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 PD-AAF-116-81

AGENCY FOR INTERNATIONAL DEVELOPMENT PROJECT PAPER FACESHEET		1. TRANSACTION CODE <input type="checkbox"/> A ADD <input type="checkbox"/> C CHANGE <input type="checkbox"/> D DELETE <div style="border: 1px solid black; width: 20px; height: 20px; text-align: center; margin: 5px;">A</div>	PP 2. DOCUMENT CODE <div style="border: 1px solid black; width: 20px; height: 20px; text-align: center; margin: 5px;">3</div>
3. COUNTRY/ENTITY SUDAN		4. DOCUMENT REVISION NUMBER Original <input type="checkbox"/>	
3. PROJECT NUMBER (7 digits) <div style="border: 1px solid black; padding: 2px;">650-0020</div>	6. BUREAU/OFFICE A. SYMBOL AFR B. CODE <div style="border: 1px solid black; padding: 2px;">06</div>	7. PROJECT TITLE (Maximum 40 characters) <div style="border: 1px solid black; padding: 2px;">Western Sudan Agricultural Research</div>	
8. ESTIMATED FY OF PROJECT COMPLETION FY <div style="border: 1px solid black; padding: 2px;">8</div> <div style="border: 1px solid black; padding: 2px;">5</div>		9. ESTIMATED DATE OF OBLIGATION A. INITIAL FY <div style="border: 1px solid black; padding: 2px;">78</div> B. QUARTER <div style="border: 1px solid black; padding: 2px;">4</div> C. FINAL FY <div style="border: 1px solid black; padding: 2px;">84</div> (Enter 1, 2, 3, or 4)	

88p.

10. ESTIMATED COSTS (\$000 OR EQUIVALENT \$) -						
A. FUNDING SOURCE	FIRST FY			LIFE OF PROJECT		
	B. FX	C. L/C	D. TOTAL	E. FX	F. L/C	G. TOTAL
AID APPROPRIATED TOTAL	530.6	86.4	617.0	9,200	10,800	20,000
(GRANT)	(530.6)	(86.4)	(617.0)	(9,200)	(10,800)	(20,000)
(LOAN)						
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY		412.6	412.6	-	10,400	10,400
OTHER DONOR(S) IBRD	379.2	-	379.2	15,000	-	15,000
TOTALS	909.8	499.0	1,408.8	24,200	21,200	45,400

11. PROPOSED BUDGET APPROPRIATED FUNDS (\$000)									
A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE		E. 1ST FY <u>78</u>		H. 2ND FY <u>79</u>		K. 3RD FY <u>80</u>	
		C. GRANT	D. LOAN	F. GRANT	G. LOAN	I. GRANT	J. LOAN	L. GRANT	M. LOAN
(1) F/N	111	080		617		2,418		2,589	
(2)									
(3)									
(4)									
TOTALS				617		2,418		2,589	

A. APPROPRIATION	N. 4TH FY <u>81</u>		Q. 5TH FY <u>82</u>		LIFE OF PROJECT		12. IN-DEPTH EVALUATION SCHEDULED
	O. GRANT	P. LOAN	R. GRANT	S. LOAN	T. GRANT	U. LOAN	
(1) F/N	4,210		3,612		20,000		<div style="border: 1px solid black; padding: 5px; display: inline-block;"> MM YY 01 82 </div>
(2)							
(3)							
(4)							
TOTALS		4,210		3,612		20,000	

13. DATA CHANGE INDICATOR. WERE CHANGES MADE IN THE PID FACESHEET DATA, BLOCKS 12, 13, 14, OR 15 OR IN PRP FACESHEET DATA, BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET.

1

 1 = NO
2 = YES

14. ORIGINATING OFFICE CLEARANCE		15. DATE DOCUMENT RECEIVED IN AID/W. OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION	
SIGNATURE <i> Gordon K. Pearson</i>		<div style="border: 1px solid black; padding: 5px; display: inline-block;"> MM DD YY 0 7 2 6 7 8 </div>	
TITLE AID Representative Democratic Republic of Sudan			
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IBRD, June 6, 1978.
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IBRD, June 6, 1978.
- I. Host Country Application for Assistance

I. Project Summary and Recommendations

A. Recommendation

Authorization of a grant of \$20,000,000 for the Western Sudan Agricultural Research Project (650-0020). The project is to be jointly financed by the IBRD, Government of Sudan (GOS), and AID; total life of project funding by all donors is estimated at \$45,400,000.

AID Grant	\$20,000,000
IBRD-IDA Credit	15,000,000
GOS Contribution	<u>10,400,000*</u>
Total Project	\$45,400,000

B. The Project

1. Introduction

The Government of Sudan, recognizing the critical role of agriculture and agricultural research in the development of the country, requested IBRD to design a program to create research infrastructure to serve the farmers in the western portion of the country. The national expansion of agricultural production in the Western Sudan is essential if the country is to meet its food needs and development goals. The IBRD, in response to the Government's request, developed the project described in this paper. This project will create the infrastructure necessary to support an applied agricultural research program for the Western Sudan. The IBRD has requested AID to participate in the financing and implementation of this project. The project design was discussed and agreed upon during meetings between the Government of Sudan, the IBRD, and AID held in Khartoum from May 8 to 12, 1978. The basis for this Project Paper are two IBRD documents: (1) Sudan Agriculture Research Project - Staff Appraisal Report and (2) the Implementation Volume Report No. 1913 SU dated March 14, 1978. The documents have been included in the project paper as Annex G and H.

2. Purpose

The project will increase the capability of the Sudanese Agricultural Research Corporation (ARC) to develop and test improved production systems that conserve and rehabilitate natural resources and improve the standard of living of the subsistence farmers and pastoralists of Western Sudan.

*Includes waived duties and taxes as given in the IBRD Staff Appraisal Report.

3. Background

(a) Contribution of Agriculture in the West to the Economy

The West, comprising the four provinces of North and South Darfur and North and South Kordofan, covers an area of about 850,000 km² or 35% of the Sudan with about 5 million or about 30% of the country's total population. The West contributes about 90% of the Sudan's millet, 52% of the sesame, 46% of the groundnuts, 17% of the sorghum, 6% of the cotton and 90% of the gum arabic; an estimated 45% of the cattle (about 7 million), 37% of the sheep (about 6 million), 32% of the goats (about 3.5 million) and 65% of the camels (about 1 million) are raised in the region.

Crop Production

Small-scale subsistence agriculture is the most important economic activity in the West, and other sectors, particularly transportation and industry, are critically linked to agriculture. Only about 3% of total cultivation is commercial agriculture, largely in South Kordofan and to a small degree in South Darfur. Rainfed agriculture predominates with small irrigated plots in the Jebel Marra, at Sag el Naam in North Darfur, and around Nyala as the only exceptions. The main crops are millet, sorghum, groundnuts and sesame, with cotton and maize of lesser importance. Recorded yields reflect not only poor soils and unfavorable weather conditions but also poor husbandry practices and, in some areas, over-exploitation of the land. For all the major crops, the area under cultivation has been increasing steadily over recent years with incremental aggregate production but yields have remained stagnant or fallen, a trend which must be reversed if farmers' incomes are to be increased.

Animal Production

The conflict between individual ownership of livestock and communal land use, and the seasonal movement of the predominantly transhumant livestock producers inhibit the proper utilization of resources including range, water and the production potential of the herds. During the last 20 years, the number of animals has increased considerably through efficient veterinary services; but increased herd numbers have led to range deterioration without noticeable incremental output.

Constraints to Production

There are two main constraints to increased production: (1) ecological limitations imposed by a low and extremely variable rainfall, high evaporation, recurring drought, soils of low fertility, and limited access-

ibility of ground water; and (ii) increases in the human and livestock populations which change social traditions and engenders pressures and ecological degradation. The steadily worsening man/livestock population ratio forces many pastoralists to turn to sedentary cultivation and become settled farmers; but new and more efficient systems of land use and water management ought to be introduced into existing livestock and crop production systems if this trend is to be successful.

Many other constraints are related to these basic issues, and these can be classified as ecological and socio-economic. Some ecological issues are: deterioration of rangelands; grass fires; parasites and pests; low protein and mineral intakes by grazing stock; reciprocal pressures of livestock and crops in competing production systems; lack of effective technologies of crop husbandry; crop diseases, weeds and pests; inadequate tillage methods; unimproved crop varieties; low soil fertility; and poor water management. The socio-economic constraints include: the conflict between individual ownership of livestock and communal land use; socio-economic insecurities in a fragile ecosystem; attempts to buffer social groups against environmental vicissitudes by overstocking, shifting cultivation and increased sedentarization; lack of market opportunities, and insufficient demand for consumer goods and few opportunities for investment of capital other than in livestock.

These constraints do not generally represent discrete disciplinary problems capable of solution by traditional techniques of experimental agriculture. Rather they constitute interconnecting links which could only be strengthened through the study of production systems by multi-disciplinary teams, in order to increase crop and animal production and provide security to producers through the long-term optimum use of resources, with particular emphasis on water/soil/plant/animal/human inter-relationships.

(b) The Proposed Research Programs for the West

The Project Area

Location and Climate

The Project area extends from the Bahr el Arab in the South to the Libyan desert in the north, and from the Nile in the east to beyond the Jebel Marra massif in the west. The habitable southern two thirds of the Project area is located approximately between 9°30' and 16° N latitude and 20° and 32° longitude. The north-south rainfall gradient increases from very arid (about 25 mm per annum) in the northern desert to semi-arid (up to 900 mm) along the Bahr el Arab in the south, embracing the ecological zones of the sahara, sub-sahara, sahel, and sudanian savannah. In the south, the rainy season extends over about five months (June to October) and becomes gradually shorter towards the north.

Soils

Fragmentary soil surveys have identified three broad soil groups in the inhabited southern part of the Project area:

- (a) the stabilized (Qoz) sands complex is predominant and has low fertility but can be cultivated by hand;
- (b) the non-cracking clays which are widely scattered, with sparse vegetation because of low permeability; grazing is the most common use of these soils but they are also suited for cropping once the hard surface pan has been broken up; and
- (c) cracking clays, the most fertile and stable soils which are predominant in the Nuba Mountains and occur over much of the southern project area.

Population and Economy

Until recently, the nomadic livestock-owning Baggara people were predominant though a few Baggara and some non-Baggara people have been settled agriculturalists for a long time. Because of human and livestock population pressures, more and more pastoralists are turning to crop production in association with livestock in areas with annual rainfall over 400 mm thus reducing the land requirements per family and increasing the output per unit of land. The range areas once seasonally rested during cyclic migratory livestock movement are now subject to intense degradation. Furthermore, cash surpluses accumulated by settled cultivators are invested in livestock. Thus a continuum now exists with varying degrees of settled, semi-sedentary and fully nomadic populations, with their overlapping needs and competitive demands for resources.

C. The Production Systems and their Research Needs

The variation in natural conditions and economic behavior of the inhabitants can be differentiated into five agro-pastoral production systems, of which two are purely pastoral and three are crop/livestock combinations:

1. arid livestock production at the desert fringe;
2. semi-arid livestock production in the south of the Project area, interspersed with crop production;
3. integrated crop/livestock production on stabilized sands;
4. integrated crop/livestock production on non-cracking clays; and
5. integrated crop/livestock production on cracking clays.

There is considerable overlap between these systems: For instance, the northern (wet season) limit of the semi-arid cattle range coincides with the southern (dry season) limit of the arid camel/sheep range, thus being effectively grazed year-round and having no opportunity for recovery. Year-round livestock production is difficult on non-cracking clays due to flooding problems and on cracking clays because of mud. Livestock have to be moved to dry ground outside the area or fodder conservation is required to maintain the animals during the wet weather. The special features, constraints, research requirements of/and proposals for each system are described in the following sections.

Arid Livestock Production at the Desert Fringe

The System. Nomadic pastoralists exploit the desert fringe with camels, sheep and some goats in response to and sometimes in anticipation of irregular rainfall and shifting plant cover. Seasonal movements range from 250 to 500 km and may reach 800 km in years of exceptional rainfall with browse flushes in the desert. To maximize productivity, great experience, endurance and skill are required in manipulating the herds and flocks; for example camels are moved according to their nutritional needs, leaving people to feed on sheep and goats, and grain acquired through the barter or sale of animals.

Constraints on Production. The rainfall variability and lack of permanent water dictate repeated animal movement diverting most food energy to maintenance rather than production; body weight losses and mortalities are being incurred during the long and severe dry seasons; further constraints are loss of grazing through fire, and inadequate animal disease treatment.

The Research Program. The potential for improving the productivity of this fragile but highly adapted system through technical innovations must be regarded as limited, but studies on range condition and trend and manipulation through different livestock species, water regimes, fire and range management are indicated with a view to stopping the degradation of rangeland resources. Studies would also include the structure and productivity of camel herds, and sheep and goat flocks with the underlying technical coefficients, the effect of improved disease control, feeding of mineral supplements and drought proofing mechanisms and strategies. Human resources would be studied for a longer time span with regard to demographic structure and trends, nutritional and health status, the organizational and social context of the production unit, decision-making, socio-economic value patterns, marketing processes, animal management patterns, and inter-population pressure through competition for resources. The program would be carried out in close coordination with the range section at Ghazala Gawazat under the Western Savannah Development Corporation (WSDC).

An interdisciplinary systems research team would be established at El Fasher, comprising a range specialist (sub-program leader), a camel specialist, a sheep and goat specialist, a second range specialist, and a sociologist (based at Nyala) plus support staff,

Semi-Arid Livestock Production
(Sudanian and Sahelian Zones)

The System. The operating zone is a series of parallel longitudinal grazing orbits (from below 10°N almost to latitude 13°N) by cattle-owning Baggara pastoralists moving either towards fresh grazing (dry season) or away from biting fly and heavy mud (wet season). Seasonal movements range from 300 to 600 kms. Cattle are the main class of stock, with some sheep and goats tended in mixed bunches. Dairy produce is being consumed for subsistence or sold at local markets in exchange for grain, tea, sugar or clothing.

Cattle offtake for sale is about 5% (mainly mature stock) but small ruminants serve as the main meat supply for subsistence. The labor intensive livestock system of the Baggara is reasonably efficient in relation to the natural potential, with calving rates 65%, lambing rates 120% and kidding rates 200% being recorded. Millet production for subsistence on the easily tillable Qoz soils is expanding rapidly.

Constraints on Production. Expanding cultivation by both cattle owners and sedentary farmers as well as grass fires reduce the availability of dry season grazing, the major bottleneck in feed supply during the year; cyclical growth and weight losses are common; natural grazing and crop residues are deficient in protein and minerals; animal diseases and parasites are more important than in the north; there are local water shortages and widespread overstocking of the range; and lack of permanent water supplies along the routes of transhumance force herders to complete the southward irrigation to the Bahr el Arab before the grazing can be fully utilized.

The Research Program. The area offers more scope for technical innovation than the area to the north. The objective would be to improve the economic position of the predominantly transhumant pastoralists by improving livestock output through better range, water and livestock management, resulting in higher offtakes and increased subsistence. New technologies need to be developed that are both environmentally advantageous and socially acceptable. The main lines of research would include:

- (i) rangeland production: the assessment of range condition and trend; its primary productivity and improvement possibilities through controlled grazing, water and fire management; the introduction of new species (particularly leguminous trees and shrubs), the strategic use of localities with better soils or water availability, and to a lesser extent, re-seeding and bush control;
- (ii) livestock production: the structure and productivity of cattle herds and sheep and goat flocks, with the underlying technical coefficients; the effect of improved disease control, mineral supplements and the feeding of crop residues and by-products on herd productivity; herd productivity changes through the early extraction and fattening of young males;
- (iii) pastoral security: human resources would be studied, including investigations of the opportunities for capital investment other than in livestock;
- (iv) pastoral systems: research results on rangeland, livestock and human resources would be integrated into proposals for improving traditional systems of husbandry and lifestyles of the people. The key to such changes would be the definition of basic limitations in available resources (particularly soil, vegetation and water) and therefore the need to conserve and use rationally what is available, and what extra can be produced, for example, by the introduction of new water management technology, by balanced numbers of people and livestock, and by increased subsistence cultivation. Basic concepts of land and water use, grazing control, organized land use for pastoralism and agriculture, animal disease control and drought-proofing technology would all have to be studied and brought together so that final technology packages could be formulated and demonstrated in a manner appropriate to, and accepted by, the livestock producers.

A range and a livestock research division would be established under the WSDC at Ghazala Gawazat including two range specialists, a forage agronomist, four livestock research officers, a veterinary parasitologist and support staff. WSDC would operate the range and livestock programs until ARC would take over the operation and management of all agricultural and livestock research in the West.

Integrated Crop/Livestock Production on Stabilized Sands

The System. Livestock and crops are integrated in differing proportions and with varying efficiency on the stabilized sands in the middle belt of the Project area, between the 250 and 600 mm isohyets. Millet and groundnuts are the leading crops with some bamia (lady's finger), sesame and peppers. In the northern part, Acacia senegal is tapped in the dry season for gum arabic, thus providing a marketable production without labor competition for wet season crop harvesting. The shifting cultivation technique includes 4-5 years of cropping with gradually declining yields,

and 8-12 years of bush fallows. Longer fallow periods in the north allow the creation of more efficiently manageable gum gardens but there is mounting land pressure to reduce the fallow period. A typical production unit would consist of a family (man, wife or wives and their children) cultivating 2-4 ha of land and living in villages of 10-30 huts. Livestock (desert sheep and goats used for milk and meat production and for low volume marketing) are required to stabilize the system because of crop failures in one year out of five. Local distribution of settlements is a function of water sources which are abundant over much of the area provided that boreholes have been developed.

Constraints on Production. Marginal and variable rainfall and low soil fertility are the main reasons for a fragile farming system with high demand on land. Overstocking is prevalent around villages and grass fires are destroying most of the pasture; over exploitation of crop land through shortening fallow periods encourages erosion and dune encroachment; and there are reciprocal pressures of livestock and cultivation demands in adjoining and competing production systems.

The Research Program. Research on this integrated livestock/crop production program would include: differential efficiencies and costs of crops and livestock within the integrated production systems; the study of integrating factors such as risk immunization, even use of labor, utilization of unsaleable products and the effect of manure on soil fertility; evolution of permanent crop/fodder/pasture rotations; small farm economic studies; the social structure of production units; marketing procedures and opportunities; and institutional requirements in the subsistence sector. Technology packages would be developed which would be easily applicable by subsistence farmers. The environmental impact of innovations would be constantly monitored.

In developing these packages, particular emphasis would be laid on:

- (1) crops: the testing of food and cash crops, particularly new millet and groundnut varieties supplied by ARC stations or ICRISAT; minimum tillage and water management technology, crop protection, cultivation practices and their timing; weed control; and - to a lesser extent - fertilizer use;
- (ii) livestock: the use of draught animals; milk and meat production; nutritional values of crop by-products and residues; fertilizer values of animal wastes; comparative productive and reproductive efficiencies of local cattle, sheep and goats at low and variable feed supplies;

- (iii) pasture and forage: possible new species such as Stylosanthes (pasture legume) and Cenchrus (grass) to improve range production; the impact and economics of forage crops, fertilizers, and irrigation to increase feed supply at critical times; conserved fodder cut from pasture and forage crops; crop residues and grain supplements for the maintenance or survival feeding of stock during the dry season.

The research program would be implemented by the WSDC through the crop division at Ghazala Gawazat. The Project would support the program by providing socio-economists and millet breeders. The trial program to be financed under the Mechanized Farming Project (MFC III) at El Fuda would be expected to complement the research program and demonstrate practical solutions to farmers.

Integrated Crop/Livestock Production on Non-Cracking Clays

The System. Non-cracking clays are elements of existing production systems in the Project area: they do not constitute a production system in their own right. They are most detectable in the clay pan-sand alternation of the Baggara pattern; interspersed with cracking clays around the Nuba Mountains; and in a stabilized sands/non-cracking clays mosaic south of El Obeid. Non-cracking clays are used mainly for livestock, as water catchments, and are capable of providing range grasses and browse of high mineral content.

Constraints on Production. The hard surface pan of these basically fertile soils prevents their use by smallholders: traditional tillage techniques cannot break them up for cropping on a significant scale. Otherwise similar problems prevail in the production system as described in para. 4.14.*

The Research Program. The general approach would be the same as for the integrated crop/livestock systems on stabilized sands (para. 4.15 and 4.16)* with greater risks of drought (El Obeid receives 420 mm average annual rainfall with a coefficient of variation of 28%). Crop production research would include millet, and focus on improved tillage technology, including animal traction at the smallholder level.

A specialized study on gum arabic (mainly growing on stabilized sands) would include the establishment and culture of Acacia senegal; gum arabic secretion; harvesting and marketing; the grid planting of A. senegal to form shelter breaks, control soil erosion, improve soil fertility through the fixation of atmospheric nitrogen, and improve the water-holding capacity of the soil through increased organic matter; the use of the tree as animal fodder; and its inclusion in an appropriate long-term rotation under range conditions.

*See Staff Appraisal Report pp. 18-19.

A multi-disciplinary team comprising a systems agronomist (sub-program leader), two gum arabic specialists, agricultural engineer, farm management economist, millet breeder, livestock specialist, research liaison officer and support staff would be established under the Project at El Obeid.

Integrated Crop/Livestock Production on Cracking Clays

The System. Cracking clays are characteristic of the south-east of the Project area. The major differences between this system and that on stabilized sands would be the replacement of millet as the major crop by sorghum, which is more tolerant of heavy soils, and the replacement of groundnuts by sesame as the major support crop. In the Nuba Mountains, cotton is important, replacing gum arabic of the stabilized sands as a cash crop. Livestock differences also exist: desert sheep decline in importance and are replaced by goats and cattle.

Constraints on Production. In addition to the problems common to all cultivators in the Project area, specific problems exist with regard to the short period for seed bed preparation and planting on cracking clays; traditional tillage technology limiting the area that can be cultivated; unimproved sorghum and sesame varieties; weed competition (striga) in sorghum and post-harvest pests in sesame. Livestock is seriously affected by mud and flies in the wet season. Nevertheless, it should be noted that the cracking clays have the greatest development potential of all production systems under consideration.

Further to the research program described under the stabilized sands, emphasis would be on:

- (i) crops: sorghum, sesame, cotton and soybeans suitable for reasonable rainfall conditions as in the case of Kadugli (average rainfall 760 mm/year; C of V 18%); the wild-growing plant kerkadeh would be studied regarding its suitability both in an integrated farming system or as a plantation crop;
- (ii) livestock: animal traction; milk and meat production of local and introduced breeds of cattle, sheep and goats, and their crosses;
- (iii) pasture and forage: because of the difficulties of grazing clay soils during the wet season, techniques of fodder conservation, in particular hay; and
- (iv) cultural techniques: examination of hand and mechanized tools for more rapid and more efficient cultivation of the difficult black cotton soils; tillage practices by hand, animal traction and varying degrees of mechanization in relation to optimal water use, root penetration and plant growth, soil erosion, timing of tillage, labor requirements and economic evaluation.

A multi-disciplinary systems research team would be stationed at Kadugli, comprising a plant breeder/agronomist as sub-program leader; two farm management economists, kerkadeh specialist, research liaison officer, and support staff. Close linkages would be established with one ODM group of scientists expected to be placed with the Nuba Mountains Corporation shortly.

Supporting Services

Water and Land Use Management Research Program

This program, to be based at Nyala, would support the five multi-disciplinary systems research teams in the Project area, including the survey, monitoring and classification of available land and water resources, and their rational use in crop or livestock production. The efficient use of limited rainfall is the key to the optimization of crop and animal production in the West. The main lines of research would include:

- (a) resource potential: an inventory and the analysis of previous investigations, and of existing environmental data for the Project area such as meteorological records, air photographs and satellite imagery; the inventory (including maps) would set out overall system parameters, such as water balance, primary productivity, pedology, ecological trend, and human and animal demography;
- (b) water management technology: water conservation, infiltration, penetration, run-off, harvesting, surface, soil profile and underground storage, evaporation, and efficient minimum use for crops, livestock and human populations;
- (c) socio-economics of water management: comparative costs and benefits of the techniques of harvesting, storing and using water; social structures and economic pressures as mechanisms to control and restrict water use in order to control livestock numbers, improve rangeland management and improve crop farming;
- (d) land use planning: preparation of a land use classification system for the West based on suitability of land for crop or livestock production; preparation of land use plans avoiding conflicts between the interests of pastoralists and cultivators and including dry season grazing reserves for pastoralists; stock route planning; improvement of traditional crop farming, and identification of further settlement areas and localities for large-scale, mechanized farming and irrigation development;

operational (or pilot) research projects involving land use on a catchment basis and the main soil types;

- (e) solar energy: adapting new solar energy technologies for cooking, transportation, and the recovery, distillation and recycling of water.

The water and land use management research team based at Nyala would comprise a program leader and deputy leader; soil physicist; soil chemist; two agro-climatologists; water engineer; and technical support staff. Field project officers and technical support staff would also be stationed at El Obeid and Kadugli.

Socio-Economic Support Services

A group consisting of two sociologists, two economists and a biometrician would be established at Nyala in order to be available to the multi-disciplinary research teams in matters concerning economics and human resources and in project design and analysis. The group would not carry out its independent research program but be strictly integrated into the multi-disciplinary sub-programs. The advantages of stationing the group at Nyala would be to control technical supervision and utilization of research staff for more than one production system.

Testing and Application of Technology

Agricultural research on stations risks becoming academic if not closely linked to farm-level problems. New technology would, therefore, not only be tested at the research station or on a simulated smallholding, but also on farmers fields. The research liaison officers to be stationed at Nyala, El Obeid and Kadugli would be responsible for the adaptation of the technology packages to practical farming conditions; they would also be responsible for the transfer of technical language into simple leaflets for extension staff and for field days. The most important delivery systems of new technology to farmers would be the field services of the WSDC in Southern Darfur and the MFC and the Nuba Mountains Corporation in Southern Kordofan including one ODM Project are expected to establish agricultural extension services after first research results have become available for application.

Training and Extension Unit (TEU)

The TEU would organize short refresher courses for scientists and technicians and prepare brochures and pamphlets for extension staff. It would be headed by a scientist with training experience, supported by an assistant training officer. The unit would be established in year 5 when the first research results will become available for extension and when the first refresher courses are expected to be needed.

(d) The GOS Research Management

The primary responsibility for overall research policy formation in Sudan, is vested in the National Council for Research (NCR) established by the official NCR Act of 1973. The NCR primarily serves as advisor and consultant to the GOS, its government agencies, public corporations and the private sector in matters relating to scientific research. However, all agriculture research activities are carried out by and are the responsibility of the Ministry of Agriculture, Food and Natural Resources (MAFNR). The MAFNR, in turn, has vested most of this research responsibility in a semi-autonomous body called the Agriculture Research Corporation (ARC) which was established under the ARC Act of 1967 and 1977 respectively. The remaining agriculture research activities are being implemented by the Animal Production Research Administration (APRA); Veterinary Research Administration (VRA) and a series of agriculture service departments. Based upon the ARC Act of 1977, the GOS has transferred all research in forestry; pasture and range; wild life and game; soil conservation; fisheries and marine biology, and food processing to ARC. The GOS' official intent and policy is that all such agricultural research programs presently being undertaken by other agencies and service departments, which have been legally transferred to ARC, will be dissolved and assumed by ARC.

ARC is presently funded from a variety of sources. These sources include an annual GOS contribution, revenues from sale of crop and other products, grants from local and international institutions, and income from the sale of publications and services rendered. In addition to absorbing the research functions from other departments, ARC will assume the research and administrative responsibilities of the Western Savannah Development Corporation (WSDC). The WSDC is a corporation established by the GOS to administer the research activities implemented under a previous IDA Development Credit Agreement, together with other international donors (including the Saudi Fund), located at Ghazala Gawazat. This transfer, however, will also include the transfer of WSDC's staff and operational budget as well.

4. Project Description

The overall Project is basically divided into two phases of approximately three years each, thus making a six-year life of project. It is anticipated that the initial project activities would begin on or about January 1, 1979, and end on or about December 31, 1984. Phase I is primarily concerned with the development of the research facilities, i.e., construction of the project center at Nyala and the three research stations at El Fasher, El Obeid and Kadugli. Phase II, towards the end of the first half of year three, would begin the actual initiation of the respective research programs. There would be limited research activity during Phase I to carry out an integrated multi-disciplinary research program.

Presently, ARC is based at Wad Medani and is responsible for five regional stations and twelve sub-stations. To provide more autonomy for ARC to carry out its expanded activities and the conditions as outlined in the ARC Act of 1977, the ARC is examining the feasibility of moving the headquarters office from Wad Medani to Khartoum, thus alleviating the ARC headquarters staff of the responsibility for the implementation of the operational research programs. Two new units will be established, a Project Support Unit (PSU) and the Planning and Evaluation Unit (PEU), in an attempt to strengthen ARC's research management capability. During the fifth year of the project, a Training and Extension Unit (TEU) originally planned for the ARC headquarters will be established at the Project Center in Nyala.

The Project Support Unit will be responsible for research station development, procurement of goods, services and transportation. A special office within PSU would provide for linkages with the Integrated Area Development Research Program, including technical staff support, to handle the services of the four regional research programs (West, South, North and East) and for external agencies cooperating in various research and development activities. The Planning and Evaluation Unit would have the responsibility for planning, coordination and budgeting of research programs, producing feasibility studies for new programs and facilities, planning of manpower requirements, program evaluation and for carrying out policy studies and studies on research management and organization. The TEU would organize short refresher courses for scientists and technicians and prepare brochures and pamphlets for extension staff. It would be headed by a scientist with training experience, supported by an assistant training officer. The unit would be established in year 5 when the first research results will become available for extension and when the first refresher courses are expected to be needed.

The Project will be further implemented, by ARC, through the establishment of a new Project Center at Nyala. This facility would include a research center, project headquarters including offices, laboratories, a documentation center, a conference room and 55 staff houses. Three new research stations would also be constituted as follows:

- (1) El Fasher: Research station, including offices and field laboratories, farm buildings, 16 staff housing and minor fencing;
- (2) El Obeid: Research station including offices, field laboratories, farm building, 28 staff housing, landscaping and fencing;
- (3) Kadugli: Research station, at Habila, including offices, field laboratories, farm building, 29 staff housing, landscaping and fencing.

It has been projected that Phase I, over a three year period, would encompass the construction and equipping of all of the facilities indicated above. Further, it is anticipated that prior to the end of year three, Phase II implementation of the research program would begin. The research program would include two major programs, i.e., livestock/crop production systems and water and land use management research. The research program on livestock/crop production systems would be implemented under three sub-programs at the three research stations. This would include integrated crop-livestock research on non-cracking clay soils at El Obeid, integrated crop/livestock on cracking clay soils at Kadugli, and livestock at the arid desert fringe at El Fasher. The research program on water and land use management would be directed from the Project Center at Nyala and would be in support of the research undertaken at the stations and WSDC. In addition, and as previously stated, ARC will also assume responsibility for the research carried out by the WSDC at Ghazala Gawazat. This research would cover two other important production systems, namely integrated crop/livestock on stabilized sands and livestock in the semi-arid areas. (A further description of these systems may be found in Part IV-B Sections 4.04 through 4.34 of the Appraisal Report.)

5. Inputs

a. A.I.D.

AID will finance the following inputs toward achievement of the project purpose:

1. Technical Assistance: It is projected that a total of approximately 46 scientists and senior administrators and approximately 99 technical support staff would be employed under the Project, at the respective locations, i.e., Khartoum Headquarters, Project Center, Nyala and the three research stations at El Obeid, El Fasher and Kadugli. Sixteen members of this staff would be key staff, six of which would be Sudanese, including the Project Director, while the remaining ten would be internationally recruited specialists. These specialists will be funded by AID and their station location is as follows:

<u>Title</u>	<u>Location</u>	<u>Man Years</u>
1. Senior Research Advisor to Director General	Khartoum	6
2. Research Planning and Evaluation Advisor	Khartoum	6
3. Project Architect/Planner	Khartoum	6
4. Deputy Project Director	Nyala	6
5. Land and Water Use Specialist	Nyala	6
6. Agroclimatologist	Nyala	4
7. Sociologist	Nyala	5
8. Farm Management Economist	Kadugli	5
9. Agriculture Engineer	Kadugli	4
10. Livestock/Crop Production System Specialist	Nyala	<u>6</u>
	Total	54

It is imperative that the Deputy Project Director and the Production Systems Specialists be recruited to serve for a period of no less than five years and the remaining individual specialists serve for a minimum of two years each. This is necessary to maintain continuity and consistency through the project cycle. The specific duties of these consultants are found in Annex C.

The Project would also provide for approximately 80 man months of short term consultants (12-14 man per year) to be used for the preparation of the Research Plan (due in three years), project monitoring, solar energy research, specialized consultancies in research programs, building program and procurement assistance and the external project review proposed for years three and six.

It is also anticipated that during the life of the Project, specialized research problems will arise that are important and which cannot be undertaken within the framework of ARC. It is proposed that such research be contracted to specialized institutions, outside of Sudan, for implementation. Such selected institutions would be agreed upon by the respective donors.

2. Participant Training: The AID-funded portion of the project would provide participant training for approximately 28 research fellowships for the scientific staff of which 6 would be for the PhD. degree, 5 for the M.Sc. degree and 17 non-degree specialized

courses ranging from 3-12 months each. The proposed fields of study for each of these fellowships are as follows:

<u>Specialization</u>	<u>Degree</u>	<u>Length of Trng.</u>
1 - Soil Physicist	Ph.D	4 years
1 - Sociologist	Ph.D	4 years
1 - Range Specialist	Ph.D	4 years
1 - Farm Management Economist	Ph.D	4 years
1 - Gum Arabic Specialist	Ph.D	4 years
1 - Yet to be Identified	Ph.D	4 years
2 - Economists	M.Sc.	2 years
1 - Farm Management Economist	M.Sc.	2 years
1 - Agriculture (Engineer)	M.Sc.	2 years
1 - Agro Climatologist	M.Sc.	2 years

(Further training, particularly at the M.Sc. level, may be requested by Sudanese authorities.)

The following fellowships are all non-degree and short-term (3-12 months):

- 3 - Research Officers
- 1 - Forage Agronomist/Livestock Specialist
- 1 - Livestock Specialist
- 1 - Small Stock Specialist
- 1 - Economist
- 1 - Groundnut Breeder
- 1 - Millet Breeder
- 1 - Sorghum Breeder
- 2 - Field Project Officers
- 1 - Water Engineer
- 1 - Agricultural Engineer
- 1 - Land and Water Use Specialist (Deputy Program Leader)
- 1 - Gum Arabic Specialist
- 1 - Kerkadeh Specialist

3. Specialized Technical Assistant Services:

During Phase I, it is projected that a series of AID-financed technical assistance services, as indicated previously, will be required to perform specific services as soon as the project has been implemented. The first of these are the recruitment of an Architect Planner and the contractual acquisition of an architectural firm to prepare the building plans, implementation schedules, bidding and contract documents, carry out bid analysis, advise on the award of contracts and supervises construction. The second is to secure the services of two senior advisors, to be stationed at the headquarters in Khartoum as soon as possible. In this

respect, the GOS has indicated a strong preference for such specialists, to be recruited through the International Agriculture Development Services (IADS) headquartered in New York. Concurrence in the selection of such consultants, from IADS, was also strongly endorsed by the IBRD. The contractual arrangements for the services of these consultants would be sub-contracting under the Title XII contract. The services for the specialists to be assigned to the Project Center and the respective research stations have been contracted for through the Title XII mechanism. The Consortium for International Development (CID) is the selected institution.

4. Operations Support: AID will support ARC operations by financing the following inputs:

--70% of local salaries over six years

--100% of office expenditures, transports costs, building (equipment maintenance costs), and farm costs for six years.

5. Capital Costs: AID will fund 100% of the following project capital costs:

--Furniture and equipment for the project center at Nyala, the three new research stations (including staff house furnishing). An illustrative list of the equipment to be purchased is included in Annex H.

-- Vehicles and farm equipment consisting of 7 mobile research units, 56 four-wheel drive vehicles, 1 minibus, 5 tractors, and related farm implements.

-- Farm development consisting of landscaping and fencing at research stations.

-- A Small Purchases Fund to enable the ARC to buy and maintain experimental animals and cover other incidental expenses.

b. IBRD

The IBRD, through an IDA credit, will partially finance the following inputs:

-- Construction of the Project Center and three research stations, including offices, laboratories, staff houses, a documentation center, and a conference room.

-- Purchase and operating expenses for a project aircraft.

c. GOS

The GOS contribution includes partial funding of the following inputs:

- Construction of the Project Center and three research stations
- Aircraft purchase and operating expenses
- 30% of local salaries over the six-year project
- waived duties and taxes

6. Outputs

The Project would, over a six-year period, develop and operate ARC's research capability in the West, and provide support services at ARC's headquarters. In particular, the Project outputs will be:

(a) Research projects dealing with: (i) livestock and crop production systems at El Obeid (integrated crop/livestock on non-cracking clays), Kadugli (integrated crop/livestock on cracking clays) and El Fasher (arid livestock) - in close cooperating with WSDC - Ghazala Gawazat (integrated crop/livestock on stabilized sands and semi-arid livestock); and (ii) water and land use management research at Nyala, including research support services;

(b) Development of an ARC research center and regional headquarters at Nyala; and of research stations at El Obeid, Kadugli and El Fasher, including 128 houses, about 4,200 m² of office space and field laboratories, and about 2,700 m² of farm buildings, land-scaping and fencing; plus furniture and office/housing equipment;

(c) Strengthening of ARC's headquarters through the establishment of a Project Support Unit (PSU), a Planning Evaluation Unit (PEU), and a Training and Extension Unit (TEU);

(d) contract research to be carried out by specialized research institutions other than ARC;

(e) Sudanese scientists trained and employed on project research stations (6 for Ph.D, 5 for M.Sc. and 17 for non-degree specialization courses).

These outputs will enable the ARC to develop technology packages suitable for use by the nomadic herdsmen and dryland farmers in the West. Ultimately, the research programs resulting from the project will, in conjunction with improved extension services, lead to increased productivity and improved use of the natural resources in the project area.

II. Project Analysis

A. Technical Analysis

The Sudan's agricultural development strategy laid down in the Six-Year Development Plan (1977-83) (SYP) emphasizes the need to make full use of existing resources and at the same time to correct the wide variance in productivity and income between the commercial (irrigated and mechanized rainfed) sector and subsistence agriculture. As part of this strategy, GOS is according high priority to launching development programs for subsistence cultivators and pastoralists in the West. Intensified use of arable land, range, livestock and water could contribute to reaching the plan targets in the country and a steady improvement in living standards of the population in the West. This is critically dependent on the transfer, development and adoption of improved technical packages which call for a back-up by a largely increased agricultural research program. In the short term the Savannah belt is the climatically most suited area in the Sudan for the expansion of rainfed agriculture. The plan targets for increased surpluses in sorghum, groundnuts, sesame and gum arabic, and in better crop/livestock integration, would crucially depend on the success of development projects in the West.

This project will provide the GOS with the essential elements required to establish a variable research program in the Western Sudan. Technical support to the Agricultural Research Corporation (ARC) headquarters will assist the GOS in its design and analysis of national research programs in general and the Western Sudan in particular. IBRD funding of an airplane will insure reliable and timely transport of staff and materials between Khartoum and the four research facilities.

The research to be carried out by AID-funded technicians and local specialists at the project centers will be related mainly to plant and animal improvement and production techniques. Management of each commodity program would be provided by a specialist, National Program Coordinator, who would be based at a station where the commodity has its greatest regional importance. He would be responsible for: the technical aspects of the commodity program at this station and at the various satellite research stations, transmitting information between stations

and from international sources, advising the Government on his commodity reports, and reviewing research programs and proposals in his field.

Under ARC's staff development program, about 60 scientists are currently abroad for advanced degree training, and many of these would be expected to join the project upon their return. In addition, new participants will be selected and funded by AID under this project to insure the availability of qualified Sudanese for key planning, organizational and scientific research positions by the end of project.

The general technical approach as presented in the IBRD Appraisal is judged to be basically sound. The degree of exactness of applicability and relevance of the research results to the area problems will not be known until the project is well under way and results have been applied. An implementation work plan and periodic fine tuning of that plan will be needed from time to time to maintain research direction and appropriateness.

B. Financial Analysis

1. Recurrent Costs

Following project completion, the annual recurrent costs of research in the West on the same scale as the project is estimated at \$3.3 million (1983 prices). This will require an additional \$2.9 million in GOS budget allocations to maintain project activities and although this is a substantial increase, it is in line with research allocations in the Central and Eastern areas. The GOS has indicated that steps are being taken to assume full recurrent costs upon project completion and the IBRD has indicated that such steps are satisfactory.

2. Financial Plan/Budget Tables

The project will be jointly financed by the IBRD through an International Development Association (IDA) credit, contribution by the GOS, and a grant from AID. Table 1, Financing Schedule, provides for a distribution of funding by general category and the amount and percent to be financed by each donor. Based upon prior IBRD/AID discussions it was proposed that the GOS/IBRD assume the financial cost for the construction of the facilities and the purchase and operating cost of the aircraft; GOS/AID would share (30/70%) cost of local salaries and AID would assume all of the remaining operational, training, equipment, furnishings and related costs.

As per IBRD/USAID discussions, AID would finance all of the project costs with the exception of cost related to the construction of facilities, purchase and operational costs of the aircraft and approximately 30% of local salaries.

Specifically, Capital Cost, totalling \$4.434 million, includes the following: furniture and equipment (\$2.359 million), vehicles and farm equipment (\$1.278 million), farm development (\$.157 million) and incidental expenditures (\$.640 million). Under Operating Cost, totalling (\$7.0 million) the distribution is as follows: local salaries (\$4.774 million), office expenditures (\$.163 million), transport (\$.500 million), building and equipment maintenance (\$1.322 million) and farm costs (\$.270 million). Technical Assistance costs totalling (\$8.566 million) are as follows: contract teams (\$5.576 million), participant training (\$.584 million), conferences (\$.034 million), short-term consultants (\$1.104 million) and the cost for an architectural firm to implement the building program (\$1.268 million).

The total project costs, including contingencies, are estimated at \$45.4 million of which \$24.2 million or 53% would be in foreign exchange. (See Section 6.01 Appraisal Report.)

a. Capital Cost

Table II provides a distribution of the Capital Cost Component of the project for each year during the life of project. Specifications for major positions of the required equipment, housing furnishings, vehicles, laboratory facilities for the respective project sites have yet to be developed. However, it is projected that the project will require approximately 7 mobil research units, 56 4-wheel drive vehicles, 1 minibus, 5 tractors and related farm implements. (A waiver for these vehicles will not be requested as these will be procured in the U.S.). It is proposed that the procurement of this equipment and commodities be procured under the CID contract with a sub-contract to the AAPC for the actual procurement of the same. Funds for farm development (\$.156 million) and incidental expenditures (small purchases of \$.640 million) will be provided through a Grant to the GOS with the appropriate accounting system.

b. Operating Cost

Table III also provides a distribution of the Operating Cost Component of the project for each year during the life of project. The GOS is contributing a total of 30% towards local salary costs (\$4.744 million) which could also be handled by a direct grant to ARC/GOS under an appropriate accounting system. It also is proposed that the remaining operating costs, i.e., office expenditures, (\$.163 million), transport (\$.500 million), building and equipment maintenance (\$1.322 million) and farm costs (\$.270 million) be handled by a direct grant to ARC/GOS with the appropriate accounting procedures.

c. Technical Assistance

Table IV provides a schedule for the distribution of the Technical Assistance components of the project for each year during the life of project. As mentioned under Part III-E Specialized Technical Assistance Services, there are a series of separate contract actions that must be initiated as soon as possible as major components of the project depend upon the respective contract personnel. The first of these is the basic contract for the internationally recruited scientists. AID has already initiated a Title XII action which has resulted in the selection of the Consortium for International Development (CID) to be the prime contractor for these consultant services.

The GOS has urged securing the services of two scientists from the International Agriculture Development Service (IADS) based upon their association with and development of the research program with the ARC. It is proposed that these services be included in the CID contract. The Participant Training component (\$.584 million) of the project will also be handled under the CID contract. The Short-Term Consultants Component (\$1.104 million) will also be included in CID contract based upon their provision of key scientists for other positions. The final technical assistance services required is that of an architectural firm to provide the services as outlined in the Appraisal Report under Section 7.07. As per the Project and Credit Agreements, the services of such a firm should be effected by March 31, 1979. In addition, the services of one Project Architect/Planner will be needed to serve as the Adviser to ARC and to assist in providing direction and guidance to the Architectural Firm. The services of this Specialist will be included in the CID contract.

Listed below is a distribution of the services required, the proposed method for implementation and the cost for such services.

Funding Category

<u>Capital Costs</u>	<u>Method of Implementation</u>	<u>Funding</u>
1. Furniture & Equipment	CID - Contract	2,359,000
2. Vehicles & Farm Mach.	CID - Contract	1,278,020
3. Farm Development	Grant - GOS	156,680
4. Small Purchases	Grant - GOS	640,000

Operating Costs

1. Local Salaries	Grant - GOS	4,744,200
2. Office Expenditures	Grant - GOS	163,300
3. Building Maintenance	Grant - GOS	844,500
4. Equipment Maintenance	Grant - GOS	477,300
5. Farm Costs	Grant - GOS	270,000
6. Transport	Grant - GOS	500,250

Technical Assistance

1. Int. Recruited State	CID - Contract	5,576,510
2. Participant Training	CID - Contract	584,325
3. Short Term Consultants	CID - Contract	1,104,000
4. Building Program	Contract Arch. Firm	1,268,000
5. Conferences	CID - Contract	34,020

TABLE I

Financing Schedule
US\$(M11) (Including Contingencies) Figures Not Rounded

Category	Participating Donors				Percentage of Total		
	IDA	AID	GOS	TOTAL	IDA	AID	GOS
I. Capital Costs							
a. Buildings	14.275	-----	8.086	22.361	64 91		36 9
b. Aircraft Purchase	.310	-----	.033	.343			
. Other Costs	-----	4.434	-----	4.434		100	
Sub-Total	14.585	4.434	8.119	27.138			
II. Operating Costs							
a. Local Salaries	-----	4.744	2.073	6.817	67	70	30
b. Aircraft Operation	.415	-----	.208	.623			
c. Other Cost	-----	2.256	-----	2.256			
Sub-Total	.415	7.000	2.281	9.696		100	33
III. Technical Assistance							
a. Bldg. Program	-----	1.268	-----	1.268	100	100	
b. Other Costs	-----	7.298	-----	7.298			
Sub-Total	-----	8.566	-----	8.566			
TOTAL	15.000	20.000	10.400	45.400			

TABLE II

Financing Schedule Capital Costs
 US\$ (Including Contingencies)
 Life of Project Years

Funding Category	1	2	3	4	5	6	TOTAL
<u>Capital Costs</u>							
a. Furniture & Equipment	69,500	227,040	1,369,980	346,190	346,190	-----	2,358,900
b. Vehicles & Farm Machines	564,480	321,940	104,600	199,550	87,450	-----	1,278,020
c. Farm Development	42,720	56,980	56,980	-----	-----	-----	156,680
d. Small Purchases	-----	128,000	128,000	128,000	128,000	128,000	640,000
TOTAL	676,700	733,960	1,659,560	673,740	561,640	128,000	4,433,500

TABLE III
Financing Schedule Operating Costs
US\$ (Including Contingencies)

Funding Category	1	2	3	4	5	6	TOTAL
<u>Operating Costs</u>							
a. Local Salaries	130,290	559,816	768,560	967,560	1,153,340	1,164,634	4,744,200
b. Office Expenditures	20,800	28,500	28,500	28,500	28,500	28,650	163,450
c. Transport	39,000	65,250	91,000	99,000	103,000	103,000	500,250
d. Bldg. Maintenance	----	----	40,500	220,000	254,000	330,000	844,500
e. Equip. Maintenance	2,300	23,000	52,000	114,000	132,000	154,000	477,300
f. Farm Costs	21,000	45,000	51,000	51,000	51,000	51,000	270,000
GRAND TOTAL	213,390	721,566	1,031,560	1,480,060	1,721,840	1,831,284	6,999,700

TABLE IV

Financing Schedule Technical Assistance

US\$ (Including Contingencies)

Funding Category	1	2	3	4	5	6	TOTAL
<u>Technical Assistance</u>							
a. Inter. Recruited Staff	816,510	939,000	1,039,000	1,039,000	1,039,000	704,000	5,576,510
b. Training	60,000	155,000	230,000	125,000	14,325	—	584,325
c. Conferences	—	—	—	4,020	15,000	15,000	34,020
d. Short-term Consultancies	—	39,000	250,000	290,000	290,000	235,000	1,104,000
e. Bldg. Design Assistance	1,268,000	—	—	—	—	—	1,268,000
TOTAL	2,144,510	1,133,000	1,519,000	1,458,020	1,358,325	954,000	8,563,855

TABLE V

Financing Schedule FY Funding
US \$ (Including Contingencies)

FUNDING CATEGORY	FY 78	FY 79 1	FY 80 2	FY 81 3	FY 82 4	FY 83 5	FY 84 6
<u>Capital Cost</u>							
Furniture & Equipment	---	69,500	227,040	1,369,980	346,190	346,190	---
Vehicles & Farm Machines	---	564,480	321,940	104,600	139,550	87,450	---
Farm Development	---	42,720	56,980	56,980	---	---	---
Small Purchases	---	---	128,000	128,000	128,000	128,000	128,000
<u>Operating Cost</u>							
Local Salaries	---	130,290	559,816	768,560	967,560	1,153,340	1,164,634
Office Expenditures	---	20,800	28,500	28,500	28,500	28,500	28,650
Transportation	---	39,000	65,250	91,000	99,000	103,000	103,000
Building Maintenance	---	---	---	40,500	220,000	254,000	330,000
Equipment Maintenance	---	2,300	2,300	52,000	114,000	132,000	154,000
Farm Costs	---	21,000	45,000	51,000	51,000	51,000	51,000
<u>Technical Assistance</u>							
International Recruited Staff	617,000	199,510	939,000	1,039,000	1,039,000	1,039,000	704,000
Training	---	60,000	155,000	230,000	125,000	14,325	---
Conferences	---	---	---	---	4,020	15,000	15,000
Consultancies	---	---	39,000	250,000	290,000	290,000	235,000
Building Program	---	1,268,000	---	---	---	---	---
TOTAL	617,000	2,417,600	2,588,526	4,210,120	3,611,820	3,641,805	2,913,284

Table V provides a composite distribution for all project cost financed by AID for each year of the life of project.

3. Inflation and Contingency Factors

Cost estimates are based on prices projected to April 1978 and include a 15% physical contingency for construction works and an inflation contingency totalling 27% of total base project costs. A breakdown of expected price increases by year from 1978-1985 is included in section 6.02 of the IBRD Appraisal Report.

C. Economic Analysis

As is generally the case in research projects, the lag time between project construction startup/initiation of research and adoption of results by beneficiaries is sufficiently long and strewn with pitfalls to make standard economic analysis tenuous. This is especially true where the development of a research capability begins from scratch. This project will establish the organization and infrastructure required to undertake adaptive agricultural research in four similar, but distinct areas. Though having the same basic focus, adaptive research, both the infrastructure, staff, and research programs and the project beneficiaries will vary between the four areas. Under these conditions any calculation of return on investment for this project would hold little meaning.

It is worth considering, however, the potential benefits for the target groups, nomadic herdsman and dry-land farmers, in the project area. Under the best of conditions, the project implementation will follow its schedule without unusual delays, specific production problems will be identified and research will address these problems in such a way that local farmers or herdsman will have the option of adopting the improved input or practice. Output will increase and, assuming an adequate demand for and means for distribution of produce, beneficiaries' income will improve. Improved production systems will permit the target groups to substitute inputs, including land, in such a way as to improve outputs, income, leisure and environmental quality in agreement with both national goals and local socio-cultural values. In the simplest case, traditional crops and livestock will increase with incremental additions of modern inputs and/or minimum transformation of traditional methods. The new output will be sold for local or export demand and the resultant income will allow the producers to raise their standard of living.

In a worst case situation, the research centers would be constructed and staff assigned in variance with the implementation plans. Research results, though based on rigorous analysis of local condition and potentials would be ill suited for and poorly adopted by local producers. Where successfully adopted, factors beyond the control of the project would inhibit the timely acquisition of inputs and subsequent sale of outputs. This is the transport constraint on economic development. In addition, two of the main crops, groundnuts and gum arabic, in the project area are important export crops that will be subject to world market characteristics. A combination of declining market prices and poor transportation could make the producers worse off.

In summary, there are three kinds of risk which could affect the overall success of the project: (1) implementation risks; (2) unsatisfactory transfer of results to the producers; and (3) marketing and distribution variances.

In order to reduce the implementation risk, great care was taken to strengthen ARC's management capability through organizational arrangements, training programs and provision of technical assistance. Regarding the transfer of research results to the producer, recent Sudan Government steps to bring more effective extension to the producer through the WSDC, MFC and Nuba Mountains Agricultural Production Corporation are commendable. However, these corporations only cover part of the area. The Government has about 5 years until the new research begins to produce results, and this should be used to expand delivery systems in the region. Discussions about expanding the extension service are taking place in several contexts. With respect to a companion risk rejection or slow acceptance of new technology by the producer, measures have been taken to ensure that research results will be tested under practical farming conditions before advocating them through the extension system.

These risks must be balanced against the greater certainty that without the project, the long-term degradation of the West would be accelerated, and the incomes and the way of life of the inhabitants seriously jeopardized. The problems associated with transportation are common throughout the Sudan and will require continued planning and development. The IBRD as well as other donors have committed considerable funds for the improvement of infrastructure in the Central and West Sudan.

The expansion of food crops and livestock is in agreement with the Sudan's Food Investment Strategy. The rain-fed areas which are largely covered by the Project are being called upon to meet the countries growing food needs. The economic

implication for the producer is relative market security and favorable prices. The same can be said for the expected benefits accruing to gum arabic producers in light of Sudan's position as the world's major producer.

As a final note to the analysis, it is worth mentioning that A.S. Kahlon, et. al. in "Returns to Investment in Agricultural Research in India" concluded the following:

". . . we do have enough basis to suggest that agricultural research does make a positive and substantial contribution. The state-level analysis tends to support the results of the national analysis in confirming that agricultural research is a productive investment."*

The research results from this project could be applicable by about 1 million farming families in Western Sudan whose present incomes are about \$400 for a family of six, or about the same as the estimated income level of \$65 per head for the Sudan. Because of ecological similarities, some of the research findings would also be applicable in the East of the Sudan. Indirect benefits would accrue to the economy generally in the form of incremental foreign exchange earnings, and to the public sector in the form of additional revenues.

D. Social Soundness Analysis

The World Bank Staff Appraisal Report contains several brief references to socio-economic elements within the proposed research program for the Western Region. Provision for a multi-disciplinary unit to undertake socio-economic research is described in the background section of this paper. The scope of work for the senior sociologist who will head the unit is set out in Annex C. The five main research components** include inter alia several issues with important socio-cultural dimensions. The format and length of the Appraisal Report, however, do not provide scope for an extended discussion of these issues.

*A.S. Kahlon, et. al. "Returns to Investment in Agricultural Research" in Resource Allocation and Productivity in National and International Agricultural Research (Minneapolis: University of Minneapolis Press, 1977), pp 124-147.

**These are respectively: arid livestock production at the desert fringe, semi-arid livestock production, integrated crop/livestock production on stabilized sands, integrated crop/livestock production on cracking clays, and integrated crop/livestock production on non-cracking clays.

A considerably more explicit treatment of social issues may be found in the Bank's Project Preparation Report,* which is dated May 31, 1977. The earlier document provides a useful source in addressing AID's concerns in the area of social soundness. Three aspects of the socio-economic research program are reviewed below.

1. Theoretical Orientation

The Western Region is vast in size, and contains a diversity of ethnic groups engaged in a range of different production systems. A comprehensive approach is required in order to capture the interaction of complex factors within the region ecosystem. During the past two decades, the nature of the interface between pastoralism and sedentary agriculture has been progressively modified: the population, dependent on cultivation, has grown dramatically, with a corresponding increase in the area under crops. The latter phenomenon has directly threatened the seasonal movement of animal herds along established north-south grazing "orbits".** The socio-political implications of this trend are extremely serious, given the fragility of the environment and the scarcity of land and water needed for both animal and crop production.

The Bank's Project Preparation Report provides a useful framework for development-related research:

"Efficient development in the arid and semi-arid Western Region requires a systematic evaluation of its human as well as its environmental and agricultural resources. The many local populations of the West exhibit very varied resource exploitation skills which have been gradually developed under selective pressure. These populations have also, over a long period, generated complex responses to each others' presence. The proper approach to the human factor in the West should therefore be regional and a regional research thrust in human resources is thus a necessary complement to the various production systems research thrusts which examine human response as one component of a complex local situation. A regional approach would also minimize those unintended negative effects created when, in a situation such as Western Sudan, overlocalized development projects cause dislocations outside their chosen area of operation."

*A social anthropologist, in a consultant role of the Bank, participated in the project preparation mission and in the writing of the report.

**See Map IBRD 12959, in Appraisal Report.

The Appraisal Report indicates that the originally produced "human resources thrust" has been subsumed under the production systems research effort. This decision is meant to ensure that socio-economic research is not carried out independently; yet the earlier document makes a strong case for obtaining an analytical overview of the region. The technical assistance staff recruited by AID should be made aware of this shift in emphasis, and the original conception should be re-evaluated, since it appears more consistent with AID's guidelines and broad social concerns.

2. Specific Research Problems

A number of problems requiring detailed study can be identified at the present stage, but the following list should not be considered exhaustive:

- Interfaces between difference production systems (marketing, exchange, symbiosis, competitive exclusion);
- demographic and spatial shifts, including movements by individuals, domestic groups, and larger social units from one production system to another;
- dislocations in traditional north-south grazing "orbits", leading to conflict between nomads and expanding sedentary cultivators;
- the effects of immigration from neighboring West African countries, and processes of incorporation and assimilation;
- marketing systems (formal and informal) and the effects of enlargement of these systems;
- the role of government (national, provincial and local) as factors in different production systems; and
- emergent patterns of social organization in communities undergoing fundamental economic change.

Each of these problem areas deserves thorough investigation. At present, even superficial generalizations are difficult to formulate, and a sustained research effort will be needed to generate qualitative data on these phenomena.

3. Methodology

The priority areas identified above cannot be thoroughly studied with a single methodological approach. As the project's research program evolves, it will be necessary to employ a range of different methods. Considerable flexibility will be called for in executing the program of socio-economic research. Although the discipline leader for this effort has been identified as a "Sociologist" in the Appraisal Report, the range of methods to be applied crosses disciplinary lines. This suggests that some latitude should be allowed in order to recruit a specialist familiar with several, if not all, of the techniques mentioned above.

Women in the western provinces of North and South Darfur and North and South Kordofan compose a crucial part of the active labor force. A sample census of Agriculture (1964-65, Department of Statistics) indicated that approximately one-third of those persons engaged in agriculture in the area were female. Many of the problems faced by these females are also faced by the men. But as men migrate to cash crop areas or to the towns in search of wages, the women must assume a dual responsibility for the farm and the home -- all the while utilizing outmoded agricultural instruments.

Success in the expansion of agricultural production will require a transformation of traditional production and distribution methods as well as a serious effort to augment the efficiency of the work of women. It is reasonable to assume that the women will welcome innovations that lighten some of the more arduous aspects of their current workload e.g., fuel and water portage, grinding grains, etc. They will also be receptive to change if these innovations promise them greater control over the disposition of the products of their work. Since rural women do not readily accept the presence of non-family males as change or extension agents, provisions would have to be made for women trainers, especially social workers, agriculturalists and home economists.

In a research project of this nature, socio-economic analysis is an continuous process. The multi-disciplinary team stationed at the Research Center in Nyala will be integrally involved in the various research programs to be undertaken. The team, consisting of two sociologists, two economists, and a biometrician, will participate in research program planning to ensure that sociological considerations are incorporated into each technical package. The team will also participate in the implementation of research programs. An AID-funded sociologist will serve as discipline leader for the Socio-Economic Support

Services team, be responsible for the development of the sociological research programs, and participate in the selection and training of the Sudanese Project staff.

III. Implementation Arrangements

A. Project Management

ARC's Director General will have overall responsibility for project implementation and will nominate a Project Director candidate for approval by the Minister of Agriculture, AID, and IDA. Day-to-day management of the project will be the responsibility of the Project Director who will be stationed at Nyala. The Director will coordinate all agricultural research programs in the West; in particular, he will be authorized to: (i) assign the scientific and administrative staff; (ii) direct the operation of the research stations; and (iii) coordinate the activities of the PSU and PEU at Khartoum. In addition, the Director will be responsible for financial and budget control of the Project.

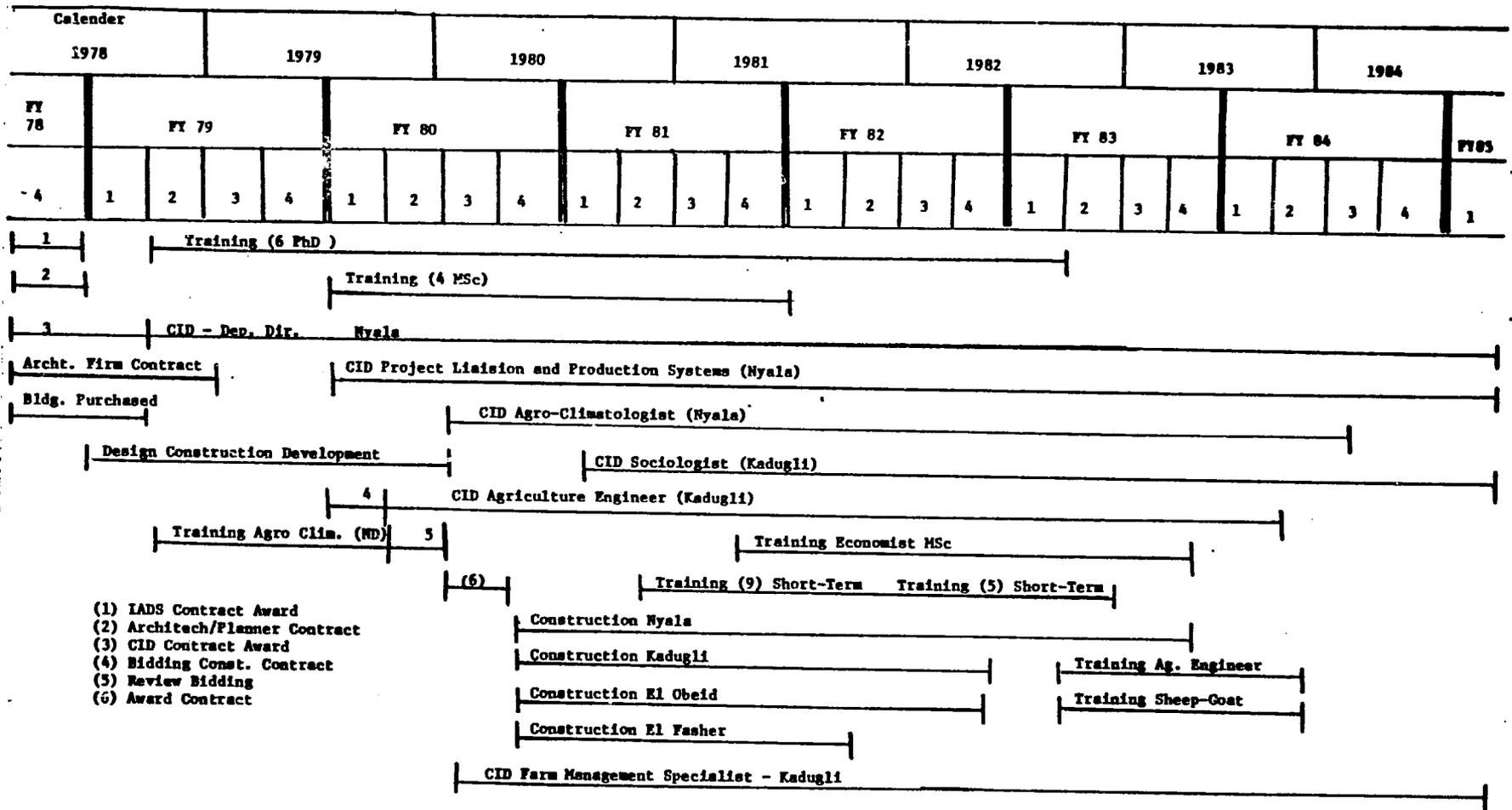
The Project Director will be assisted by the Deputy Project Director in all matters, by the Production Systems Program Leader in systems research matters, and by the Station Superintendent in stations management. The research stations will be managed by station program leaders. Annex 2 of the IBRD Appraisal Report provides a list of the senior staff for ARC headquarters and the four research stations.

B. Implementation Plan

The implementation schedule (Table VI) should be considered illustrative at this time; the CID team currently in the Sudan is developing, in conjunction with the ARC, a detailed plan for project implementation. Additionally, the Project Director, with assistance from the PSU and PEU in Khartoum, will prepare a detailed research plan and budget for the West covering the final three years of the project. This will be reviewed as described in Section III.C. and will form the basis for work programs in years 4-6.

A detailed procurement plan for project commodities, equipment, and furnishings has not been prepared. A condition precedent will be included in the Grant Agreement requiring AID's approval of (1) the specifications and costs of grant funded equipment, etc. and (2) a detailed plan for procurement.

Table VI
IMPLEMENTATION SCHEDULE



C. Evaluation Plan

Periodic evaluations will be undertaken by IDA during the construction of facilities, Phase I, in which AID will be invited to participate. The prime contractor for scientific personnel, CID, will be required to perform periodic evaluation and to report on the progress of activities being undertaken by or under the direct supervision of individual scientists, as well as an overall evaluation of the progress of the Project. A formal review and evaluation will be carried out in year three, involving three international scientists and representatives of IDA, GOS and AID, to review the detailed research program proposals for years four through six and to assess the timing of the transfer of research facilities, as outlined under the Six Year Development Plan, to ARC. The evaluation of these plans must be approved by all of the participating donors. A second project evaluation would be performed in year six, as outlined above, when the results of the research efforts would be forthcoming and at which time the stage would have been set for the future orientation of agriculture research in the west.

D. Conditions and Covenants

The following conditions precedent to disbursement will be included in the Grant Agreement:

- (1) An executed agreement committing the IBRD to contribute to the Project in the approximate amount described in the financial plan.
- (2) Evidence that a qualified Sudanese National, acceptable to AID, has been appointed as Project Director.
- (3) Evidence that the GOS has established, in the name of ARC, an account in a commercial bank to be used for the sole purpose of making payments for eligible operating costs financed by AID.
- (4) Approval by AID of contracts for architectural, procurement, or other services.
- (5) Approval by AID of the specific equipment and furnishings to be financed under the grant and certification by AID that the cost estimates for equipment and furnishings are reasonable.
- (6) Approval by AID of a detailed procurement plan for equipment, commodities, and furnishings to be financed under the grant.

6C(2) - PROJECT CHECKLIST

Listed below are, first, statutory criteria applicable generally to projects with FAA funds, and then project criteria applicable to individual fund sources: Development Assistance (with a sub-category for criteria applicable only to loans); and Security Supporting Assistance funds.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP-TO-DATE? IDENTIFY. HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT?

A. GENERAL CRITERIA FOR PROJECT.

1. App. Unnumbered; FAA Sec. 653(b)

(a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project;
(b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than \$1 million over that figure plus 10%)?

(a) FY 1978 Congressional Advice of Program Change.

(b) Yes.

2. FAA Sec. 611(a)(1). Prior to obligation in excess of \$100,000, will there be (a) engineering, financial and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

(a) Yes.

(b) Yes.

3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?

3. Legislation and national commitment already established.

4. FAA Sec. 611(b); App. Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per Memorandum of the President dated Sept. 5, 1973 (replaces Memorandum of May 15, 1962; see Fed. Register, Vol. 38, No. 174, Part III, Sept. 10, 1973)?

4. Not applicable.

5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed \$1 million, has Mission Director certified the country's capability effectively to maintain and utilize the project?
5. Yes.
6. FAA Sec. 209, 619. Is project susceptible of execution as part of regional or multi-lateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs. If assistance is for newly independent country, is it furnished through multilateral organizations or plans to the maximum extent appropriate?
6. The project has been developed in conjunction with the IBRD.
7. FAA Sec. 601(a); (and Sec. 201(f) for development loans). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.
7.(a) Not Applicable.
(b)-(e) There will not be a negative impact.
8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).
8. U.S. technical assistance and commodities will be supplied through this project.
9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.
9. See financial analysis of project paper.

10. FAA Sec. 612(d). Does the U.S. own excess foreign currency and, if so, what arrangements have been made for its release? 10. No.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(c); Sec. 111; Sec. 281a.

Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production, spreading investment out from cities to small towns and rural areas; and (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions?

a. Project emphasis is toward design of an effective program which will create a research infrastructure to serve farmers in the western portion of the country.

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: [include only applicable paragraph—e.g., a, b, etc.—which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source.]

(1) [103] for agriculture, rural development or nutrition; if so, extent to which activity is specifically designed to increase productivity and income of rural poor; [103A] if for agricultural research, is full account taken of needs of small farmers;

(1) (103) Project purpose is to increase production and income of traditional farmers and herders.

(2) [104] for population planning or health; if so, extent to which activity extends low-cost, integrated delivery systems to provide health and family planning services, especially to rural areas and poor;

(2) (104) Not Applicable

(3) [105] for education, public admin-

(3) (105) Project will

istration, or human resources development; if so, extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, or strengthens management capability of institutions enabling the poor to participate in development;

train counterpart staff. It will also provide technical assistance for specific services as soon as the project has been implemented.

- (4) [106] for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is:

(a) technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;

(a) Substantial coops proposed with IBRD.

(b) to help alleviate energy problem;

(b) Not Applicable.

(c) research into, and evaluation of, economic development processes and techniques;

(c) Project aims to develop and test improved production systems that conserve and and rehabilitate natural resources and improve living standard of subsistence.

(d) reconstruction after natural or manmade disaster;

(d)-(f) Not Applicable

(e) for special development problem, and to enable proper utilization of earlier U.S. infrastructure, etc., assistance;

(f) for programs of urban development, especially small labor-intensive enterprises, marketing systems and financial or other institutions to help urban poor participate in economic and social development.

- (5) [107] by grants for coordinated private effort to develop and disseminate intermediate technologies appropriate for developing countries.

(5)(107) Not Applicable

c. FAA Sec. 110(a); Sec. 208(e). Is the recipient country willing to contribute funds to the project, and in what manner has or will it provide assurances that it will provide at least 25% of the costs of the program, project or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?

d. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing?

e. FAA Sec. 207; Sec. 113. Extent to which assistance reflects appropriate emphasis on; (1) encouraging development of democratic, economic, political and social institutions; (2) self-help in meeting the country's food needs; (3) improving availability of trained worker-power in the country; (4) programs designed to meet the country's health needs; (5) other important areas of economic, political and social development, including industry; free labor unions, cooperatives and Voluntary Agencies; transportation and communication; planning and public administration; urban development and modernization of existing laws; or (6) integrating women into the recipient country's national economy.

f. FAA Sec. 281(b). Describe extent to which program recognized the particular needs, desires and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.

c. Not applicable to a multi-donor project.

d. NO.

e.(1) Agricultural Research Center will be developed as the mechanism to implement the project. (2) Project purpose is to increase ARC's capability to develop and test improved production systems and to improve living standards of subsistence farmers and pastoralists. (3) project will train counterpart staff. (4) Not applicable. (5) Not applicable. (6) Special emphasis will be placed on development activities for women of agricultural production.

f. Project supports a national program developed by the GOS, which emphasized local participation and development.

- g. FAA Sec. 201(b) (2)-(4) and -(8); Sec. 201(e); Sec. 211(a) (1)-(3) and -(8). Does the activity give reasonable promise of contributing to the development: of economic resources, or to the increase of productive capacities and self-sustaining economic growth; or of educational or other institutions directed toward social progress? Is it related to and consistent with other development activities, and will it contribute to realizable long-range objectives? And does project paper provide information and conclusion on an activity's economic and technical soundness?
- g. Yes. See social, technical and financial sections of project paper.
- h. FAA Sec. 201(b) (6); Sec. 211(a) (5), (6). Information and conclusion on possible effects of the assistance on U.S. economy, with special reference to areas of substantial labor surplus, and extent to which U.S. commodities and assistance are furnished in a manner consistent with improving or safeguarding the U.S. balance-of-payments position.
- h. U.S. technicians and commodities will be utilize in this project.
2. Development Assistance Project Criteria (Loans only)
2. a-f Not Applicable.
- a. FAA Sec. 201(b) (1). Information and conclusion on availability of financing from other free-world sources, including private sources within U.S.
- b. FAA Sec. 201(b) (2); 201(d). Information and conclusion on (1) capacity of the country to repay the loan, including reasonableness of repayment prospects, and (2) reasonableness and legality (under laws of country and U.S.) of lending and relending terms of the loan.
- c. FAA Sec. 201(e). If loan is not made pursuant to a multilateral plan, and the amount of the loan exceeds \$100,000, has country submitted to AID an application for such funds together with assurances to indicate that funds will be used in an economically and technically sound manner?

d. FAA Sec. 201(f). Does project paper describe how project will promote the country's economic development taking into account the country's human and material resources requirements and relationship between ultimate objectives of the project and overall economic development?

e. FAA Sec. 202(a). Total amount of money under loan which is going directly to private enterprise, is going to intermediate credit institutions or other borrowers for use by private enterprise, is being used to finance imports from private sources, or is otherwise being used to finance procurements from private sources?

f. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?

3. Project Criteria Solely for Security Supporting Assistance

3. Not applicable.

FAA Sec. 531. How will this assistance support promote economic or political stability?

4. Additional Criteria for Alliance for Progress

4. a-b Not applicable

a. FAA Sec. 251(b)(1), -(8). Does assistance take into account principles of the Act of Bogota and the Charter of Punta del Este; and to what extent will the activity contribute to the economic or political integration of Latin America?

b. FAA Sec. 251(b)(8); 251(h). For loans, has there been taken into account the effort made by recipient nation to repatriate capital invested in other countries by their own citizens? Is loan consistent with the findings and recommendations of the Inter-American Committee for the Alliance for Progress (now "CEPCIES", the Permanent Executive Committee of the OAS) in its annual review of national development activities?

6C(3) - STANDARD ITEM CHECKLIST

Listed below are statutory items which normally will be covered routinely in those provisions of an assistance agreement dealing with its implementation, or covered in the agreement by exclusion (as where certain uses of funds are permitted, but other uses not).

These items are arranged under the general headings of (A) Procurement, (B) Construction and (C) Other Restrictions.

A. Procurement

1. FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of goods and services financed? 1. Yes.
2. FAA Sec. 604(a). Will all commodity procurement financed be from the U.S. except as otherwise determined by the President or under delegation from him? 2. Yes. Where necessary, applicable waivers will be obtained prior to purchase of non-U.S. commodities.
3. FAA Sec. 604(d). If the cooperating country discriminates against U.S. marine insurance companies, will agreement require that marine insurance be placed in the U.S. on commodities financed? 3. Yes.
4. FAA Sec. 604(e). If offshore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity? 4. Not applicable.
5. FAA Sec. 608(a). Will U.S. Government excess personal property be utilized wherever practicable in lieu of the procurement of new items? 5. Not practicably applicable.
6. FAA Sec. 901(b). (a) Compliance with requirement that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners and tankers) financed shall be transported on privately owned U.S.-flag commercial vessels to the extent that such vessels are available at fair and reasonable rates. 6. Compliance will be observed where applicable.

7. FAA Sec. 621. If technical assistance is financed, will such assistance be furnished to the fullest extent practicable as goods and professional and other services from private enterprise on a contract basis? If the facilities of other Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?
7. Technical assistance will be provided under the Title XII mechanism.

8. International Air Transport. Fair Competitive Practices Act, 1974
8. Yes.

If air transportation of persons or property is financed on grant basis, will provision be made that U.S.-flag carriers will be utilized to the extent such service is available?

B. Construction

1. FAA Sec. 601(d). If a capital (e.g., construction) project, are engineering and professional services of U.S. firms and their affiliates to be used to the maximum extent consistent with the national interest?
1. Not Applicable
2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable?
2. Not Applicable
3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed \$100 million?
3. Not Applicable

C. Other Restrictions

1. FAA Sec. 201(d). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter?
1. Not applicable.



INITIAL ENVIRONMENTAL EXAMINATION

Project Location: SUDAN

Project Title: Western Agricultural
Research

Funding: \$20.0 Million

Life of Project: Six (6) Years

IEE Prepared by: REDSO/EA

Date: June 23, 1978

Environmental Action Recommended: Negative Determination

Concurrence:  Robert H. Bell
Acting Director, REDSO/EA

Date: June 21, 1978

Assistant Administrator's Decision

Approved: _____

Disapproved: _____

Date: _____

I. Project Description

The Sudan's agricultural development strategy laid down in the Six-Year Development Plan (1977-83) (SYP) emphasizes the need to make full use of existing resources and at the same time to correct the wide variance in productivity and incomes between the commercial (irrigated and mechanized rainfed) sector and subsistence agriculture. As part of this strategy, GOS is according high priority to launching development programs for subsistence cultivators and pastoralists in the West. Intensified use of arable land, range, livestock and water could contribute to reaching the plan targets in the country and a steady improvement in living standards of the population in the West, but this is critically dependent on the transfer, development and adoption of improved technical packages which call for a back-up by a largely increased agricultural research program.

The Project area includes the Provinces of North and South Kordofan and North and South Darfur and extends from the Bahr el Arab in the South to the Libyan desert in the North, and from the Nile in the East to beyond the Jebel Marra Massif in the West. The habitable southern two-thirds of the Project area is located approximately between 9°30' and 16° N. latitude and 20° and 32° longitude. The north-south rainfall gradient increases from very arid (about 25mm per annum) in the northern desert to semi-arid (up to 900mm) along the Bahr el Arab in the south, embracing the sociological zones of the sahara, sub-sahara, sahel, and sudanian savannah. In the south; the rainy season extends over about five months (June to October) and becomes gradually shorter towards the north.

Fragmentary soil surveys have identified three broad soil groups in the inhabited southern part of the Project area:

- (a) the stabilized (Qoz) sands complex is predominant and has low fertility but can be cultivated by hand;
- (b) the non-cracking clays which are widely scattered, with sparse vegetation because of low permeability; grazing is the most common use of these soils but they are also suited for cropping once the hard surface pan has been broken up; and

- 2 -

- (c) cracking clays, the most fertile and stable soils which are predominant in the Nuba Mountains and occur over much of the southern project area.

Until recently, the nomadic livestock-owning Baggara people were predominant though a few Baggara and some non-Baggara people have been settled agriculturalists for a long time. Because of human and livestock population pressures, more and more pastoralists are turning to crop production in association with livestock in areas with annual rainfall over 400mm, reducing the land requirements per family and increasing the output per unit of land. The range areas once seasonally rested during cyclic migratory livestock movement are now subject to intense degradation. Furthermore, cash surpluses accumulated by settled cultivators are invested in livestock. Thus a continuum now exists with varying degrees of settled, semi-sedentary and fully nomadic populations, with their overlapping needs and competitive demands for resources.

The variation in natural conditions and economic behavior of the inhabitants can be differentiated into five agro-pastoral production systems, of which two are purely pastoral and three are crop/livestock combinations:

- (a) arid livestock production at the desert fringe;
- (b) semi-arid livestock production in the south of the Project area, interspersed with crop production;
- (c) integrated crop/livestock production on stabilized sands;
- (d) integrated crop/livestock production on non-cracking clays; and
- (e) integrated crop/livestock production on cracking clays.

There is considerable overlap between these systems: for instance, the northern (wet season) limit of the semi-arid cattle range coincides with the southern (dry season) limit of the arid camel/sheep range, thus being effectively grazed year-round and having no opportunity to recovery. Year-round

livestock production is difficult on non-cracking clays due to flooding problems and on cracking clays because of mud. Livestock have to be moved to dry ground outside the area or fodder conservation is required to maintain the animals during the wet weather.

Small-scale subsistence agriculture is the most important economic activity in the West. Only about 3% of total cultivation is commercial agriculture, largely in South Kordofan and to a small degree in South Darfur. Rainfed agriculture predominates with small irrigated plots in the Jabel Marra, at Sag el Naam in North Darfur, and around Nyala as the only exceptions. The main crops are millet, sorghum, groundnuts and sesame, with cotton and maize of lesser importance. Recorded yields reflect not only poor soils and unfavorable weather conditions but also poor husbandry practices and, in some cases, over exploitation of the land. For all the major crops, the area under cultivation has been increasing steadily over recent years with incremental aggregate production but yields have remained stagnant or fallen.

The conflict between individual ownership of livestock and communal land use, and the seasonal movement of the predominantly transhumant livestock producers inhibit the proper utilization of resources including range, water and the production potential of the herds. During the last 20 years, the number of animals has increased considerably through efficient veterinary services; but increased herd numbers have led to range deterioration without noticeable incremental output.

There are two main constraints to increased production: (i) ecological limitations imposed by a low and extremely variable rainfall, high evaporation, recurring drought, soils of low fertility, and limited accessibility of ground water; and (ii) increases in the human and livestock populations which changes social traditions and engenders pressures and ecological degradation. The steadily worsening man/livestock population ratio forces many pastoralists to turn to sedentary cultivation and become settled farmers; but new and more efficient systems of land use and water management ought to be introduced into existing livestock and crop production systems if this trend is to be successful.

Many other constraints are related to these basic issues, and these can be classified as ecological and socio-economic. Some ecological issues are: deterioration of rangelands;

grass fires; parasites and pests; low protein and mineral intakes by grazing stock; reciprocal pressures of livestock and crops in competing production systems; lack of effective technologies of crop husbandry; crop diseases, weeds and pests; inadequate tillage methods; unimproved crop varieties; low soil fertility; and poor water management. The socio-economic constraints include: the conflict between individual ownership of livestock and communal land use; socio-economic insecurities in a fragile ecosystem; attempts to buffer social groups against environmental vicissitudes by overstocking, shifting cultivation and increased sedentarization; lack of market opportunities, and insufficient demand for consumer goods and few opportunities for investment of capital other than livestock.

These constraints do not generally represent discrete disciplinary problems capable of solution by traditional techniques of experimental agriculture. Rather they constitute interconnecting links which could only be strengthened through the study of productive systems by multidisciplinary teams, in order to increase crop and animal production and provide security to producers through the long-term optimum use of resources, with particular emphasis on water/soil/plant/animal/human inter-relationships.

The Western Agriculture Research Project would, over a six-year period, develop and operate the Agricultural Research Corporation's research capability in the West, and provide support services at ARC's new Khartoum headquarters. In particular, the Project would include:

- (a) two research programs dealing with: (i) livestock and crop production systems at El Obeid (integrated crop/livestock on non-cracking clays) and El Fasher (arid livestock -- in close cooperation with the Western Savannah Development Corporation (WSDC) at Ghazala Gawazat (integrated crop-livestock on stabilized sands and semi-arid livestock); and (ii) water and land use management research at Nyala, including research support services;
- (b) development of an ARC research center and regional headquarters at Nyala; and of research stations at El Obeid, Kadugli and El Fasher, including 128 houses, about 4,200 m² of office space and field laboratories, and about 2,700 m² of farm buildings, landscaping and fencing; plus furniture and office/housing equipment;

- (C) strengthening of ARC's headquarters through the establishment of a Project Support Unit (PSU), a Planning Evaluation Unit (PEU), and a Training and Extension Units (TEU).

The Project would be implemented by ARC through a regional headquarters to be established at Nyala, supported by the new ARC headquarters at Khartoum. The Project would consist of two phases: a development phase of about three years and a research phase of a further three years.

The Project will be financed jointly by USAID, IDA of the World Bank and the Government of the Sudan. USAID will contribute \$20.0 million, IDA \$15.0 million and the GOS \$10.0 million for a total project cost of \$45.0 million. GOS financing will cover 30% of local salaries and taxes and duties. The IDA will finance all the physical construction and costs related to the project aircraft. USAID will finance the remaining costs including all technical assistance, participant training, equipment and commodities and 70% of local salaries.

To implement the research activities, a total of forty-six scientists and senior administrators and nine-nine technical support staff will be employed under the Project. Sixteen of them will be key staff: The Project Director; Deputy Project Director; Project Liaison Officer; a land and water use specialist (program leader); his deputy; an agro-climatologist; a range specialist (sub program leader of arid livestock production system); a sociologist (discipline leader); a production systems research program leader; a sub-program leader for cracking clays; a sub-program leader for non-cracking clays; a farm management economist (discipline leader); an agricultural engineer (discipline leader); the Senior Research Advisor to the Director General (DG) of ARC; the Project Architect/Planner and the Research Planning and Evaluation Advisor. For ten posts of the sixteen, candidates will be recruited internationally by USAID.

- (a) Senior Research Advisor to the DG (Khartoum)
- (b) Project Architect/Planner (Khartoum)
- (c) Research Planning and Evaluation Advisor (Khartoum)
- (d) Deputy Project Director (Nyala)

- (e) Production Systems Specialist (Nyala)
- (f) Land and Water Use Specialist (Nyala)
- (g) Agro-Climatologist (Nyala)
- (h) Sociologist (Nyala)
- (i) Farm Management Economist (Kadugli)
- (j) Agricultural Engineer (Kadugli)

In addition, USAID will provide \$0.4 million (base cost) for 80 man-months of short-term consultancies (12 to 14 man-months per year) to be used for the preparation of the Research Plan (due in Year 3), project monitoring, specialized consultancies in the research programs, building program and procurement assistance and the external Project reviews in Years 3 and 6.

The Project construction and research plans are only outlined in general terms at this stage. For example, not all construction sites have been selected at this time. In many cases, the choice has been narrowed down to one or the other of two possible sites. Also, building areas are estimated on the basis of similar agricultural research projects in other parts of the world. Actual building and site plans have not been prepared. During the development phase of the project (the first three years), USAID-financed technical services will prepare the detailed final plans for construction and research programs.

II. Discussion of Impacts of Project Components

A. El Fasher -- Arid Livestock Production at the Desert Fringe

Nomadic pastoralists exploit the desert fringe with camels, sheep and some goats in response to and sometimes in anticipation of irregular rainfall and shifting plant cover. Seasonal movements range from 250 to 500 km and may reach 800 km in years of exceptional rainfall with browse flushes in the desert. To maximize productivity, great experience, endurance and skill are required in manipulating the herds and flocks; for example camels are moved according to their nutritional needs, leaving people to feed on sheep and goats, and grain acquired through the barter of sale or animals.

The rainfall variability and lack of permanent water dictate repeated animal movement diverting most food energy to maintenance rather than production; body weight losses and mortalities are being incurred during the long and severe dry seasons; further constraints are loss of grazing through fire, and inadequate animal disease treatment.

The potential for improving the productivity of this fragile but highly adapted system through technical innovations must be regarded as limited, but research studies on range condition and trend and manipulation through different livestock species, water regimes, fire and range management are proposed with a view to stopping the advance of the desert. Studies would also include the structure and productivity of camel herds, and sheep and goat flocks with the underlying technical coefficients, the effect of improved disease control, feeding of mineral supplements and drought proofing mechanisms and strategies. Human resources would be studied for a longer time span with regard to demographic structure and trends, nutritional and health status, the organizational and social context of the production unit, decision-making, socio-economic value patterns, marketing processes, animal management patterns, and inter-population pressure through competition for resources.

An interdisciplinary systems research station would be established at Sag el Naam, including about 550 m² offices and field laboratories, 300 m² farm buildings, 16 staff houses and minor fencing. The site selected for the research station is near a new housing development that has water and electrical services available. Land clearing is not required because there is no natural plant growth at the site.

B. Ghazala Gawazat -- Semi-Arid Livestock Production
(Sudanian and Sahelian Zones)

This operating zone is a series of parallel longitudinal grazing orbits (from below 10° N almost to latitude 13° N) by cattle-owning Baggara pastoralists moving either towards fresh grazing (dry season) or away from biting fly and heavy mud (wet season). Seasonal movements range from 300 to 600 kms. Cattle are the main class of stock, with some sheep and goats tended in mixed bunches. Dairy produce is being consumed for subsistence or sold at local markets in

exchange for grain, tea, sugar or clothing. Cattle offtake for sale is about 5% (Mainly mature stock) but small ruminants serve as the main meat supply for subsistence. The labor-intensive livestock system of the Baggara is reasonably efficient in relation to the natural potential, with calving rates 65%, lambing rates 120% and kidding rates 200% being recorded. Millet production for subsistence on the easily tillable Qoz soils is expanding rapidly.

Expanding cultivation by both cattle owners and sedentary farmers as well as grass fires reduce the availability of dry season grazing, the major bottleneck in feed supply during the year; cyclical growth and weight losses are common; natural grazing and crop residues are deficient in protein and minerals; animal diseases and parasites are more important than in the north; there are local water shortages and widespread overstocking of the range; and lack of permanent water supplies along the routes of transhumance force herders to complete the southward migration to the Bahr el Arab before the grazing can be fully utilized.

The objective of research activities would be to improve the economic position of the predominantly transhumant pastoralists by improving livestock output through better range, water and livestock management, resulting in higher offtakes and increased subsistence. New technologies will be developed that are both environmentally advantageous and socially acceptable. The main lines of research would include:

- (i) rangeland production: the assessment of range condition and trend; its primary productivity and improvement possibilities through controlled grazing, water and fire management; the introduction of new species (particularly leguminous trees and shrubs), the strategic use of localities with better soils or water availability; and to a lesser extent, reseeding and bush control;
- (ii) livestock production: the structure and productivity of cattle herds and sheep and goat flocks, with the underlying technical coefficients; the effect of improved disease control, mineral supplements and the feeding of crop residues and by-products on herd productivity; herd productivity changes through the early extraction and fattening of young males;

- (iii) pastoral security: human resources would be studied including investigations of the opportunities for capital investment other than in livestock;
- (iv) pastoral systems: research results on rangeland, livestock and human resources would be integrated into proposals for improving traditional systems of husbandry and life styles of the people. The key to such changes would be that definition of basic limitations in available resources (particularly soil, vegetation and water) and therefore the need to conserve and use rationally what is available, and what extra can be produced, for example, by the introduction of new water management technology, by balanced numbers of people and livestock, and by increased subsistence cultivation. Basic concepts of land and water use, grazing control, organized land use for pastoralism and agriculture, animal disease control and drought proofing technology would all have to be studied and brought together so that final technology packages could be formulated and demonstrated in a manner appropriate to, and accepted by, the livestock producers.

A range and a livestock research division would be established at existing facilities at Ghazala Gawazat. The existing personnel and facilities will be assimilated into the project after year three.

Integrated Crop/Livestock Production on Stabilized Sands

Livestock and crops are integrated in differing proportions and with varying efficiency on the stabilized sands in the middle belt of the Project area, between 250 and 600 mm isoyets. Millet and groundnuts are the leading crops with some bamia (lady's finger), sesame and peppers. In the northern part, Acacia senegal is tapped in the dry season for gum arabic, thus providing a marketable production without labor competition for wet season crop harvesting. The shifting cultivation technique includes 4-5 years of cropping with gradually declining yields, and 8-12 years of bush fallows. Longer fallow periods in the north allow the creation of more efficiently, manageable gum gardens but there is mounting land pressure to reduce the fallow

period. A typical production unit would consist of a family (man, wife or wives and their children) cultivating 2-4 hectares of land and living in villages of 10-30 huts. Livestock (desert sheep and goats used for milk and meat production and for low volume marketing) are required to stabilize the system because of crop failures in one year out of five. Local distribution of settlements is a function of water sources which are abundant over much of the area provided that boreholes have been developed.

Marginal and variable rainfall and low soil fertility are the main reasons for a fragile farming system with high demand on land. Overstocking is prevalent around villages and grass fires are destroying most of the pasture; over exploitation of crop land through shortening fallow periods encourages erosion and dune encroachment; there is no technology which would allow crop yields to increase by means other than increased cultivation areas; and there are reciprocal pressures of livestock and cultivation demands in adjoining and competing production systems.

Research on this integrated livestock/crop production program would include: differential efficiencies and costs of crop and livestock within the integrated production systems; the study of integrating factors such as risk immunization, even use of labor, utilization of unsalable products and the effect of manure on soil fertility; evolution of permanent crop/fodder/pasture rotations; small farm economic studies; the social structure of production units; marketing procedures and opportunities; and institutional requirements in the subsistence sector. Technology packages would be developed which would be easily applicable by subsistence farmers. The environmental impact of innovations would be constantly monitored.

In developing these packages, particular emphasis would be laid on:

- (i) crops: the testing of food and cash crops, particularly new millet and groundnut varieties supplied by ARC stations or ICRISAT; minimum tillage and water management technology, crop protection, cultivation practices and their timing; weed control; and -- to a lesser extent -- fertilizer use;
- (ii) livestock: the use of draught animals; milk and meat production; nutritional values of crop by-products and residues;

fertilizer values of animal wastes; comparative productive and reproductive efficiencies of local cattle, sheep and goats at low and variable feed supplies;

- (iii) pasture and forage: possible new species such as Stylosanthes (pasture legume) and Cenchrus (grass) to improve range production; the impact and economics of forage crops, fertilizers and irrigation to increase feed supply at critical times; conserved fodder cut from pasture and forage crops; crop residues and grain supplements for the maintenance or survival feeding of stock during the dry season.

The research program would be implemented through the existing crop division at Ghazala Gawazat.

C. El Obeid -- Integrated Crop/Livestock Production Non-Cracking Clays

Non-cracking clays are elements of existing production systems in the Project area: they do not constitute a production system in their own right. They are most detectable in the clay pan-sand alternation of the Baggara pattern; interspersed with cracking clays around the Nuba Mountains; and in a stabilized sands/non-cracking clays mosaic south of El Obeid. Non-cracking clays are used mainly for livestock, as water catchments, and are capable of providing range grasses and browse of high mineral content.

The hard surface pan of these basically fertile soils prevents their use by smallholders: traditional tillage techniques cannot break them up for cropping on a significant scale.

The general approach of research studies would be the same as for the integrated crop/livestock systems on stabilized sands with greater risks of drought (El Obeid received 420 mm average annual rainfall with a co-efficient of variation of 28%). Crop production research would include millet, and focus on improved tillage technology, including animal traction at the smallholder level.

A specialized study on gum arabic (mainly growing on stabilized sands) would include the establishment and culture of Acacia senegal; gum arabic secretion; harvesting

and marketing; the grid planting of Acacia senegal to form shelter breaks, control soil erosion, improve soil fertility through the fixation of atmospheric nitrogen, and improve the water-holding capacity of the soil through increased organic matter; the use of the tree as animal fodder; and its inclusion in an appropriate long-term rotation under range conditions.

A research station of 300 feddan with, about 1,000 m² offices and field laboratories, 1,200 m² farm buildings, 28 staff houses, landscaping and fencing; would be established under the Project at El Obeid.

Two potential sites have been identified, one west of the town airport and the other south of the town and to the east of the airport. Both sites will have access to roads and electrical, water and sewage facilities that will be developed as part of the town extension plans over the next two to three years.

D. Kadugli -- Integrated Crop/Livestock Production on Cracking Clays

Cracking clays are characteristic of the south-east of the Project area. The major differences between this system and that on stabilized sands would be the replacement of millet as the major crop by sorghum, which is more tolerant of heavy soils, and the replacement of groundnuts by sesame as the major support crop. In the Nuba Mountains, cotton is important, replacing gum arabic of the stabilized sands as a cash crop. Livestock differences also exist: desert sheep decline in importance and are replaced by goats and cattle.

In addition to the problems common to all cultivators in the Project area, specific problems exist with regard to the short period for seed bed preparation and planting on cracking clays; traditional tillage technology limiting the area that can be cultivated; unimproved sorghum and sesame varieties; weed competition (striga) in sorghum and post-harvest pests in sesame. Livestock is seriously affected by mud and flies in the wet season.

Further to the research program described under the stabilized sands emphasis would be on:

- (i) crops: sorghum, sesame, cotton and soybeans suitable for reasonable rainfall conditions as in the case of Kadugli (average rainfall 760 mm/year; C of V 18%); the wild-growing plant kerkadeh would be studied regarding its suitability both in an integrated farming system or as a plantation crop;
- (ii) livestock: animal traction; milk and meat production of local and introduced breeds of cattle, sheep and goats, and their crosses;
- (iii) pasture and forage: because of the difficulties of grazing clay soils during the wet season, techniques of fodder conservation, in particular hay; and
- (iv) culture techniques: examination of hand and mechanized tools for more rapid and more efficient cultivation of the difficult black cotton soils; tillage practices by hand, animal traction and varying degrees of mechanization in relation to optimal water use, root penetration and plant growth, soil erosion, timing of tillage, labor requirements and economic evaluation.

The research studies will be accomplished by development of a 500 feddan research station at Habila with about 1,100 m² offices and field laboratories, 1,200 m² farm buildings, 29 houses and landscaping and fencing.

At this time, it has not been decided whether to utilize an existing research station at Kadugli or to develop a new site. If a new site is developed, some land clearing may be required.

E. Nyala -- Water and Land Use Management Research Program

This program, would support the five multi-disciplinary systems research teams in the Project area, including the survey, monitoring and classification of available land and water resources, and their rational use in crop or livestock production. The efficient use of limited rainfall is the key to the optimization of crop and animal production in the West. The main lines of research would include:

- (i) resource potential: an inventory and the analysis of previous investigations, and of existing environmental data for the Project area such as meteorological records, air photographs and satellite imagery; the inventory (including maps) would set out overall system parameters, such as water balance, primary productivity, pedology, ecological trend and human and animal demography;
- (ii) water management technology: water conservation, infiltration, penetration, runoff, harvesting, surface, soil profile and underground storage, evaporation and efficient minimum use for crops, livestock and human populations;
- (iii) socio-economics of water management: comparative costs and benefits of the techniques of harvesting, storing and using water; social structures and economic pressures as mechanisms to control and restrict water use in order to control livestock numbers, improve rangeland management and improve crop farming;
- (iv) land use planning: preparation of a land use classification system for the West based on suitability of land for crop or livestock production; preparation of land use plans avoiding conflicts between the interests of pastoralists and cultivators and including dry season grazing reserves for pastoralists; stock route planning; improvement of traditional crop farming; and identification of further settlement areas and localities for large-scale, mechanized farming and irrigation development; operational (or pilot) research projects involving land use on a catchment basis and the main soil types;
- (v) solar energy: adapting new solar energy technologies for cooking, transportation, and the recovery, distillation and recycling of water.

The research program would be supported by development of a research center and Project headquarters facilities that would comprise 1,500 m² offices, laboratories, a documentation center and a conference room; and 55 staff houses.

Two potential sites have been identified. One would co-locate the station with facilities for another donor project at a site south of the river that runs through the town. The other proposed site is north of the river. No land clearing would be required at either site. Electrical and water services are available to the south site, but present capacity is not always adequate for current requirements.

F. Khartoum -- Strengthening of ARC Headquarters

To enable ARC to effectively operate and administer a nationwide balanced agricultural research program, it would be essential to move its headquarters from Wad Medani to Khartoum. The Project would provide for renting of suitable office space in Khartoum including the purchase of office furniture and equipment; included also would be conference facilities, a documentation center, and an illustration and graphics studio. The space needs are estimated at about 2,400 m².

III. Recommendation for Environmental Action

Environmentally, AID's primary concern with projects of this nature are the immediate physical impacts of the construction activities and the long-term socio-economic and cultural implications of applied research results. While construction for the project is not financed by AID and application of research is not part of the project, AID is the major donor for the Project and, through provision of the technical services that will prepare the final construction and research plans, can directly influence the environmental impact of the Project.

To satisfy AID's concerns for construction, it is recommended that a covenant be included in the Project Agreement requiring site selection and construction to be undertaken with consideration of AID's environmental guidelines. An AID engineer would visit sites once selected and review construction plans once prepared to assure that environmental needs are met. At that time, an environmental examination following the IEE format would be prepared for each construction site.

The socio-economic and cultural implications of applied research are dependent on two components of the research program, i.e., the focus of research activities and the

specialities of the research technicians. The research program, as outlined in the Discussion of Impacts, acknowledges the need to examine socio-economic and cultural impacts when conducting research into possible developmental activities. As planned, any application of research will have the benefit of thorough environmental analysis at the research stage. The specialities of the AID-financed technicians, e.g., the sociologist, the farm management economist, the research planning and evaluation advisor, etc., assure the Project's capability to perform this environmental analysis.

The inherent environmental focus of the research program and the covenant concerning construction that has been suggested here should assure the Project of having no significant adverse effects on the environment. Therefore, it is recommended that a Negative Environmental Determination be made.

IMPACT IDENTIFICATION AND EVALUATION FORM

**Impact
Identification
and
Evaluation 1/**

A. LAND USE

- 1. Changing the character of the land through:
 - a. Increasing the population ----- L
 - b. Extracting natural resources ----- L
 - c. Land clearing ----- U
 - d. Changing soil character ----- L
- 2. Altering natural defenses ----- N
- 3. Foreclosing important uses ----- N
- 4. Jeopardizing man or his works ----- N
- 5. Land Use Planning ----- L

B. WATER QUALITY

- 1. Physical state of water ----- N
- 2. Chemical and biological states ----- U
- 3. Ecological balance ----- N

C. ATMOSPHERE

- 1. Air additives ----- N
- 2. Air pollution ----- N
- 3. Noise pollution ----- N

D. NATURAL RESOURCES

- 1. Diversion, altered use of water ----- N
- 2. Irreversible, inefficient commitments ----- N

1/ Use the following symbols: N - No environmental impact
 L - Little environmental impact
 M - Moderate environmental impact
 H - High environmental impact
 U - Unknown environmental impact

IMPACT IDENTIFICATION AND EVALUATION FORM

E. CULTURAL

- 1. Altering physical symbols ----- N
- 2. Dilution of cultural traditions ----- N

F. SOCIO-ECONOMIC

- 1. Changes in economic/employment patterns --- L
- 2. Changes in population ----- L
- 3. Changes in cultural patterns ----- N

G. HEALTH

- 1. Changing a natural environment ----- L
- 2. Eliminating an ecosystem element ----- N
- 3. New pathways for disease vectors ----- L

H. GENERAL

- 1. International impacts ----- N
- 2. Controversial impacts ----- N
- 3. Larger program impacts ----- N

SUDAN

AGRICULTURAL RESEARCH PROJECT

Summary of Senior Staff

II. Draft Scopes of Work for 16 Key Project Staff

1. Project Director

The Project Director (PD), a Sudanese national, would have the rank of a Chief Scientist 1/ with wide experience in carrying out and directing livestock/crop research. In addition, he should be familiar with the delivery of technology to the farm level. The PD would be based at the Nyala Regional headquarters of ARC. In particular, he would: (a) under the overall direction of the Director General of ARC, be responsible for development of research programs based on established priorities, for scientific direction, and for operation and management of all aspects of ARC's agricultural research programs in the West; (b) be a member of the Technical Committee of the Agricultural Research Council; (c) be Secretary of the Project Advisory Council under the chairmanship of ARC's Director General; (d) through the Project Support Unit and Planning and Evaluation Unit to be based at Khartoum, liaise with ARC on all matters of program planning, program evaluation, finance, station development, staff recruitment, staff training as well as through his responsibilities in formal consultative processes within ARC; (e) (assisted by the Project Architect) be responsible for the overall planning and development of Project's physical facilities; (f) assist with the identification and selection of fellowship candidates and give leadership in other aspects of training and public relations to be arranged by the Training and Extension Unit based at Nyala headquarters (or at Khartoum); (g) participate in the selection of internationally recruited scientists and consultants, indicate subject areas where their services might be required; (h) liaise with representatives of Technical Assistance Agencies and with International Agricultural Research centers such as CYMMIT, CIP, ICRISAT, ILCA, ILRAD and IRRI to attract additional support for the research programs in the West and to confide specialized research problems to specialized research institutions.

The PD would have authority to delegate certain duties as listed above to his Deputy and other senior staff members.

2. Deputy Project Director

The Deputy Project Director would be an internationally recruited scientist of high qualifications in the animal, plant or soil sciences with long and appropriate experience in the direction of multi-disciplinary

1/ Refers to GOS Research Staff grading.

research, including experience in developing countries. He would, in addition, have experience in the transfer of new technology to producers. In selecting an individual to fill this post, due regard would be given to complementing the experience of the person selected to fill the post of Project Director. The Deputy Project Director would be stationed at the Nyala Project H.Q. under the following terms of reference:

- (a) he would carry out duties assigned to him by the Director;
- (b) he would serve as a special adviser who would carry out specific assignments in all parts of the Project, such as:
 - (i) participation in research program reviews;
 - (ii) supervision of specific programs;
 - (iii) analysis of research results and the development of special programs of transfer of technology;
 - (iv) participation in certain specialized training programs;
 - (v) participation in research program evaluation procedures;
 - (vi) an advisory function in relation to the preparation of architect's conceptual briefs;
 - (vii) monitor the activities of the International Agricultural Research Centers relevant to agricultural research in the West;
 - (viii) any other assignment that the PD may appropriately have in mind; and
- (c) he would at all times be expected to ensure that his capability was transferred to Sudanese staff.

His functions may be adjusted and/or extended as the need arises.

3. Senior Research Adviser to the Director General (DG) at ARC/H.Q. Khartoum

The Senior Research Adviser to the DG would be an international agricultural research scientist with high qualifications and experience and a demonstrated capacity to advise on the organization and management of agricultural research of broad ecological scope and multi-disciplinary complexity. Experience in developing countries would be essential. He would be based in Khartoum and carry out the following specific functions:

- (a) act as an Adviser to the Director General of ARC regarding the re-organization and management of the national agricultural research program;

- (b) maintain contacts with other relevant sections of MAFNR, with the Project Director and other senior Project staff, with research staff in other regions of the Sudan with the International Agricultural Research Centers, and with area development schemes, and report his findings and recommendations to the Director General of ARC; and
- (c) head the Project Support Unit closely assisted by the Project Liaison Officer; (on the instruction of the DG) carry out longer-term studies in his field of competence, of relevance to restructuring the Sudanese national agricultural research services.

His functions may be adjusted and/or extended as the need arises.

4. Project Liaison Officer at ARC H.Q. Khartoum

The Project Liaison Officer to be stationed at the ARC headquarters at Khartoum would be a Sudanese scientist at Senior Scientist 1/ level. His basic discipline would be of lesser importance than long experience in multi-disciplinary research and proven administrative capacity. Some experience in transfer of technology to producers, project preparation and management, and personnel recruitment would be desirable. In particular, his terms of reference would include:

- (a) work under the direction of the PD;
- (b) on behalf of the PD, act as an interface in Khartoum with all sections of ARC and also with appropriate units of MAFNR;
- (c) assist the PD in his role as the Executive Secretary of the Project Advisory Council with responsibility for convening meetings, issuing documentation, recording and circulating minutes and taking follow-up action as necessary after meetings;
- (d) assist with staff selection, recruitment of expatriates and consultants and arrangements for fellowship training;
- (e) be responsible for reception, accommodation and transportation of incoming staff and other staff movements through Khartoum;
- (f) arranging audit control of all centrally maintained Project accounts and records and for the regular transmission of information on these to the Nyala H.Q.; and
- (g) keep the PD and Team and Station Heads informed on all Project matters arising in Khartoum and similarly be responsible for keeping the relevant authorities in Khartoum informed on all matters arising on Project Stations;

1/ Refers to GOS Research Staff grading.

The above listed functions may be adjusted and/or extended as the need arises.

5. Research Planning and Evaluation Adviser at ARC/H.Q. Khartoum

This post will be filled by an international agricultural research scientist, highly experienced in research program planning, coordination, budgeting, management and evaluation of research results. Experience in developing countries would be essential. He would be based in Khartoum and have the following terms of reference:

- (a) act as an Adviser to ARC's DG regarding the development of national systems for research program planning, coordination, budgeting, management and evaluation;
- (b) maintain contacts with other relevant sections of MAFNR, with the Project Director and other senior Project staff, with research staff in other regions of the Sudan, and with area development schemes and will be expected to report his findings and recommendations to the Director General of ARC; and
- (c) be assigned to longer term studies in his field of competence where in the view of the Director General, such studies constitute a necessary prelude to reorganizing Sudanese research operational procedures.

His functions may be adjusted and/or extended as the need arises.

6. Project Architect/Planner at ARC/H.Q. Khartoum

This post will be filled by an architect experienced in the problems of research station development, operation and maintenance. Experience in developing countries would be essential. He would be based in Khartoum and have the following terms of reference:

- (a) act as an Adviser to ARC's DG regarding research station development, operation and maintenance on a National basis but with particular emphasis on the station development program under the Project;
- (b) maintain contacts with other relevant sections of MAFNR, with the Project Director and senior Project staff, with research staff in other regions of the Sudan and with area development schemes and will be expected to report his findings and recommendations to ARC's DG; and
- (c) be assigned to longer term studies in his field of competence where, in the view of the Director General, such studies are required in connection with the restructuring of Sudanese National Research stations and the physical facilities within them.

His functions may be adjusted and/or extended as the need arises.

7. Land and Water Use Specialist - Program Leader

This post would be filled by an international scientist with high scientific qualifications in one of the physical disciplines and extensive field experience in land and water use planning and implementation, including field experience in developing countries. In addition, the person appointed would have experience in land and water use planning at a high level, in operational research projects, of working with other involved disciplines such as sociologists, economists, livestock and crop scientists, road and water engineers, and the ability as a scientist to determine in consultation with the PD and his Deputy, which components of total situations should be the subject of research by members of his own or other teams. The Land and Water Use Specialist would be stationed at Nyala but would supervise research activities on all Project stations. In particular, his terms of reference would include:

- (a) (under the Project Director) to be responsible for the development of all research programs in his problem area;
- (b) to be responsible for the planning and implementation of pilot or operational research projects in association with local regional authorities;
- (c) to maintain regular contact with national units in MAFNR and ARC which are concerned with his problem area and outside agencies involved in similar activities elsewhere, such as the water management technology and farming systems programs of ICRISAT; and land and water aspects, and arid and semi-arid range research of ILCA and others;
- (d) to participate in the selection of Sudanese staff for the Project, advise on their training and supervise their work when they join the project; and
- (e) to work in close cooperation with Sudanese Scientists to ensure that his capability was duly transferred.

His functions may be adjusted and/or extended as the need arises.

8. Land and Water Use Specialist - Deputy Program Leader

This post would be filled by a Sudanese scientist at Senior Scientist 1/ level, with a basic degree in one of the physical sciences, a good personal research record and considerable experience in the implementation of land and water use technology under low rainfall conditions. He would join the Project in Year 4 and would, after a few months, proceed on short-term training at a renowned specialized institute, such as ICRISAT; the All India Coordinated Dryland Farming Program; the Land and Water Division of FAO; the Land Resources Division of ODM or others. He would be stationed at

1/ Refers to GOS Research Staff grading.

Nyala but would be involved in research activities in all Project stations. In particular, his terms of reference would include:

- (a) to work closely with the Land and Water Use Specialist Leader in order to gain experience within this Program; and
- (b) progressively assume fuller responsibility for parts of the programs and especially for one or more pilot or operational research projects.

The above-mentioned functions may be adjusted and/or extended as the need arises.

9. Agro-Climatologist - Discipline Leader

The Agro-Climatologist (Discipline Leader) would be an international scientist with high scientific qualifications preferably based in the agricultural biological sciences followed by post graduate or post doctoral specialization in meteorology/climatology. He should have had several years of experience in studying and evaluating the relationships between animal and crop production systems and climate, be well qualified in the methodology of study and analysis of climatic data as a basis for delineating parameters for varied animal and crop production systems in arid and semi-arid situations extending to probability weather forecasting. Team experience of working with other scientists on the preparation of alternative production systems against a background of predicted weather situations would be an advantage. The Agro-Climatologist would be based at Nyala but his interests would cover the whole of Western Region against a continental background of weather systems information and evaluation. In particular, his terms of reference would include:

- (a) to work under the direction of the PD;
- (b) to be responsible for contact with outside bodies both in Sudan and overseas who could be in a position to supply data, information, analyses, forecasts, and consultancy services;
- (c) to advise the PD, Team Leaders and Station Heads on the establishment of weather system recording and on the equipment for weather stations and their operation; and
- (d) to work in close cooperation with Sudanese scientists, advise on training and ensure that his capability was duly transferred.

His functions may be adjusted and/or extended as the need arises.

10. Livestock/Crop Production Systems Specialist - Production Systems Program Leader

This post will be filled by an international scientist with high qualifications in the animal, range and crop sciences and long experience in mixed farming activities involving both livestock and crop production in integrated systems, including experience in African countries. Alternatively,

consideration could be given to appointment of an agricultural economist with a similar general background. This specialist would be stationed at Nyala and have responsibilities extending to all sub-stations of the Project. In particular, his terms of reference would include:

- (a) (under the PD) to be responsible for the development of the range and crop/livestock systems research programs;
- (b) to maintain regular contact with national units in MAFNR and ARC which are concerned with the same problem areas, and relevant outside agencies such as ICRISAT, ILCA and ICARDA;
- (c) to participate in the selection of Sudanese Project staff, to advise on their training and to supervise their work when they join the program; and
- (d) to work in close cooperation with Sudanese scientists designated to continue in the programs to ensure that his capability was duly transferred.

His functions may be adjusted and/or extended as the need arises.

11. Sociologist - Discipline Leader

This post would be filled by an international scientist with high qualifications in the social sciences and extensive experience in developing countries with the problems of rural communities especially those involved with pastoralism and animal production in both sedentary and nomadic production systems. The person appointed would be experienced in the methodology of survey planning, data collection and analysis, and in multi-disciplinary research. He would be in charge of the Project activities in his discipline and be stationed at Nyala. In particular, his terms of reference would include:

- (a) (under the PD) to be responsible for the development of all sociological research programs;
- (b) to participate in the selection of Sudanese Project staff; to advise on their training and to supervise their work when they join the Project;
- (c) to participate in research program planning to ensure that sociological aspects become recognized at an early stage and that Project sociologists participate in research project implementation;
- (d) to maintain regular contact with MAFNR, ARC units, WSDC and with other Sudanese organizations, as well as with international organizations such as ICRISAT, ILCA and overseas universities; and

- (a) to work in close cooperation with Sudanese staff members designated to continue in the Project to ensure that his capability was duly transferred.

His functions may be adjusted and/or extended as the need arises.

12. Range Specialist - Sub-Program Leader
Arid Livestock System

This post would be filled by a Sudanese Scientist at Senior Scientist 1/ level with range management or a closely related subject as his basic discipline. He would be expected to have a good personal research record and considerable experience in the transfer and implementation of range management technology, especially in arid areas. Experience in multi-disciplinary research activities would be essential. He would join the Project in Year 1 and would be stationed at El Fasher. In particular, his terms of reference would include:

- (a) to be the Sub-Program Leader of the Arid Livestock Systems Sub-Program under the direction of the Production Systems Program Leader;
- (b) to participate in the development of the research program and in planning and implementing the process of transfer of technology in association with local authorities;
- (c) to be responsible for direction of all staff based at El Fasher and be Station Head;
- (d) to be responsible for station administration, accounting and other aspects of station management; and
- (e) to be responsible for keeping his Program Leader informed on all aspects of the work at El Fasher including matters requiring attention in the Project headquarters, and to maintain contact with other workers in his area as necessary.

13. Plan Breeder/Agronomist. Sub-Program Leader - Cracking Clays
Integrated Livestock Crop System

This post would be filled by a Sudanese Scientist at Senior Scientist 2/ level with plant science as his basic discipline, a good personal research record and broad qualifications and experience in the field of general agronomy. Experience in multi-disciplinary farming systems research would be essential. He would join the Program in Year 1 and be stationed at Kadugli. In particular, his terms of reference would include:

- (a) to be Sub-Program Leader of the Cracking Clays Sub-Program under the direction of the Production Systems Program Leader;

1/ Refers to GOS Research Staff grading.

- (b) to participate in the development of the research program and in planning and implementing the process of transfer of technology;
- (c) to be responsible for the direction of staff based at Kadugli and to be the Station Head;
- (d) as Station Head, to be responsible for station administration, accounting and other aspects of station management; and
- (e) to be responsible for keeping his Team Leader informed on all aspects of the work at Kadugli including matters requiring attention in the Programs Headquarters office and to maintain contact with other workers in his area as necessary.

His functions may be adjusted and/or extended as the need arises.

14. Farm Management Economist - Discipline Leader
Integrated Livestock Crop System

This post would be filled by an international scientist with high qualifications in agricultural economics and extensive experience with farm production systems in developing countries, including traditional small farm situations. He should have experience of the methodologies of farm surveys and data analysis. He would be responsible for his problem area in the Integrated Livestock/Crop Systems Program and would also be expected to assist as required in other Project programs. He would be stationed at Kadugli. In particular, his terms of reference would include:

- (a) (under the PD) to be responsible for the development of all research programs in his problem area;
- (b) to participate in the selection of Sudanese staff who would join the Project, advise on their training and supervise their work when they join the program;
- (c) to participate in research program design in order to ensure that farm economic aspects were recognized at an early stage and that participation of economists was planned;
- (d) to maintain regular contact with units of MAFNR and ARC engaged in similar work and also with other Sudanese and international organizations, such as ICRISAT, ILCA and overseas universities;
- (e) to participate in the selection of Sudanese Project staff, to advise on their training and to supervise their work when they join the program; and
- (f) to work in close cooperation with Sudanese Scientists designated to continue on the programs to ensure that his capability was duly transferred.

His functions may be adjusted and/or extended as the need arises.

**15. Agricultural Engineer - Discipline Leader
Integrated Livestock/Crop System**

This post would be filled by an international scientist with high qualifications in agricultural engineering and extensive experience with farm production systems in developing countries including small farm situations. He should have experience in developing and testing agricultural machinery and be familiar with animal drawn implements. He would be responsible for his problem area in the integrated Livestock/Crop Systems Program and assist in other programs as required. He would be stationed at Kadugli. In particular, his terms of reference would include:

- (a) (under the Project Director) to be responsible for the development of all research programs in his problem area;
- (b) to participate in the selection of Sudanese staff who would join the Project, advise on their training and supervise their work when they join the program;
- (c) to participate in the research program design in order to ensure that farm mechanization aspects were adequately reflected;
- (d) to maintain regular contact with units of MAFNR and ARC engaged in similar work and also with other Sudanese and international organizations such as ICRISAT;
- (e) to participate in the selection of Sudanese Project staff, to advise on their training and to supervise their work when they join the program; and
- (f) to work in close cooperation with Sudanese Scientists designated to continue on the programs to ensure that his capability was duly transferred.

His functions may be adjusted and/or extended as the need arises.

**16. Systems Agronomist - Sub-Program Leader - Non-Cracking Clays
Integrated Livestock/Crop System**

This post would be filled by a Sudanese Scientist at Senior Scientist 1/ level with agronomy as his basic discipline, a good personal research record and experience in multi-disciplinary research including crop/livestock integration. Some experience with tree crops would be an advantage. He would join the program in Year 1 and be stationed at El Obeid. In particular, his terms of reference would include:

- (a) to be Sub-Program Leader of the Non-Cracking Clays Sub-Program under the direction of the Production Systems Program Leader;

1/ Refers to GOS Research Staff grading.

- (b) to participate in the development of the research program and in planning and implementing the process of transfer of technology;
- (c) to be responsible for the direction of staff based at El Obeid and to be Station Head;
- (d) as Station Head to be responsible for station administration, accounting and other aspects of station management; and
- (e) to be responsible for keeping his Program Leader informed on all aspects of the work at El Obeid including matters requiring attention at the Project headquarters and would maintain contact with other workers in his area as necessary.

The above listed functions may be adjusted and/or extended as the need arises.

Basis for Cost Estimates

1. Research Stations - Construction and Equipment

Construction cost estimates for the four research stations are based on data provided by the Ministry of Construction and Public Works and by architects who have experience both in the Sudan and in designing research centers similar to those proposed for this project. Facilities and housing construction are costed at \$53/ft² and \$45/ft² respectively (Khartoum cost basis, April 1978). These base cost estimates are adjusted for physical contingencies (15%) and provincial cost variations of 15% in Nyala, 10% in El Obeid, 20% in El Fasher, and 25% in Kadugli.

Furniture costs are estimated at 5% of construction costs; laboratory and audio-visual equipment costs are estimated at 25% of construction costs. These estimates are based on previous IBRD experience in projects involving research station construction.

2. Vehicles and Farm Machinery - Base Cost Estimates

Mobile Units	\$32,500 each
4-wheel drive vehicles	\$11,250 each
Minibuses	\$15,000 each
Tractors	\$14,250 each

3. Technical Assistance

Technical advisors are costed at \$72,000 per staff year.

Illustrative List of Equipment Requirements for Research Stations

<u>Item</u>	<u>Number</u>
Seed germination chambers	4
Plant dryer	4
Plant balance	4
Feed mixer	1
Livestock equipment	
Large animal scales	1
Small animal scales	2
Metabolism cages	6
<u>Agricultural</u>	
Irrigation equipment (pumps, pipes)	3
Tractor (large, medium, small)	9
Ploughs	3
Ridger and furrower	3
Small plot thresher (Vogel)	4
Mower	3
Mini-seed drill	4
Mini-fertilizer spreader	3
Harrows	3
Hand tools	3
Feed weighing scales (2)	2
Feed buckets	
<u>Agricultural Engineering</u>	
Forge	2
Drill for metal	2
Sheet metal bender	2
Metal cutter	2
Portable welding	2
Drill	
Stand-by generator	3
Hand tools	
<u>Laboratory</u>	
Refridgator, deep freeze	
Balances 100 g	6
5 kg	5
Fume hood	2
Furnace	1
Spectrophotometer	1
Drying ovens	6

<u>Item</u>	<u>Number</u>
Incubators	1
Infective disease transmission chamber	3
Centrifuges	2
Microscopes - high power	4
- dissecting	3
Insect cages	7
Autoclaves	
Kjeldahl unit	1
Media preparation oven, etc.	2
Electronic calculators	8
Mini-computer	4
pH meter	5
Cameras - still	6
- movie	1
Projector - slide	4
-movie	3
Mills (for grinding - plant spp)	3
- soil	1
Chemicals	2
Glassware	3
<u>Administrative and Office</u>	
Duplicator	3
Xerox, typewriters, etc.	3

ANNEX F

CERTIFICATION PURSUANT TO

Section 611(e) of the

FOREIGN ASSISTANCE ACT

As Amended

I, Gordon K. Pierson, the principal officer of the Agency for International Development in the Democratic Republic of Sudan, do herewith certify that in my judgment, Sudan has both the financial capability and the human resources to maintain and utilize effectively goods and services procured under this development assistance project entitled Western Sudan Agricultural Research.



Gordon K. Pierson
AID Representative
Democratic Republic of Sudan

8/30/78
Date

project file
western Ag. Research



THE DEMOCRATIC REPUBLIC OF THE SUDAN
MINISTRY OF AGRICULTURE, FOOD AND NATURAL RESOURCES
MINISTER'S OFFICE

P. O. Box 285
Khartoum

...S...

Ref: 171414/D

Date: 12 Nov, 1977

Mr. Pearson
US. AID Office
Khartoum.

Would you kindly consider providing
the Tech. Assistance component to the
I B R D / Gos Agric. Research Project in
the Western Sudan.

With kind regards.

Dr. Abdalla A. Abdalla

Minister for Agriculture, Food,
and Natural Resources
Khartoum Sudan.

.....

Marian.

جمهورية السودان الديمقراطية

The Democratic Republic of the Sudan

وزارة التخطيط القومي

Ministry of National Planning

P.O. BOX 3088 KHARTOUM

Cables (EIMAR)

TELEX 324

Ref. : MNP/101/2/1 - 1/8/4 - XR/Khartoum, 15th NOVEMBER, 1977330/8/10

ص.ب ٢٠٩٢ - الخرطوم

تلفونيا (امبار)

تلكس : ٢٢٤

التمرة

الخرطوم في

Mr. Gordon Pierson
U.S. Aid Representative,
Embassy of the United States of America,
Khartoum.

SUBJECT: Traditional Agriculture in a Fragile
Environment - North Kordofan

Dear Mr. Pierson,

I am referring to Mr. Machmer's letter of September 17, 1977, on the above subject according to which a design team was to visit the Sudan to develop the project in detail. I also refer to our meeting late last month. The team's arrival is still awaited. I hope that meanwhile you have had a chance to get acquainted with the existing and proposed activities of other aid projects in the Western Sudan. The following projects are particularly relevant:-

- 1- CDM/Abu Dhabi project in Southern District of South Darfur (Project Agreements signed)
- 2- Saudi Fund/IDA Western Savanna Project South Darfur (Project Agreements signed)
- 3- World Bank Agricultural Research Project for Western Sudan (proposed);
- 4- World Bank 3rd Farm Mechanization Project, South Kordofan (proposed); and
- 5- Modernization of Traditional Agriculture in Nuba Mountains (under feasibility study by AGRAR)

The first two projects in the list have substantial research components. The research involved is mostly adaptive similar to envisaged in AID proposal. Projects number 4 & 5 would also include component of adaptive research. The Agricultural Research Project proposed by the IDA is designed to undertake both basic and adaptive research. We are in complete agreement with the broad objectives outlined in the proposed AID project in North Kordofan. But, in view the limitations of financial and manpower resources and the desirability of avoiding duplication we are of the opinion that the research components of various projects could be coordinated. It is felt that the Agricultural Research Project prepared by IDA after some modifications of its components, could effectively cover the activities and objectives proposed in the US AID Project. It would be

Helpful, therefore, if the proposed AID design team could meet with the World Bank officials in Washington D.C. to work out a joint project to be co-financed by AID and the Bank. The design team would be welcome to visit the Sudan prior to consultations with the Bank but I do hope the contact with the Bank will be made before the Bank team that recently visited the Sudan finalises the revised project.

I have indicated to you in our meeting the extent of the expected foreign exchange gap in the IDA Project. I hope the AID coordination with IDA will take this into account.

Warm personal regards,

Yours Sincerely,



Abdel Fahman Abdel Wahab
UNDER SECRETARY,
MINISTRY OF NATIONAL PLANNING

Copy to:-

Minister of Agriculture, Food &
Natural Resources.