b) Net value of agricultural output

c) Production increase between "with project" and "without project"

d) Individual farm income

(6) Project Implementation Schedule

a) Construction plan

b) Construction time schedule

c) Construction equipment and materials

d) Operation and management of construction works

(7) Cost estimates

a) Capital cost estimates

b) Engineering and general expences

c) Contingency and reserves

d) Annual cost estimates

3.3.4 Organization and Management

a) General aspects

b) O & M arrangement

c) Extension services program

d) Research program

e) Supply of inputs and marketing

f) Credit system

g) Project authority or cooperative

h) Training program

3.3.5 Economic Evaluation

a) Project cost and incremental benefits

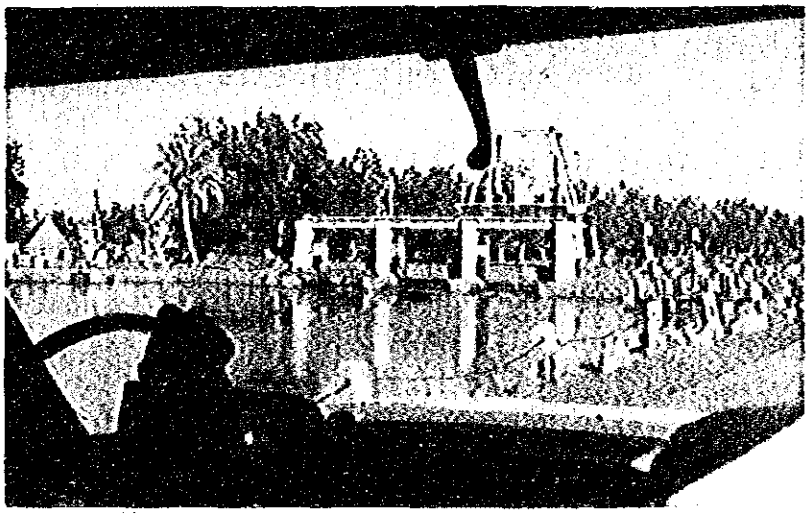
b) Secondary benefits and intangible benefits

4. ATTACHMENTS

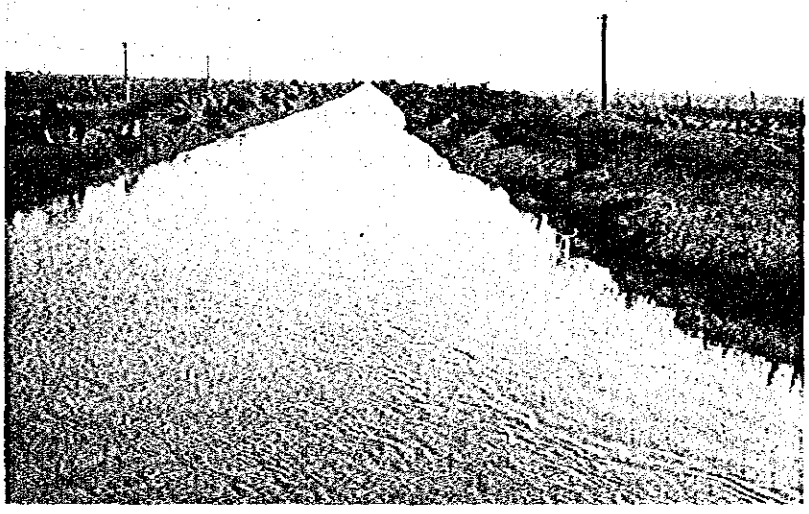
4.1 Field Photos

GEZIRA SCHEME

With officers in charge and a counterpart



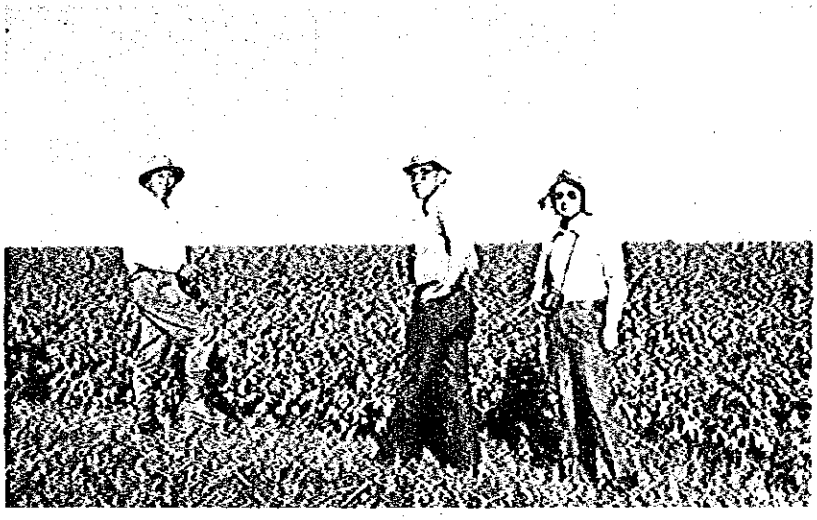
Diversion works on a main irrigation canal



Irrigation canal

GEZIRA SCHEME

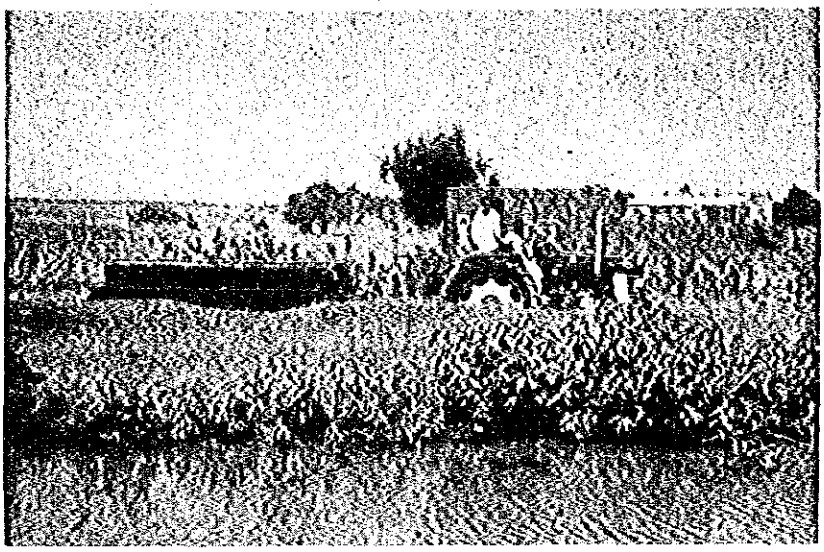
A herd of cattle on the fallow



Catton in full bloom

Irrigation canal

GEZIRA SCHEME



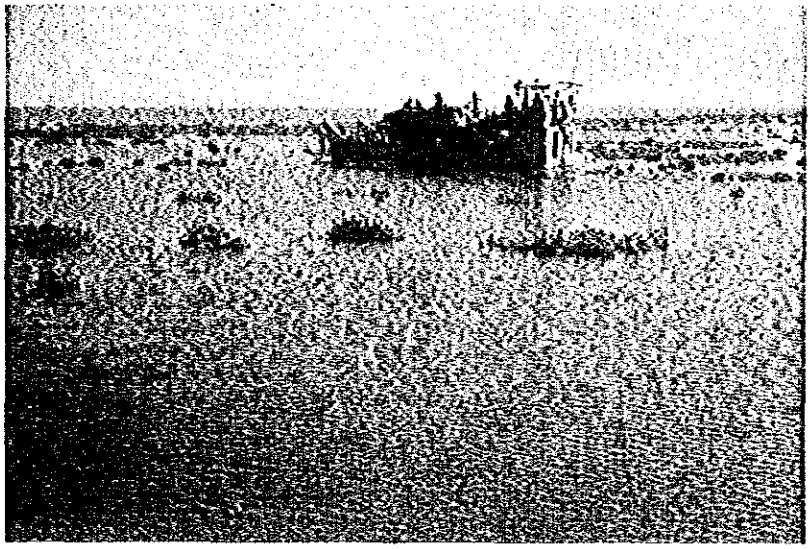
Tenants taking their way to farm land

A village

ED. DUEIM

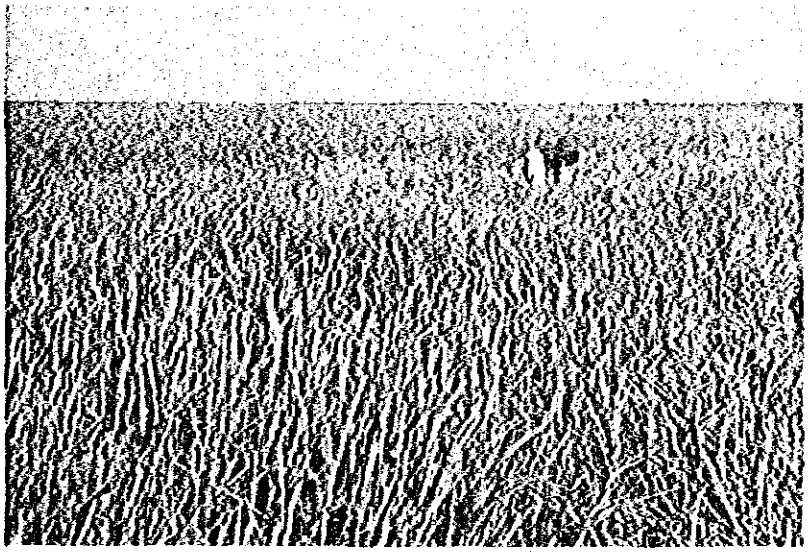
A fruiterer's

WHITE NILE PROVINCE



White Nile
and a ferry

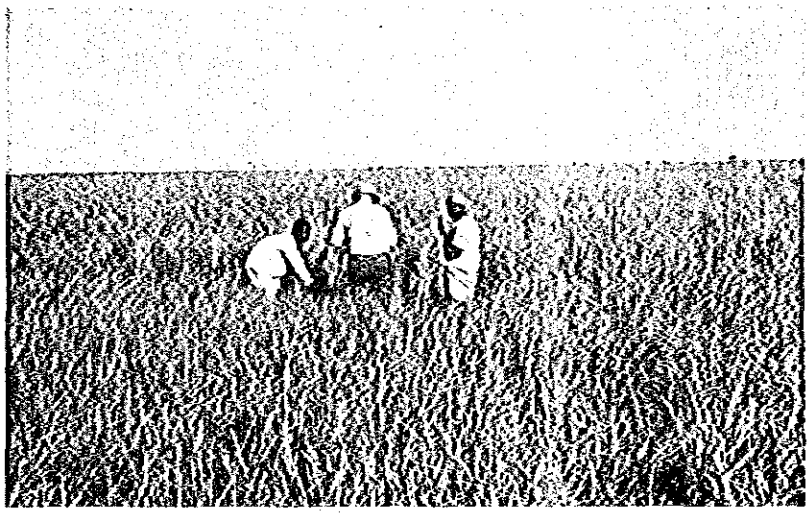
Experimental farm
at a Agricultural
Research Office



Traditional
rice Cultivation
land near
the Gasaba Area

WHITE NILE PROVINCE

Traditional rice cultivation land near the Gasaba Area

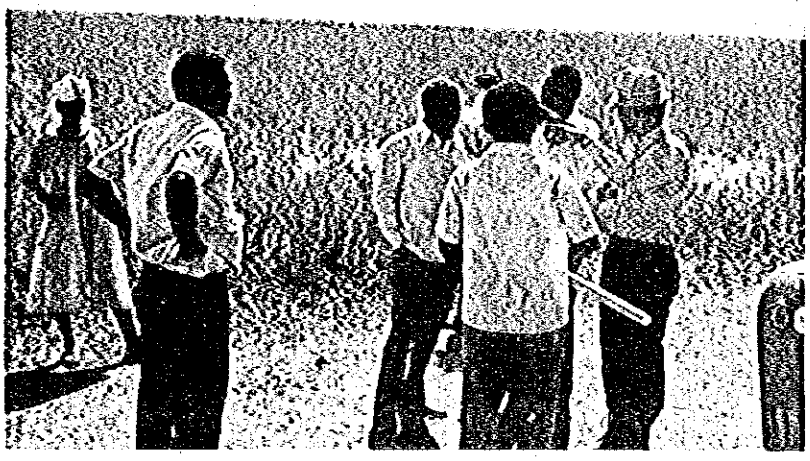


Same as abone

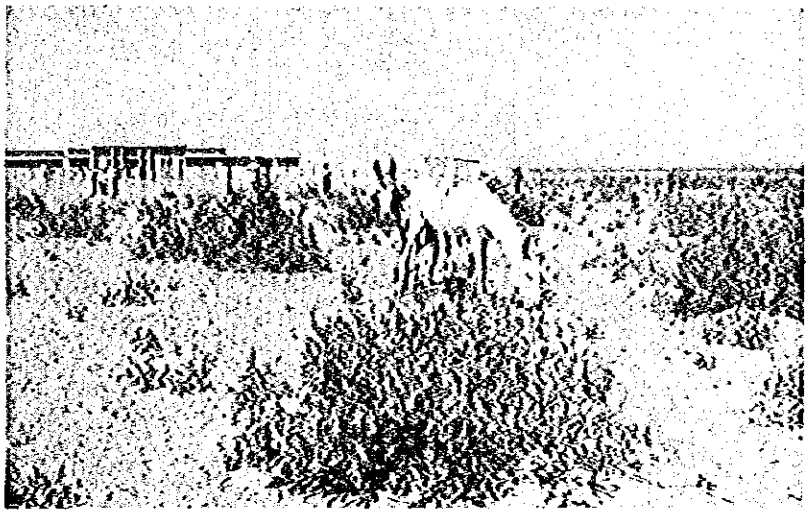
Same as abone

WHITE NILE PROVINCE

URBIK Pamp
irrigation area

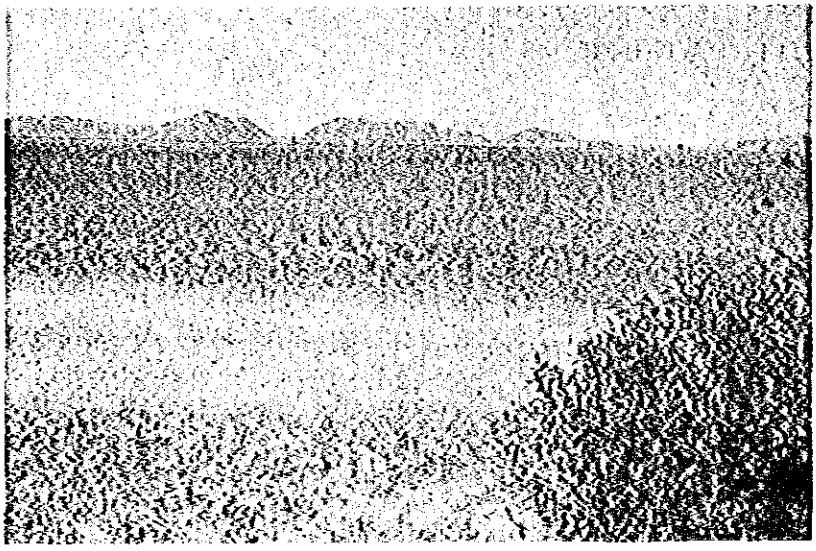


SUFI village



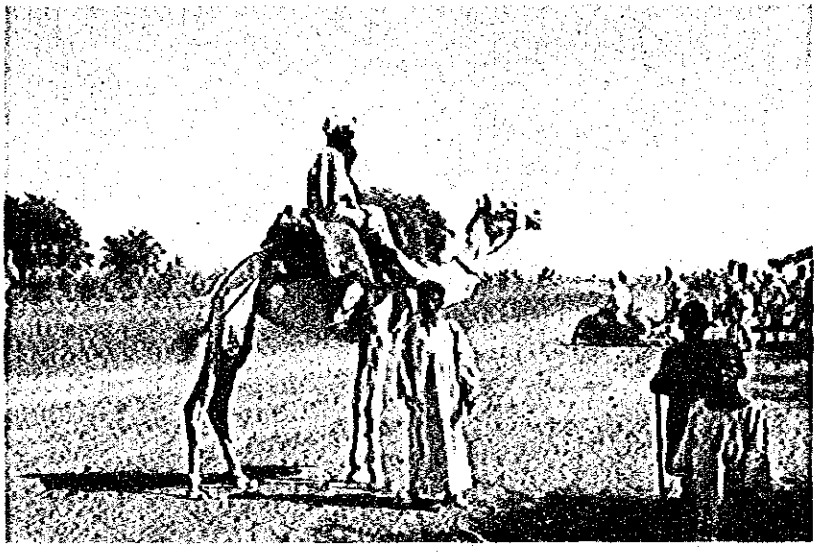
SHATAWI Area

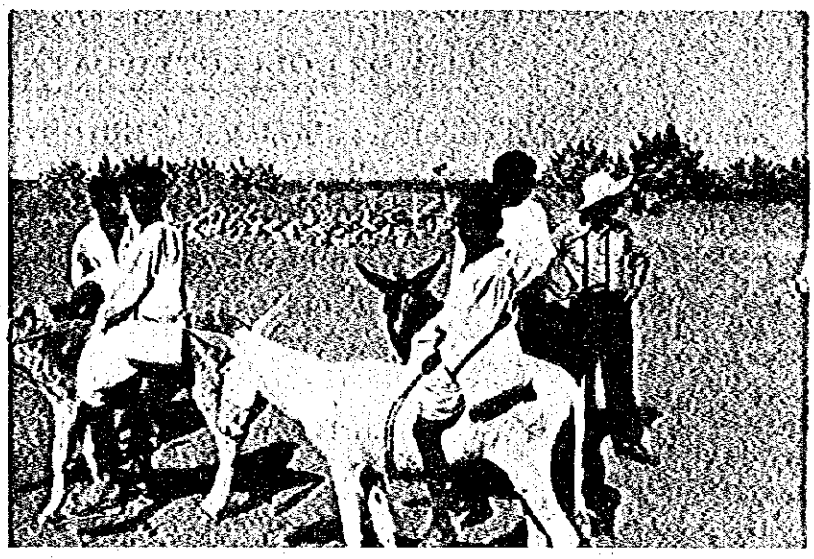
Distant view of expected quarry site



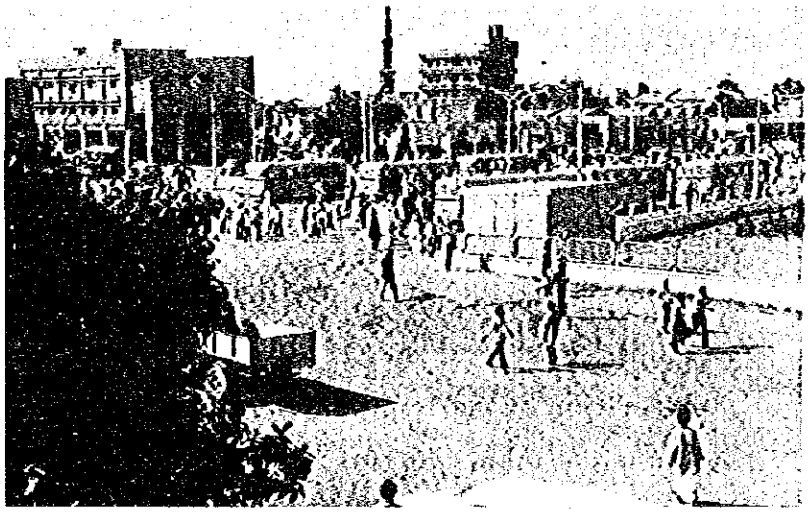
Tenants

Tenants and camels





Children
riding donkeys



Center of
Khartoum

Secretaries of
Department of
Agricultural
Engineering Affairs,
Ministry of Agriculture,
Food and Natural
Resources, Sudan

4.2 List of Collected Data

LIST OF COLLECTED DATA

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2. Basic Program for Agricultural Development in the Democratic Republic of the Sudan. 1976-1985 by Arab Fund for Economic and Social Development.
3. Program of Work Season 1976-1977 by the Agricultural Research Corporation; Wad Medani.
4. List of Research Officers and Adminstrations by the Ministry of Agriculture, Food and Natural Resources, Agricultural Research Corporation.
5. Reconnaissance Soil Survey, White Nile Rice Pump Scheme by Soil Survey Department; Wad Medani.
6. The Gezira Scheme Past and Present by the Information and Publication Section Sudan Gezira Board.
7. Preliminary Report on Electrification, Grouping Extention and Modification of the Pumping Schemes on the Blue Nile and White Nile. by Mohamed Abdel Karim Asakir Asst. Under Secretary, Ministry of Irrigation & H.E.P. in August, 1972.
8. Climatological Normals (1941-1970) in Ed Dueim by the Meteorological Department.
9. Population in White Nile Province 1973 by Statistical Office in Ed Dueim.
10. Population by Five Year Age Groups and Sex, Province of White Nile in 1973.
11. Area and Field of Each Crop Irrigation in White Nile Province.
12. Jabel Aulia Dam Upstream Gauge at Ed Dueim in 1974 and 1975.
13. Design Sheets: Data for Design, Estimates, and Construction-Canals.
14. Proposed White Nile Rice Pump Schemes; Land Capability Map (Shatawi, Shitait and Zalaga)

15. Location Map of White Nile Pump Schemes (1/100.000)

16. Location Map of El Kawa Bastri Rice Sheme, Blue Nile Province Ed Dueim District (1/10.000)

17. Location Map of Shatawi Rice Scheme, White Nile Province (1/20.000) Area: 26,500 Feddans (No. 1-3)

18. Location Map of El Banonab Rice Scheme (shown Red), Blue Nile Province, Ed Dueim District (1/10.000) Area: 4.600 Feddans.

19. Location Map of Shatawi Rice Scheme, White Nile Province (1/50.000) Area: 26.500 Feddans.

20. Contoured Map of the White Nile.

21. Map of Irrigation Development in Sudan. (Part 1-3) (1/2000.000)

22. Geographical Map of the Aba Island (1/250.000)

23. Geographical Map of El Geteina (1/250.000)

24. Geographical Map of Khartoum (1/250.000)

25. Geographical Map of El Jabelein (1/250.000)

26. Geographical Map of Wad Medani (1/250.000)

27. Geographical Map of Sennar (1/250.000)

28. Geographical Map of Karkoj (1/250.000)

29. Geographical Map of Khartoum (1/1.000.000)

30. Geographical Map of Sudan (1/4.000.000)

31. Vegetation Map of Sudan (1/4.000.000)

32. Map of Average Annual Rainfall in Sudan 1921-1950 (1/8.000.000)

33. Map of Main Agricultural Regions in Sudan (1/8.000.000)

34. Road Map of the Sudan (1/8.000.000)

35. Map of Principal Agricultural Products in The Sudan (1/8.000.000)

36. List of Publications Issued by the Department of Statistics

37. Monthly Foreign Trade (Regular Report) by the Dept of Statistics.

38. Statistical Yearbook (1973) by the Dept of Statistics.

39. Sudan Foreign Trade Annalysis (1969-1973) by the Dept of Statistics.

40. Annual Foreign Trade 1974 by the Dept of Statistics.

41. Annual Foreign Trade Statistics (1975) by the Dept of Statistics.

42. Internal Trade Statistics (1972)(Annual) by the Dept of Statistics.

43. First Population Census of Sudan 1955/1956 Final Report, Vol. II

44. A Report on the Census of Pump Schemes June-August 1963 Vol. I. A coordinated Picture of Area Irrigated by Pump Schemes in the Republic of Sudan (Jan. 1967) by the Department of Statistics.

45. Some Result of the Pilot Sample Census of Agriculture in some Councils 1963-1964 by the Department of Statistics.

46. A Report on the Census of Pump Schemes (June-August 1963) Blue Nile Province Vol. II Part I (July 1965) by the Department of Statistics.

47. A Report on the Pilot Surveys Conducted in 1965-1966 and 1966-1967 for Bstimating the Field Rate of Wheat in Pump Irrigation Schemes of the Northern Province. by the Department of Statistics.

48. National Income (1971/72) by the Department of Statistics

49. The Household Budget Survey in the Gezira, Managil Area (Sept 1965) by the Department of Statistics.

50. Household Sample Survey in the Sudan (1967-1968) by the Department of Statistics.

51. Population and Housing Survey; Blue Nile Province (Sept 1968) by the Department of statistcs.

52. The New Cost of Living Indexes.

53. Location map of the Shatawi Rice Scheme, white Nile Province (1/50.000) area 26.500 Feddans.

54. Map of Jabel Aulia Basin investigation Proposed. Reclaimed Basins (1/250.000)

55. Map of Jabe Aulia Basin investigation Proposed Reclaimed Basins (1/50.000)

56. Sudan Irrigation

57. The Development Present Economic Perfomance and Future Prospects of Nile Pump Irrigated Agriculture in the Sudan.

58. Technical Notes on Water Use.

59. Irrigation and Drainage Paper (Effective Rainfall)

60. Irrigation and Drainage Paper (Drainage of Heavy Soils)

61. Irrigation and Drainage Paper (Drainage of Salty Soils)

62. Expert Consultation on the Mechanization of Rice production. (Ibadan Nigeria, 10-14 June 1974)

63. Growing Native Vegetables in Nigeria.

64. Irrigation Drainage and Salinity.

65. Working Paper on Land and Water Development and Use.

66. Soil Map of the World

67. Perspective study of agricultural development for the Democratic Republic of the Sudan (Central Policy Paper)

68. Perspective study of agricultural development for the Democratic Republic of the Sudan (Domestic Demand Projections for Agricultural Commodities)

69. Perspective study of agricultural development for the Democratic Republic of the Sudan (Foreign trade Policies)

70. Perspective study of agricultural development for the Democratic Republic of the Sudan (Land and Water Development and Use)

71. Perspective study of agricultural development for the Democratic Republic of the Sudan (The fisheries sector)

72. Perspective study of agricultural development for the Democratic Republic of the Sudan (Economics of Fertilizer Use)

73. Perspective study of agricultural development for the Democratic Republic of the Sudan (Agricultural Research)

74. Perspective study of agricultural development for the Democratic

74. Perspective study of agricultural development for the Democratic Republic of the Sudan (Marketing Implications for the Central Policy Paper)

75. Perspective study of agricultural development for the Democratic Republic of the Sudan (Grain Storage)

76. Perspective study of agricultural development for the Democratic Republic of the Sudan (Transport)

77. Perspective study of agricultural development for the Democratic Republic of the Sudan (Farm Organization and Farm Income)

78. Perspective study of agricultural development for the Democratic Republic of the Sudan (An Account and Analysis of Present and Past Technical Assistance in the Rural Sector)

79. Perspective study of agricultural development for the Democratic Republic of the Sudan (The Agricultural Price Policy in the Sudan)

80. Perspective study of agricultural development for the Democratic Republic of the Sudan (Inputs and Investment Requirements in Agriculture)

4.3 Scope of Work

SCOPE OF WORK FOR PRELIMINARY SURVEY ON AGRICULTURAL DEVELOPMENT IN THE DEMOCRATIC REPUBLIC OF THE SUDAN

I. INTRODUCTION

In response to the request made by the Democratic Republic of the Sudan for technical cooperation in conducting a preliminary survey for agricultural development in the Sudan, the Government of Japan has decided to dispatch a Japanese survey team consisting of six members for a period of about three weeks in November, 1976.

The preliminary survey will be carried out by Japan International Cooperation Agency (JICA), the sole official agency responsible for the implementation of the Japanese Government's Technical Cooperation Programmes.

The present document sets forth the scope of work for the survey.

II. OBJECTIVES OF THE SURVEY

The objectives of the survey will be;

(1) to confirm the detailed contents of the request for the technical cooperation made by the Sudanese Government:

(2) to explain the technical cooperation system established by the Japanese Government:

(3) to negotiate with the responsible personnel of the Sudanese Government, and study in order to find out such a way for immediate implementation of the technical co-operation as to meet the above-mentioned system:

(4) to grasp the present condition and the existing problems in the agricultural development through data collection, interviews, site survey, etc., as well as the situation of the technical cooperation performed by the third countries:

(5) to select the most suitable irrigated rice cultivation project area along the White Nile River and others if possible:

III. OUTLINE OF THE SURVEY

The activities to be undertaken in the survey and study will be divided into two main parts;

1. Field work
2. Indoor work

1. Field work

The field work will cover the following;

1.1 to collect and review the relevant existing data and information including,

- a. Meteorology and hydrology
- b. Geology
- c. Agriculture and agro-economy
- d. Regional economy
- e. Topographic and aerial photographs
- f. Agro-soil

1.2 to carry out general survey for delineation of the project area,

1.3 to select and delineate the project area if possible on the basis

of the above works.

2. Indoor work

Based on the results of the field work, the indoor work will be carried out covering the following;

2.1 to review the results of the field work,

2.2 to propose the scope of work for the coming feasibility study, if the results are favorable,

2.3 to prepare and submit the interim report and the final report on the preliminary survey to the Sudanese Government (Refer to the next chapter),

IV. REPORT

1. Interim report

Ten (10) copies of the field work.

2. The comments on the interim report made by the Sudanese Government will be requested to be sent to the Japanese Government as soon as possible after presentation of the interim report at the latest by the end of December, 1976. And then, fifty (50) copies of the final reports will be prepared and submitted to the Sudanese Government by the end of March, 1977.

V. UNDERTAKING OF THE SUDANESE GOVERNMENT

For the purpose of the survey, the Sudanese Government will co-operate by;

1. Providing the team with necessary entry and stay visas, residence and work permits, exchange permits and travel documents, if necessary for its stay in Sudan.

2. Clearing through customs any equipment, materials, and supplies necessary for the survey and the personal effects of the team without charging and import/customs duties on the team.

3. Providing counterpart engineers in the following sectors according to the necessity to cooperate and assist the team in carring out the field work without charging any cost on the team. However, one

responsible personnel should be the full time counterpart engineer for the team,

3.1 Irrigation

3.2 Agronomy

3.3 Agro-economy

3.4 Geology

3.5 Hydrology

3.6 Agricultural machinery

4. Providing the team with at least three (3) jeeps or land cruisers and one (1) boat (if necessary) with drivers and necessary maintenance and repairing services including supply of fuel, oil and lubricant, free of charge, during the entire period of the field work.

5. Arranging a hotel or lodging facilities to accommodate six (6) team members.

6. Providing the team with copies of available aerophotos and topographic maps covering the proposed project areas.

7. Providing the team with the data and information concerned with the survey.

8. Allowing the team to take all data and materials concerned including aerophotos and maps to Japan for preparing the final report.

9. Maintaining security of lives and properties of the team during its stay in Sudan.

10. Providing the team with any other available facilities that requested for the execution of the survey.

11. Making the detailed travelling schedule for the team before its departure to the field, in line with the tentative schedule proposed as shown in ANNEX.

ANNEX

Tentative Schedule

Nov.	5th (Fri.)	Leaving Tokyo for Cairo by JAL
	6th (Sat.)	Leaving Cairo for Khartoum by
	7th (Sun.)	Courtesy call at Embassy of Japan and having discussion
	8th (Mon.)	Courtesy call at Ministry of Agriculture and having discussion with personnel concerned, and data collection
	9th (Tue.)	Moving from Khartoum to Ed Dueim.
	10th (Wed.) – 13rd (Sat.)	Field Survey of areas along the White Nile
	14th (Sun.)	Returning to Khartoum
	15th (Mon.) – 17th (Wed.)	Field survey of areas along the Blue Nile
	18th (Thur.) – 20th (Sat.)	Making an interim report
	21st (Sun.)	Reporting the results of survey and discussion to Embassy of Japan
	22nd (Mon.)	Having discussion with personnel concerned of the Sudan Government by submitting the report
	23rd (Tue.)	Leaving Khartoum for Tokyo via Cairo
	24th (Wed.)	Arriving in Tokyo

4.4

Khartoum: November 22, 1976

His Excellency Abdelrahim Mekki,
State Minister of Agriculture,
The Democratic Republic of the Sudan

Dear Sir,

RE: RESULT OF PRELIMINARY SURVEY OF
RICE CULTIVATION ALONG WHITE NILE
IN THE SUDAN

I have a great pleasure to submit herewith a note of the result of the Preliminary Survey of Rice Cultivation along the White Nile, carried out by the Survey Mission from the Government of Japan, just before our leaving.

The contents, however, are tentative and accordingly subject to be modified on the occasion of making the final report after our return to Japan.

I expect that the following action will be taken very soon by the Government of Japan.

I wish to express our hearty gratitude for your sincere cooperation with us and your convenience and hospitality given us all through the survey.

I remain,

Respectfully yours,

Junichi Kitamura

Junichi KITAMURA,
Leader of Japanese Preliminary
Survey Mission for Agricultural
Development in the Sudan

A NOTE
ON THE RESULTS OF PRELIMINARY SURVEY OF RICE CULTIVATION ALONG THE WHITE NILE IN THE SUDAN IN NOVEMBER, 1976

CONTENTS

PRELIMINARY SURVEY MISSION
FROM
JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

1. CIRCUMSTANCES:

In response of the request made by the Government of the Democratic Republic of the Sudan for technical co-operation in conducting a preliminary survey for Rice Cultivation along the White Nile in the Sudan, the Government of Japan has decided to dispatch a Japanese survey mission consisting of six members for a period of about three weeks from November, 5, 1976.

The preliminary survey was carried out successfully as schedule by the survey mission and consequently a note will be submitted herewith before their return, as an interim report.

2. MISSION'S SCOPE OF WORK GIVEN BY JAPANESE GOVERNMENT:

The objectives of the survey were:

(1) To confirm the detailed contents of the request for the technical co-operation made by the Sudanese Government.

(2) To explain the technical cooperation system established by the Japanese Government.

(3) To negotiate with the responsible personnel of the Sudanese Government, and to study in order to find out such a way for immediate implementation of the technical cooperation as to meet the above-mentioned system.

(4) To grasp the present condition and the existing problems in the agricultural development through data collection, interviews, site survey, etc., as well as the situation of the technical cooperation performed by the third countries.

(5) To select the most suitable irrigated rice cultivation project area along the White Nile River and others if possible.

3. SUMMARIZED RECORDS OF DISCUSSIONS:

(1) The White Nile Province have had just an independance from the former Blue Nile Province and therefore positions far behind the Gezira Province in the agricultural development, and in the preparation stage.

(2) The idea of the rice cultivation around El Dueim, the capital of the province, along the White Nile was set forth by the former Minister

of Agriculture.

Currently it has been promoted by the Commissioner of the Province, S.S.U. and others,and supported by the political motivation.

(3) The construction and management of the pilot farm are handled by the Ministry of Agriculture and the construction of the main irrigation project is controlled by the Ministry of Irrigation which was separated from the Ministry of Agriculture a few years ago. This irrigated rice cultivation project has already been consulted in the committee consisting of the responsible persons in both the Ministry.

The formal request for the feasibility study of the main irrigated rice cultivation project, as well as of the pilot farm implementation was, however, made by the Ministry of Agriculture on behalf of the Government of the Sudan.

(4) The main irrigated rice cultivation project has not yet been concreted, because it was thought that the pilot farm implementation should be preceded the main irrigated rice cultivation project, as a test farm.

Accordingly it has not yet been decided that the development fund is procured from the Inter-Arabic Authority. the procurement from the Authority, however, is very prospective.

(5) It was explained that the reason why the pilot farm implementation should go ahead of the main irrigated rice cultivation project, derived from the necessity of exact data collection for the feasibility study of the main project.

Under the Japanese technical cooperation system, however, the pilot farm should be positioned as a part of the main irrigated rice cultivation project. Accordingly, it was stressed that the co-operation of the pilot farm would be able to be implemented, just after the feasibility of the main project was confirmed.

Eventually, the Government of the Sudan suggested to start making feasibility study of the main project and making the planning of the

pilot farm simultaneously in a practical way, esteeming the existing Japanese technical cooperation system.

(6) The Government of the Sudan according to the above-mentioned direction, promised very soon to make a newer request for the cooperation for making a feasibility study of the main project and the construction and the management of the pilot farm, to the Government of Japan.
Besides, based on the Japanese technical cooperation system, the A1 form for dispatching the experts from Japan for making a plan of the pilot farm will be submitted, if necessary.

(7) The Government of the Sudan is due to establish and enforce the Six year Development Plan from July, 1977.
This main irrigated rice cultivation project, having a high priority to be taken, will of course be included in the frame-work.

(8) The Ministry of Finance, Planning and National Economy, always having close relation to the Ministry of Agriculture, Food and Natural Resources, has already known the intention on the side of Japan which was expressed to the latter Ministry this time.
Although the Ministry of Finance also agreed the intention theoretically, they called the attention on the side of Japan repeatedly, to start the feasibility study at the soonest time and to complete for the shortest period (by the end of the fiscal year of 1977, at the latest)

4. FINDING:

(1) The project area for rice cultivation proposed by the Government of the Sudan is divided into the following three schemes:

	Name of Scheme	Gross Area (Feddan)	Location
a)	Khor Abu Gasaba	47,430	15km to 60km South of Ed Dueim
b)	Banonab	8,500	17km to 47km North of Ed Dueimk

c)	El Shatawi	26,500	65km to 108km North of Ed Dueim
	Total	82,430	

(2) The area is narrow strip of flat land consisting of alluvium deposited by the White Nile and the elevation ranges from 375m to 378m above sea level. The area is covered with swampy grasses during the inundated period of 7-months from August to February due to rivers flow control of the Jabel Aulia dam.

(3) Out of the gross area in the project area, topographic maps are only for about 65,100 feddans as shown below:

	Name of Scheme	Scale of Map	Contour interval	Gross Area (Feddan)
a)	Khor Abu Gasaba	1/50,000	0.5m	34,000
b)	Banonab	1/10,000	0.25m	4,600
c)	El Shatawi	1/20,000	0.5m	26,500
	Total			65,100

(4) The area lies within the tropical hot arid zone of the Central Sudan, and is characterized by two distinct seasons, dry and wet. The average annual rainfall at Ed Dueim is 280 mm of which about 84% is concentrated in three months from June to August. The mean monthly temperature has a fairly large variation throughout the year from 24°C to 30°C. Evaporation in piche evaporator is quite high ranging from 7.7 mm in August to 19.7 mm in April. Relative humidity in the area is considerably low particularly in March and April.

(5) The flow of the White Nile is more or less even throughout the year. This is partly because the river covers an upstream catchment area which receives rainfall in all months of the year and partly because the vast swamps in the Sudd Region in the upstream provide the natural regulation of the river flow.
According to the perspective study of agricultural development for DRS, FAO, 1973, average monthly run-off at Malakal located at about 450 km South of the project area is estimated at 847 m^3/sec.

The lowest flow with 424 m^3/sec occurs in April and highest flow with 1,083 m^3/sec in October.

(6) There are several hundred thousand feddans of farm lands irrigated by pumps along the White Nile. The irrigation water for the project area is, however, sufficiently available from the White Nile throughout the year.

(7) Reconnaissance soil survey has been conducted in a limited area of about 8,600 feddans (3,600 ha) in both Shatawi and Banonab area by the Soil Survey Department of the Government.
According to the survey report, soils in the project areas are broadly classified into two soil groups, namely, pellusterts and Udifluvents. Pellusterts develop in the elevated portion and have very fine soil texture with neutral to moderately alkaline PH values when dried, these soils become very hard and have large cracking. Udifluvents extend over the low-lying portions and have also very fine soil texture with neutral to moderately alkaline PH values. These soils are moist in subsoils throughout the year. The both soils are presently nonsaline and non-alkaline.

(8) The project area is mostly the virgin land covered with swampy grasses to large extent and with some swampy forest at present. Farmers living surrounding the project area use the area for grazing their livestock during the grass growing season.

(9) Three types of farming are mainly practiced in the area adjacent to the project area. The first is the traditional cultivation with mainly manpower in rain-fed condition. The second is the mechanized cultivation in rain-fed conditions. The last one is mechanized irrigation framing by pumping. Dura (sorghum), groundnuts, sesame and dukhn (millet) are usually cultivated under the rain-fed conditions. Their yeilds are quite unstable and considerably low. In the irrigated shemes, cotton and dura are commonly cultivated in three years rotation pattern. Those yields are fairly high compared with those in the rain-fed conditions.

(10) Rice is cultivated in the very limited area with quite primitive

practice along the White Nile near Ed Dueim. Direct sowing in the dried field is practiced before rising water level of the White Nile. No fertilizers and agro-chemicals are applied. The yield is rather low. Rice cultivation is also practiced in certain areas in the southern part of the White Nile Basin where the land is covered with heavy clay and the annual rain-fall occurs approximately 700 mm. The farming is partly fed by rain and partly irrigated.

(11) Since 1973, irrigated rice cultivation has been carried out in the Gezira Board Scheme under the great cooperation of a Chinese Mission, where the agro-meteorological conditions are similar to those of the project area. The cultivated area in 1973 was only 20 feddans (8.5 ha). In 1974 the area was extended to 10,000 feddans scattered in the whole scheme. The paddy is grown during the period from June to November.
Improved varieties have been introduced from Chine and Philippines. The yield, however, still varies considerably from 1 t/f to 3 t/f.

(12) Upland irrigation by both gravity and pumping up has long been conducted in the Sudan. Pump irrigation for upland crops, particularly, cotton, dura, and groundnuts is commonly practiced in the surrounding project area by the agricultural corporations as well as private farmers who operate the pump schemes with delivery pipes less than 15 cm in diameter.

(13) Irrigation water requirements for the upland crops for the Gezira Scheme as well as for the White Nile Pump Schemes have been estimated and standardized. Two types of rotative croppings namely, four year crop rotation and three year one, are introduced at present. The former was three croppings in three years followed by fallow. The latter is two croppings in two years followed by one year fallow. Three rotative irrigation farming prevails in the White Nile. The cropping intensity is thus estimated at 67%. The average peak monthly crop factor (Consumptive use of water per day per feddan of crop area) in the White Nile Pump Schemes is about 30 which equivalent to 7.1 mm/day in depth. Losses assumed

are 8% for conveyance and 5% for operation respectively. No crop factor for paddy has been provided. Furthermore, no field measurement of water requirement has been carried out in the country.

(14) The estimated population of the Sudan in 1973 was about 14.1 million and the average annual growth rate is estimated at 2.5%. At this growth rate, the total population will reach the level of about 15.2 million by the end of 1976.

(15) The population in the White Nile Province as of 1973 excluding nomads and part-time employees from outside was about 1,126 thousands as shown below:

Area	No. of Families	Population		
		Male	Female	Total
Dueim Rural	16,576	330,691	318,359	649,050
Dueim Urban	4,662	14,102	12,727	26,829
Kosti Rural	71,383	192,751	191,292	384,043
Kosti Urban	12,153	36,808	29,761	66,569
Total	194,774	574,352	552,139	1,126,491

(16) The economy of the country is almost entirely dependent on agriculture which contributes approximately 40% of the Gross Domestic Product at producers' value in 1971/72. In fact the total receipt from export of agricultural products in 1975 was about LS.141 million which corresponds to about 96% of the total export. The principal items for export are cotton, oil seeds, vegetable oils, gum arabic, livestock, hides and skins. On the other hand, total value of imports of agricultural products amounted to LS.65 million in 1975. The main items are wheat, wheat flour, sugar, coffee, tea, woods, etc. The Government of the Sudan is making every endeavour to attain self-sufficiency in the agricultural products and also to expand largely the export of agricultural products.

(17) Agricultural extension service is under the responsibility of the Ministry of Agriculture, Food and Natural Resources. The extension service has the normal functions of advising farmers on

better farming method and technics and assisting them in obtaining farm inputs and in using properly those inputs. The present research organization has already attained a high level of development and centralization by the establishment of the National Councils for Research in 1970. Agricultural research has been aimed at solving the problems of the Gezira Scheme and other large irrigation schemes especially on cash crops.

(18) Crop production takes place under two types of farm organization: the traditional farms and the modern commercialized farms. In almost all cases of the modern farms, the land belongs to the State and the farmers cultivate the land as tenants. In the irrigation schemes operated by the government, the tenants enjoy full security of the tenure arrangement and share the profit from major crops with the management on a pre-determined profit-sharing basis.

(19) Farm gate prices of crops in the project area in 1975 according to the field survey were LS.72.5/t to LS.116/t for dura, LS.145/t for wheat and LS.145/t for millet respectively. The unit price of milled rice in the domestic market in Wad Medani was LS.250/t at ex-mill factory. However, the imported price of rice in June 1976 was only LS.141/t C.I.F. at Port Sudan descending considerably.

5. COMMENTS:

(1) Rice cultivation under the flood irrigation in the Sudan had rather short history. For the successful implementation of the rice culture development, more thorough survey and study are required. In this view, it is proposed to carry out the feasibility study on the most appropriate scheme and to establish a pilot farm in the representative place in the project area.

(2) From the meteorological point of view in the project area, the paddy cropping is desired to be made during the period from June to November. This is also confirmed from the result of test farming in the Gezira scheme where the climate is almost similer to that in the project area.

(3) Low humidity and high temperature tend to exert unfavourable effect on the reproductive growth so that it is strongly recommended to conduct the basic experiments i.e. seasonal sowing test of rice plant throughout the year as well as variety test of paddy during the period of low humidity in order to find out the suitable cropping season and varieties.

(4) Though the rotational irrigation practice is applied for the paddy cultivation in the Gezira scheme, it is recommended to apply flood irrigation practice as long as irrigation water is obtainable. Furthermore, the transplanting method which is mostly applied in other rice cropping country is also desired to be taken into consideration.

(5) In order to get such high yield as 3 tons per feddan in dry paddy comprehensive research on paddy cultivation such as fertilizer and agro-chemical applications, water management, etc., should be carried out in addition to the points mentioned in preceding paragraphs.

(6) Available topographic maps do not cover the entire proposed project area for development. Particularly, more detailed topographic maps in a scale of 1/10.000 with 0.25m contour intervals in the Khor Abu Gasaba scheme is to be prepared as soon as possible.

(7) No measurement on consumptive use of water by paddy has been conducted so far. It is also recommended to carry out it as soon as possible by using tank method or others suitable.

(8) There are certain existing irrigation pump schemes surrounding the project area so that the project should be implemented without any trouble on those existing schemes.

(9) For making a feasibility study of the irrigated rice cultivation project, the Gasaba area with 47.430 feddans (about 20.000 ha) in gross area is first selected because of its moderate size of acreage, the convenient location and other better factors.

(10) At the strong request from the Government of the Sudan, this

feasibility study should be carried out during the next non-submersion time (May to July) for about three months. However, since the period from February to May is in a Haboob (strong wind) season and the period from June to August is also in a wet season, the survey will face on some trouble.

(11) The survey mission consisting of about ten members must stay at Ed Dueim. The housing accomodation and vehicles for them would therefore be requested to be provided sufficiently.

(12) Throughout the next survey period, the counterparts with the specialists concerned would kindly be provided.

(13) The pilot farm should be situated in or around the Gasaba Area. If it can be setup in the existing pump irrigation project area, the rice cultivation trial will be commenced at earlier time. At present the area of 500 Feddans is proposed to be established at the minimum by the Government of the Sudan.

(14) The technical cooperation for the pilot farm was suggested to be implemented half and half by the Government of the Sudan and the Government of Japan. That is, the land procurement, the labour employment, the required building construction, providing counterparts, will be performed by the Government of the Sudan.
The supply of the necessary instruments and equipments, and other input, as well as the expert dispatch will be executed by the Government of Japan.
The soonest dicision of the detailed way of the cooperation for the pilot farm will therefore be needed for the Government of Japan.

(15) The following publications to be issued are requested to be provided for the coming mission:

(1) A Comprehensive English Summary of "The Arabic Authority for Agricultural Investment and Development - Invitation to Founders" by Arab Fund for Economic and Social Development (AFESD) to be issued in December, 1976.

(2) "New Six-Year Economic Development Plan (1977-1982)

Agriculture" by the Government of the Sudan to be issued in February, 1977.

THE END

4.5 Others

THE DEMOCRATIC REPUBLIC OF THE SUDAN
MINISTRY OF AGRICULTURE, FOOD, AND NATURAL RESOURCES
ENGINEERING AFFAIRS ADMINSTRATION
WHITE NILE RICE PROJECT
PILOT FARM BUDGET
AREA 500 FEDDANS

Item	No.	Price LS. LS.1.00= US$ 2.87	Local Currency	Foreign Currency
Buildings and Foundations	Dykes, Ditches, Houses, Offices, Workshop, Pipes.	118,000	118,000	-
Machinery and Equipments	2 (60-80Hp) Tractors 1 Rice Combine 1 Rice Huller 2 Disc Ploughs 2 Disc Harrows 2 Seed Drills 2 Trailers 2 Fuel Tanks 1 Mobile Workshop 1 Workshop Equipments 2 Ditchers 1 Scraper 1 Fertilizer Distributer	76,000	38,000	38,000
Cars	3 Toyota Pickups	18,000	9,000	9,000
	1 Lorry (5-8 Tons)	12,000	6,000	6,000
	Services	40,000	4,000	-
	Experts			Japan
	Training and Studies			Japan
		264,000	211,000	53,000

* The Sudan Government approved the funds for the season 1976/77 as shown below:

	LS.(Sudanese Pounds)
Buildings and Constructions	23,038
Machinery and equipment	8,000
Wages	6,800
Services	10,000

* Sudanese graduates working as counter part should be trained in Japan to later replace the experts. We hope this will start as soon as possible.

* We expect Japan to share in excuting this project in the ratio of 50%.

DEMOCRATIC REPUBLIC OF THE SUDAN
MINISTRY OF AGRICULTURE, FOOD AND NATURAL RESOURCES
AGRICULTURAL RESEARCH CORPORATION

(1) Organization of Agricultural Research

Agricultural Research Corporation conducts research on production of field and horticultural crops. The corporation is directly financed by a block sum of money from the Government Central budget. The Corporation's act also allows for financing from proceeds from sale of crops and other produce of the corporation, grants donated by agricultural bodies and other local and international institutions or fees paid for services rendered by the corporation.

The Agricultural Research Corporation through its sections and stations, the Technical Committee and Agricultural Research Council formulate research programmes and produce annual research report. A number of specialised committee e.g. pest and disease committee, crop husbandry committee, etc. from The Research Corporation and other organizations discuss research results and pass recommendations.

Agricultural Research Corporation,
Gezira Agricultural Res. Station,
P.O. Box No. 126 - Wad Medani, Sudan.

Cable : Research

Tel. : 431, 432, 433, 434, 2226 and 2403 Wad Medani.

In the Research Corporation there are four regional stations and six research substations.

The regional stations are :

1. Gezira Research Station
2. Hudeiba Research Station
3. Kenana Research Station
4. Yambio Research Station

The research substations are :

1. Shambat Research Station
2. Kadugli Research Station
3. Guineid Research Station

4. Maatuk Research Station
5. Khashm el Girba Research Station
6. Sennar Research Station

A. REGIONAL RESEARCH STATIONS

GEZIRA RESEARCH STATION - WAD MEDANI

P.O. Box No. 126, Wad Medani, Sudan.
Cable : Research
Tel. : 431, 432, 433, 434, 2226 and 2403
Long. : 33° 29'E
Lat. " 14° 24'N

(a) Organization — The largest regional research station of the Agricultural Research Corporation, serving the Gezira Scheme and neighbouring areas. Director and 31 Scientists (two seconded from Cotton Research Corporation) in five sections. It is also the seat of the H.Q. of the Agricultural Research Corporation. Established 1918.

(b) Research Activities — Crop husbandry. Cultural practices, rotational trials, dosage and response to fertilizers, alternative crops, crop physiology and water relation.

Phytopathology. Herbarium; diseases of cotton and other crops; special attention to cotton blackarm and leafcurl virus of cotton and other crops and weed control.

Plant selection and breeding. Breeding of cotton and other crops for high yield, quality and disease resistance.

Entomology. Bionomics and control of cotton pests (bollworm, thrips, jassids whitefly etc.) and control of pests of sorghum, wheat and vegetables etc.

Soil Sciences. Methods of chemical and mechanical analysis, and classification of soils for agricultural

use. Moisture retention characteristics of different soils. Variability in productivity due to physical, chemical and microbiological factors.

Others. Other units include work on vegetable crops, statistics and agricultural engineering.

KENANA RESEARCH STATION - ABU NAAMA

Abu Naama, Blue Nile Province, Sudan

Cable : Research Abu Naama

Tel. : Number (1) Abu Naama

Long. : 34° 08'E

Lat. : 12° 44'N

(a) Organization — Regional station of the Agricultural Research Corporation for the Kenana area. Head and eight research workers. Established 1952 as the Central Rainlands Research Station at Tozi and transferred to Abu Naama in 1963.

(b) Research Activities — Crop Husbandry. Cultural practices for sorghum, groundnuts, maize, sesame, rice and kenaf. Crop rotation studies, establishment of pastures. Physiologic studies on water requirements of crops under rains, irrigation and supplementary irrigation.

Entomology. Bionomics and control of insect pests of crops in region.

Plant Breeding and selection in crops other than cotton, mainly sorghum sesame, groundnuts and kenaf.

Soil Science. Investigations on soil fertility pertaining to soil characteristics. Long and short term effects of fertilizers and crop rotation.

Plant Pathology. Disease survey. Seed dressing against soil and seed borne diseases. Control of leaf spot diseases in sesame and groundnuts. Leafcurl

transmission studies.

Botany. Weed control studies. Screening of herbicides and study of factors effecting their performance.

Agricultural Engineering. Studies on land preparation, planting, cultivation and mechanical harvesting of sesame and groundnuts.

HUDEIBA RESEARCH STATION

P. O. Box No. 31 Ed-Dammer, Northern Province, Sudan
Cable : Research Ed-Dammer
Tel. : 4351 Ed-Dammer
Long. : 33° 56'E
Lat. : 17° 34'N

(a) Organization — Regional Station of Agricultural Research Corporation in the Northern Province. Head and nine research workers. It is also the base for the Head of Horticultural research section. Established 1962.

(b) Research Activities — Crop husbandry. Irrigation of agricultural crops of the Northern Province mainly wheat, barley, maize, castor, safflower, guar and alfalfa. Irrigation, agricultural practices and fertilization of field crops, vegetables and fruits.

Soil Chemistry. Salinity and alkalinity problems, and methods of land reclamation. Fertility studies.

Botany and Plant Pathology. Seed dressing against soil and seed borne pathogens. Wilt disease of beans and cucurbits. Phyllody in bread beans. Powdery mildew in beans, cucurbits, onions and okra. Studies on viruses of borad bean and citrus etc.

Entomology. Insect survey of the Province Control of stem borers in maize and sorghum, Control of castor webworm fruit flies in cucurbits, spider mites and

scale insects on citrus and date palms.

Plant Breeding. Improvement of wheat, barley, castor, vegetables, maize and legumes.

Horticulture. Evaluation of indiginous and some introduced vegetable cultivars, cultural practices and nutritional studies of vegetables and fruit trees, summer dormancy of tomatoes. Vegetable seed production. Post harvest physiology of fruits and vegetables.

YAMBIO RESEARCH STATION - YAMBIO

Yambio, Equatoria Province, Sudan
Cable : Research Yambio
Long : 28° 24'E
Lat. : 04° 34'N

(a) Organization — Regional station of the Agricultural Research Corporation in the southern Provinces. Not functioning at present. Efforts are underway to start work shortly. Established 1948.

(b) Research Activities

No research programme conducted since 1964.

B. RESEARCH SUB-STATIONS

KADUGLI RESEARCH SUBSTATION, KADUGLI

Kadugli, Kordofan Province, Sudan
Te. : 82 Kadugli -
Cable : Buzur Kadugli
Long. : 29° 43'E
Lat. : 11° 00'N

(a) Organization — Substation for the Nuba Mountains in Kordofan Province. Work is underway for raising it to a full regional station to serve the western province in the near future.

Head and one research worker. Established 1935.

(b) Research Activities — Plant Breeding. Testing of cotton introductions and selection of resistant cotton varieties sent from Medani and Shambat as well as local selections.
Testing and selection of striper types of cotton for mechanical harvesting. Nitrogen and spacing trials on rain grown cotton.
Entomology. Bionomics and control of bollworms and flea beetles. Survey of insect pests of other crops.

SHAMBAT RESEARCH SUBSTATION - KHARTOUM NORTH

P.O. Box No. 30 Khartoum North
Cable : Buzur
Tel. : 31660 and 31744
Long. : 32° 30'E
Lat. : 15° 40'N

(a) Organization — Substaion for Gezira Research Station. Head and one research worker. Established 1904.

(b) Research Activities — Plant Selection and Breeding: Work on cytogenetics of cotton. Classification and screening of wild species of cotton for desirable characters. Crosses and selection for earlier sakel, nectariless hairiness and boll size, incorporation of blackarm resistance into some introduced types. Wheat and barley breeding and some work on vegetables.

SENNAR RESEARCH SUBSTATION, SENNAR

P. O. Box No. 36, Sennar, Sudan
Cable : Research Sennar
Tel. : 2354 Sennar
Long : 33° 37'E
Lat. : 13° 33'N

(a) Organization — Substation for Gezira Research Station for Sennar area. Head and 2 research workers. Established 1963.
Research Sugarcane agronomy, soils and insect pests.

Research on vegetables and fruits.

MAATUG RESEARCH SUBSTATION, WAD EL GHORASHI

Wad El Ghorashi, Sudan.
P. O. Box No. 9 Wad El Ghorashi
Cable : Research Wad el Ghorashi
Tel. : 3401
Long. : 32° 35'E
Lat. : 14° 11'N

(a) Organization — Substation for Gezira Research Station serving the Managil Extension of the Gezira Scheme. One Scientist. Established 1963.

(b) Research Activities — Entomology. Bionomics ecology and control of bollworms. Evaluation of insecticides for the control of cotton pests.

GUINEID RESEARCH SUBSTATION, GUINEID

P. O. Box No. 2 Guineid, Sudan
Cable : Research Guineid
Tel. : 4531 Guineid
Long. : 33° 19'E
Lat. : 14° 48'N

(a) Organization — Substation for sugarcane research. Head and two research workers. Established 1963.

(b) Research Activities — Sugar cane husbandry, variety trial and introductions. Fertility and water requirements of sugarcane. Survey and control of sugarcane diseases.

KHASHM EL GIRBA RESEARCH SUBSTATION, KHASHM EL GIRBA

Khashm el Girba, Sudan
Cable : Research Girba
Tel. : 2036 Ex. 12
Long : 35° 44'E
Lat. : 15° 08'N

(a) Organization — Regional Substation of the Agricultural Research Corporation, for Khashm el Girba Scheme. Head and

three research workers. Established 1960-63.

(b) Research Activities

Agronomy: Agronomic studies on cotton, groundnuts, wheat, safflower and sugarcane.

Chemical weed control and Ecological studies of the weed flora. Large scale trials (Conventional and ULF) for control of insect pests of cotton.

After the recent reorganization of the Ministry of Agriculture Food and Natural Resources, the following research activities are being transferred to the Agricultural Research Corporation:

1. Forest Research - with stations at Soba and El Obeid
2. Pasture Research with one station at Ghazala Gawazat
3. Wilt - life research with stations at Khartoum and Dinder
4. Fisheries and Marine Biology Research with stations at Khartoum, Halfa and Port Sudan.
5. Food Processing Research Centre - Khartoum North.