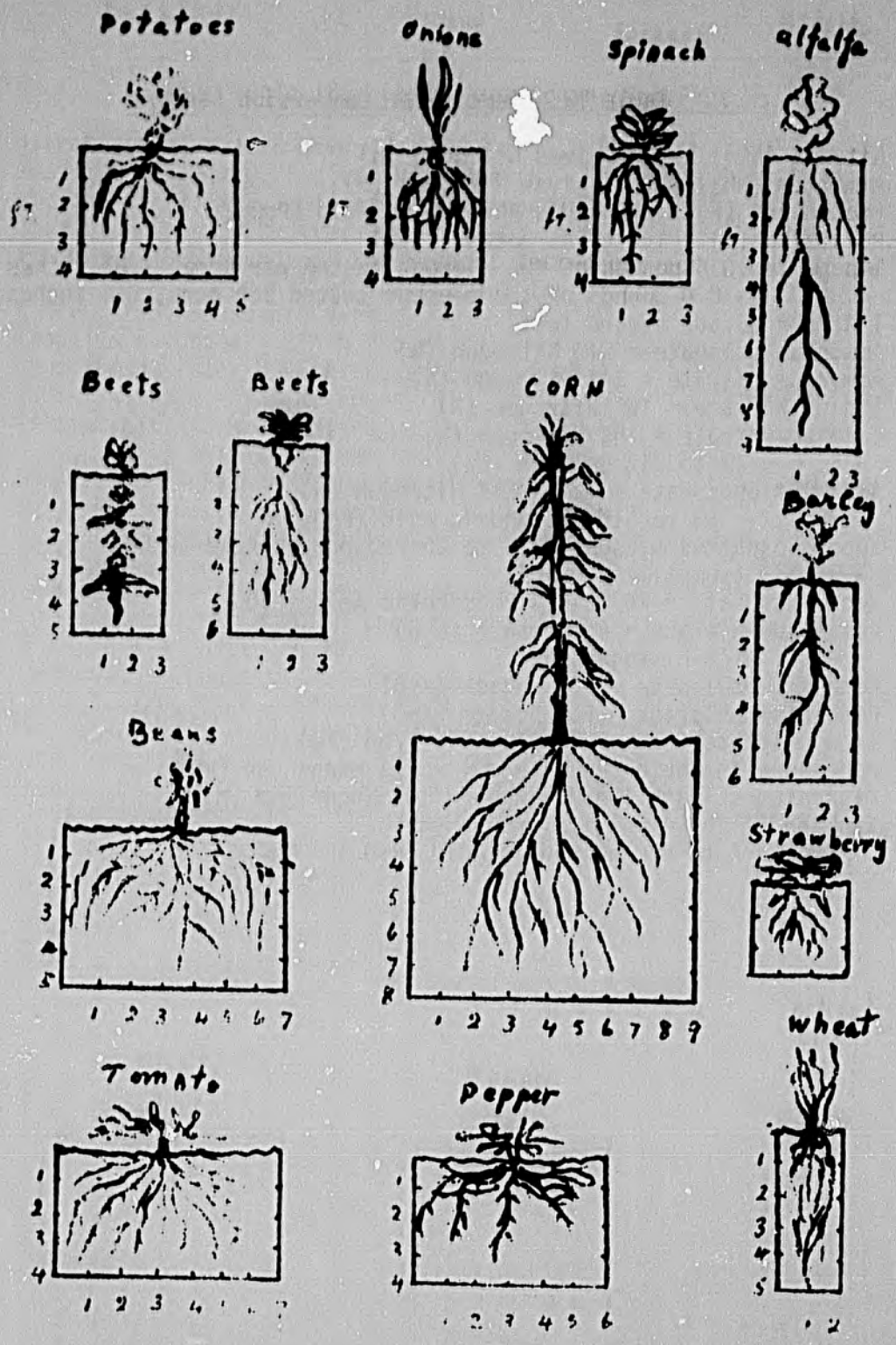
Table 4 **Relative Tolerance of Plants to Boron**

Sensitive	Semi-tolerant	Tolerant
0.5 Mg/L	1 Mg/L	2 Mg/L
Lemon	Lima Beans	Carrot
Orange	Sweet Potato	Lettuce
Apricot	Bell Pepper	Cabbage
Peach	Tomato	Turnip
Grapes	Oats	Onion
Apple	Corn (Maize)	Broad Beans
Pear	Wheat	Alfalfa
Plum	Barley	Sugar Beets
	Olive	Date Palm
1 Mg/L	Sweet Pea	10 Mg/L
	Potato	
	Lime	
	2 Mg/L	

From USAID Tech. Bulletin No. 448 (Increase in tolerance downward)

Table 12: Fertilizer Conversion Factors

Nitrate (NO_3) x .226 gives Nitrogen (N)
Ammonium (NH_4) x 0.78 gives Nitrogen (N)
Phosphorus (P) x 2.3 gives Phosphoric Acid (P_2O_5)
Potassium (K) x 1.2 gives Potash (K_2O)
1 p.p.m = 10.5 pounds of the element tested per acre, 7.87 inches deep
= 8.0 pounds of the element tested per acre, 6.0 inches deep
1 Acre = 43.560 square feet
Ammonium sulphate = 21% Nitrogen (N)
Ammonium nitrate = 34% Nitrogen (N)
Sodium nitrate = 16% Nitrogen (N)
Calcium nitrate = 15% Nitrogen (N)
17 to 24% Calcium (Ca)
Ammonium phosphate = 12 to 21% Nitrogen (N)
= 53 to 61% Phosphoric Acid (P_2O_5)
Superphosphates = usually 14 to 20 Phosphoric Acid (P_2O_5)
(sometimes 40-50%)
Rock phosphate = 24 to 35% Phosphoric Acid (P_2O_5)
Potassium nitrate = 46% Potash (K_2O)
14% Nitrogen (N)
Potassium sulphate = 48% Potash (K_2O)
Potassium chloride = 50% Potash (K_2O)
Iron sulphate ($Fe_2SO_4.7H_2O$) = 20% Iron (Fe)
Manganese sulphate ($MnSO_4.4H_2O$) = 25% Manganese (Mn)
Magnesium sulfate ($MgSO_4.7H_2O$) = 10% Magnesium (Mg)
Tankage (fish) = 6-10% Nitrogen (N)
4 to 8% Phosphoric Acid (P_2O_5)



Schematic Diagram for Root System Distribution

Ref. USDA. SCS H.B. Nti. Eng. Soil Conservation

[illegible] 1959

ANNEX B

References for Economic Analysis

(Part III, D)

VEGETABLE PRODUCTION DATA,

PRICES, YIELDS, NUMBER OF PRODUCERS, CULTIVATED AREA

TABLE 1

Vegetable Prices On Local Markets

A. Market Prices Observed on Kiffa Market, Winter Months, 1976

(quantity in kilograms, unless noted otherwise; in UM)

Product	January	February	March	October	November	December
Carrots	-	60	60	-	-	-
Tomatoes	-	45	25-30	-	-	-
Potatoes	70-80	70-80	70-80	70	70	60
Leaf Lettuce (1 bunch)	-	3	3	-	-	-
Cabbage (1 head)	-	20-25	30	-	-	-
Eggplant (1 fruit)	-	5	5	-	-	-
Beets (1 root)	-	2	2	-	-	-
Onions	50	50	50	40	50	70

Source: GIRM, Direction de l'Agriculture, Enquetes Mercuriales de Kiffa, April 4, 1977.

B. Market Prices Observed on Rosso Market, 6th Region Range of Prices Oct.-Dec. 19
(quantity in kilograms, unless noted otherwise; in UM)

Product	PRICES		
	Minimum	Maximum	Average
Tomato	15	40	20
Onion	30	50	36
Potatoes (sack of 25 kg)	1400	2000	1400-1500
Cabbage (1 head)	15	30	15
Carrots	20	40	30
Turnips	8	30	10
Eggplant	15	40	20
Parsley (1 bolt)	2	10	8

Source: GIRM, Direction de l'Agriculture, Report of the Chef de Secteur Agricole, February 1977.

TABLE 2

Area Under Vegetable Cultivation Campagne 1976-77

A. Kiffa, Third Region (in square meters)

Department	Existing Area	Additional Area Cultivated in '76 - '77	Total
Kiffa	46,760 M^2	9,352 M^2	56,112 M^2
Kankossa	21,210	2,128	23,331
Guero	8,400	840	9,240
Backeol	11,270	1,127	12,397
Boumdeid	763	76	839
Area Cultivated by Groupements Precooperatifs	30,000	12,000	42,000

B. Boghé and Vicinity and Surrounding Villages, Fifth Region (in square meters)

Locality	Total
Boghe & vicinty	8,598 M^2
Aleg	1,287
Beilane	1,350
Sinthiane Ando	96
Diama Al Walli	243
Ranere	5,350
Donnaye	174
Dar El Barka	10,520
M'Gourdiane	89
Olo Ologo	2,400
N'Goral	2,400
Magta Lahjar	n.a.

TABLE 3.

Number of Producers

A. Kiffa, Third Region

Department	Number
Kiffa	701
Kankossa	345
Guero	117
Backeol	171
Boumdeid	109
Groupements Precooperatifs	30

Source: Report of the Chef Sectuer Agricole de Kiffa to the Directeur de l'Agriculture, dated April 3, 1977.

B. Boghe and Vicinity, 5th Region

Locality	Number
Boghe	382
Aleg	168
Beilane	39
Sinthiane Ando	25
Diana Al Walli	n.a.
Ranere	22
Donnaye	25
Dar El Barka	180
M'Gourdiane	6
Olo Ologo	80
M'Goral	86
Magta Hahjar	n.a.

TABLE 4.

A. Yield by Type of Crop, Kiffa, Third Region, 1976-77 (in metric tons)

Product	Amount
Tomatoes	12.2
Potatoes	7.3
Onions	7.0
Beets	3.5
Sweet potato	1.75
Cabbage	1.05
Lettuce	.35
Other (including eggplant, okra)	1.85
TOTAL	35.0

B. Yields, by Type of Crop--Producers in 5th Region (area in square meters; yield in metric tons)

Locality	Area planted (m^2)	(1) Tomatoes	(2) Carrots	(3) Cabbage	(4) Turnips	(5) Beets	(6) Onions	(7) Lettuce	(8) Potatoes
Boghe & Vicinity	8,598	11.63	5.10	5.86	1.53	1.62	4.86	4.92	1.06
Aleg	1,287	1.70	1.16	.69	.80	.50	.52	.99	
Beilane	1,350	1.46		.99			1.09	.32	2.88
Sinthiane Ando	96	.12		.64		.25	.15	[illegible]	
Diama Al Walli	243	.21		.14			.60	.11	
Ranere	5,350	.99					1.18	.90	
Donnaye	174	.12		.18		.15	.23	.15	
Dar El Barka	10,520	.87		.69			8.50	.50	
N'Gourdiane	89	.23		.12		.13	.19	.30	
Olo Ologo	2,400	5.25		1.89		.50	2.60	.30	1.40
N'Goral	2,400	3.25		.50		.30	1.50	.80	
Majtaa Lahjar	n.a.								

Source: GIRM, Report de Chef de Secteur Agricole de Boghe, April 1977

Table 1 Vegetable Production in the 6th Region

Cron	Yield (tons)
Onion	443.7
Tomato	338.4
Potato	114.2
Cabbage	76.1
Beet	5.8
Melon	39.5
Eggplant	65 kg

District	Vegetable Production (hectares)
Rosso	33.128
R'kiz	26.345
Keur Macene	16.987
Mederdra	0.34
Total	76.800 ha.

Table 2 Vegetable Production in the 5th Region

Cron	Cultivated Area (hectares)
Onions	1.8
Tomato	0.4
Cabbage	0.3
Carrot	0.2
Beet	0.1
Potato	0.1
Turnip	0.05
Total	2.95

Annex C: Report on 1976/77 Truck Farming Season - Boghé Agricultural Sector

ISLAMIC REPUBLIC OF MAURITANIA

DIVISION OF AGRICULTURE

BOGHÉ AGRICULTURAL SECTOR

Report on 1976/77 Truck Farming Season

By

Niang Ousmane Debe

CONTENTS

I: Introduction

II: List of Personnel Having Participated in the Cropping Season

III: Equipment and Tools Used

IV: Distribution of Truck Farming Tools in the Villages

V: State of Truck Farming in Each Village

VI: List of Villages Which Participated in the Campaign

VII: General Farming

VIII: Inventory of Tools After Cropping Season

IX: Estimates for Next Cropping Season

X: Behavior of Personnel

XI: Proposals

XII: Conclusions

I: Introduction

Commencing at the end of November in certain areas and end of January in others, the 1976/77 Truck Farming Season as should be expected faced some difficulties--(problems due to ignorance and shortage of water).

1) Ignorance: Most of those who did the truck farming are simple farmers, mostly versed with Dieri or Oualo farming (flood plain farming) who know nothing about truck farming.

2) Water: The ponds or wells which the farmers themselves dug individually could not be operational throughout the season. Although the scope of action had been limited by the means put at our disposal, many villages were at least programmed. As to truck farming tools, their distribution was not done at random but in consultation with the regional administrative authorities and in accordance with the criteria laid down in circular No. 478/D.A. of the Agricultural Division.

II: List of Personnel Who Participated in the Truck Farming Campaign

a) Boghé

1 Supervisor
1 Monitor (extension staff)
1 Driver
7 Laborers

b) M'Bagne

1 Supervisor
1 Laborer

c) Magtâa Lahjar

1 Supervisor

d) Dar El Barka

1 Supervisor
2 Laborers

e) LobouDou

1 Monitor

f) Olo Ologo

1 Monitor

g) N'Goral

1 Monitor

h) Aleg

Extension service obtained from Boghé

III: Equipment and Tools Used

1 Land Rover No. SG 1899
145 Fuel Tickets
32 Liters of Engine Oil "40"
1 Liter Brake Fluid
6 Kilograms of Grease Oil
28 Liters of Engine Oil "90"

Tools:

396 watering cans
300 spades
300 hoes
250 sickles
2 sprayers
200 portable sprayers
50 powder spraying bags
3 tins of zithiol

Seeds:

3 kilograms of tomato seed
8 kg onions
2 kg lettuce
13 kg carrots
5 kg cabbage
10 kg beets
50 kg alfalfa

IV: Distribution of Tools in the Villages

Village	Tools Given		Authority
Magtâa Lahjar	-15 watering cans -35 powder sprayers	-25 spades -32 hoes	head of CER
Aleg	-20 watering cans -20 spades -15 powder sprayers	-20 hoes -25 rakes	Economic Governor
Olo Ologo	- 8 watering cans -15 powder sprayers	- 7 hoes - 7 rakes	Monitor on-the-spot
Dar El Barka	-15 watering cans -15 rakes	-15 hoes -15 spades	head of CER
M'Bagne	-20 watering cans -10 hoes	-20 rakes -20 spades	head of CER
LobouDou	- 8 watering cans - 5 hoes	- 5 spades - 5 rakes	Monitor on-the-spot
N'Goral	-10 watering cans - 5 spades	- 5 rakes -10 hoes	Monitor on-the-spot
Boghé and surrounding areas	-300 watering cans -117 spades -140 hoes	-73 rakes	Those concerned

V: State of Truck Farming in Each Village /*

Village	Area Cultivated	Area per Bed	Tomatoes	Carrots	Cabbage	Turnips	Beets	Onions	Lettuce	Irish Potatoes
Boghé (Operation covered Dhinnthou, Louguel Awguel, Touldé, Boghé town)	8598sq.m.*	3sq.m.	11.630T**	5.104T	5.867T	1.530T	1.627T	4.861T	4.927T	1.656T
Aleg	1287sq.m.	3sq.m.	1.696T	1.158T	0.690T	0.800T	0.500T	0.525T	0.999T	
Beilane	1350sq.m.	10sq.m.	1.457T		0.989T			1.085T	0.316T	2.880T
Sinthiane Ando	96sq.m.	3sq.m.	0.116T		0.644T		0.250T	0.154T		
Diama Al Walli	243sq.m.	5sq.m.	0.209T		0.142T			0.595T	0.109T	
Ranere	5350sq.m.		0.991T					1.175T	0.900T	
Donnaye	174sq.m.		0.122T		0.182T		0.145T	0.231T	0.149T	
Dar El Barka	10,520sq.m.		0.874T		0.690T			85.000T	0.499T	
N'Gourdiane	89sq.m.		0.233T		0.118T		0.125T	0.191T	0.300T	
Olo Ologo	2400sq.m.		5.246T		1.886T		0.500T	2.590T	0.300T	1.140T
N'Goral	2400sq.m.		3.246T		0.500T		0.300T	1.500T	0.800T	
Magtâa Lahjar	Report from the C.E.R. had not reached sector when these figures were gathered.									

/* These figures represent the harvest estimate for each vegetable.
*sq.m. = square meters
**T = Tons

VI: List of Villages Which Participated

Village	Number of Persons	Remarks
Boghé	382	Fair
Aleg	168	Fairly Good
Olo Ologo	80	Good Harvest
Beilane	39	Good Harvest
M'Bagne	28	Good Harvest
N'Goral	86	Fairly Good
Ranere	22	Good Harvest
N'Gourdiane	6	Fair
LobouDou	42	Fair
Dar El Barka	180	Good Harvest
Donnaye	25	Good Harvest
Ando	10	Poor
Sinthiane El Wali	25	Fairly Good

Total 1103 Persons

VII: General Summary

Vegetables	Total Area Cultivated	Estimated Harvest
Onions	17,880 sq. meters	60,132 kilograms
Cabbage	2,497 sq. meters	10,375 kgs
Tomatoes	3,777 sq. meters	18,335 kgs
Carrots	1,929 sq. meters	5,784 kgs
Beets	1,029 sq. meters	2,000 kgs
Irish Potatoes	1,099 sq. meters	6,042 kgs
Taulib	532 sq. meters	2,150 kgs

VIII: Inventory of Tools and Equipment After Cropping Season

Hoes	-	61	
Spades	-	85	
Forks	-	130	
Hand Sprayers	-	130	
Fuel (gas)	-	20	tickets
Oil "140"	-	5	liters
Grease	-	3	kilograms
Sprayer Bags	-	50	

IX: Estimates for Next Season (1977/78)

a) Tools:

Place	Watering Cans	Rakes	Hoes	Spades
Bogné	150	100	-	-
Bababé	200	150	150	150
M'Bagne	200	150	150	150
Magtâa Lahjar	100	50	50	50
Aleg	45	30	30	30
TOTAL	695	480	380	380

b) Seeds:

Tomatoes	-	9 kilograms
Carrots	-	26 kgs
Onions	-	16 kgs
Cabbage	-	10 kgs
Lettuce	-	3 kgs
Beets	-	15 kgs
Taulib	-	20 kgs
Eggplant	-	9 kgs
Irish Potatoes	-	30 kgs

X: Behavior of Staff

The whole staff proved equal to the task. Everyone diligently worked for the successful outcome of the cropping season. One could not distinguish laborer from staff, for they all worked hand in hand in a remarkable enthusiasm not only to successfully carry out this campaign but above all to teach and educate. And furthermore their attitude enabled the farmers to increase their efforts and become fully conscious. I wish to thank them all for their dynamism and spirit of sacrifice.

XI: Proposals

It is of no use doing truck farming each year if the truck farmers themselves are not aware of the importance of the crop. For this reason, it is important to differentiate true truck farmers from the false ones. In order to attain this objective the Division of Agriculture should even as a test leave the farmers to do the necessary things. That is to say leave them to buy the tools. This will require a great effort from the government, however, Because they should be able to obtain the tools from the local market, stocks of seeds and tools (spades, hoes, rakes, planters, etc.) should be constituted at regional level. These tools should be within the reach of our mass, which means that they should be sold at reasonable prices. It is conceivable that if it is the farmers themselves who buy these tools, work will be more rational. The farmer will do everything possible to make his work profitable, which will lead him to make an effort of maintaining these tools in good state.

On the other hand when an operation is planned, the headquarters should prior to its commencement put the materials and means required at the disposal of the sector concerned. They should be delivered late in July in order to enable the technicians to study and draw up a sound program. And also the gas (fuel) problem should be solved. This solution could be found by sending a special fund or valid fuel tickets to Aleg, and supplies, especially engine oil and Lockheed brake fluid, should be sent in sufficient quantities. And also in view of the great shortage of instructors to meet extension needs, it is vital to select at village level more or less experienced people to second the sector's staff, but these people should be paid.

Motor pumps should be distributed to truck farming cooperatives

which apply for them and which are likely within a short or intermediate term to cover their costs.

The sector should be equipped with sufficient treatment equipment and phyto-sanitary products. The fertilizer stock should be increased. Apart from 10.10.20 fertilizer, the sector has a shortage of the rest. It will be good to supply it. As for seeds, the taste of the population should be taken into account. The most appreciated varieties should be sent in greater quantities (onions, tomatoes, cabbage, Irish potatoes, egg-plant).

XII: Conclusion

Obviously the goal is far from being attained, however, the positive aspects brought about by the campaign should be noted. It will be worthless listing them all but stating some of them will be necessary:

1) The campaign has enabled having fresh vegetables on the local market at low prices.
2) It has reduced the importation of foreign products (tomatoes, onions). The yield was very high, for instance, that of lettuce exceeded local demand. The Boghémarket was not only supplied by on-the-spot gardens, but also surrounding villages such as Olo Ologo, Beilane, Dar El Barka, etc.
3) It has also reduced idleness, for many farmers who could not grow their crops were able at least to have some occupation. The campaign would have been more interesting and profitable if in actual fact the problem of water did not arise. It is a great