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DEMOCRATIC REPUBLIC OF THE SUDAN

MINISTRY OF PLANNING

LIVESTOCK SECTOR REVIEW

AND

PROJECT IDENTIFICATION

VOLUME III APPENDICES

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APPENDIX I

PASTURES, RANGE MANAGEMENT, FODDERS AND FEEDSTUFFS

1. GEOGRAPHY AND PHYSICAL FACTORS

This appendix refers to areas within the savanna belt of the Sudan between latitudes 10°N and 16°N in the provinces of Darfur, Kordofan, Khartoum, Blue Nile and Kassala. The area is flat to gently undulating with occasional stony hill outcrops at an altitude lying between 400 and 600 metres A. S. L.

There is a reasonably reliable summer rainfall of from 150 mm to 800 mm increasing from north to south (Tables A1. 1 and A1. 2). Mean daily maximum temperatures range from about 42°C in the summer to 30°C in the winter while mean daily minimum temperatures range from about 24°C to 14°C.

The soils in general range from sand in the north and west to clay in the central, southern and eastern areas with narrow belts of alluvial soils along the major rivers. Stabilised sand dune areas called "Qoz" support good vegetation in low rainfall areas because the plants are able to make full use of available moisture. In comparison the non-cracking clays support only limited vegetation because of their inability to absorb moisture.

The self-mulching dark cracking clay soils found in the eastern region have a good mineral status and absorb moisture well until the cracks close. Surface flooding may occur above 600 mm of rainfall[(a)].

Soils are described in more detail in "Agriculture in the Sudan" edited by J. D. Tothill, 1948.

The vegetation varies greatly with rainfall and soil type but in

(a) W. O. Shepherd, FAO Publication No. TA2468, 1968. Range and Pasture Management.

TABLE A1. 1 Annual Rainfall 1958-1970 (mm)

	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Gedaref	-	-	-	599. 9	573. 7	743. 3	555. 1	599. 3	617. 0	662. 5	550. 5	451. 2	518. 0	-
Ed Da'ein	-	-	-	501. 0	657. 0	394. 5	555. 0	572. 2	433. 5	387. 0	425. 0	429. 5	443. 0	-
Ghazala Gawazat	576. 5	390. 5	512. 4	408. 3	537. 5	-	-	-	564. 2	441. 0	451. 4	412. 2	495. 1	371. 5
Muglad	-	-	-	650. 0	561. 5	509. 0	-	-	471. 0	-	-	-	-	-
Wad Medani	-	-	-	366. 9	436. 0	391. 0	422. 4	312. 0	269. 5	504. 1	348. 7	261. 8	325. 6	-

Source: Meteorological Department.

TABLE A1. 2 Monthly Rainfall Averages (mm)

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Gedaref[a]	0	Tr	1	4	31	84	161	193	113	22	5	0	614
Doka[a]	0	0	0	4	36	139	195	215	118	27	3	0	737
Ed Da'ein[b]													480
Ghazala Gawazat[c]	0	0	2. 8	7. 5	13. 6	69. 7	102. 7	157. 3	85. 2	20. 6	0	0	459
Wad Medani[a]	Tr	Tr	Tr	1	15	29	116	133	48	19	1	Tr	362

Source: Meteorological Department.

(a) Average over 30 year period to 1970.

(b) Average for 10 years 1961 to 1970.

(c) Average for years 1958 to 1971 excluding 1964 and 1965.

Tr = Trace.

general there is good grazing on annual and perennial grasses and herbs during and just following the wet season. Heavy grazing plus the persistent use of fire has virtually eliminated perennial species from many areas.

Acacia is the most common genus of woody plants throughout the savanna area although many others occur in association with it.

M. N. Harrison and J. K. Jackson, 1958, "Ecological Classification of the Vegetation of the Sudan" is a very useful reference for further detail on vegetation.

2. PRESENT LAND USE

2. 1 Traditional Grazing

An unknown number of livestock graze, mainly nomadically, throughout the country and the over-grazing of many areas is very common, although some areas are under-utilised through lack of water. Over-grazing coupled with the indiscriminate use of fire has left many of the pasture areas in a very poor state and erosion, particularly wind erosion, is becoming a serious problem. The incidence of fire is slowly being reduced by the construction of fire lines and this policy should be encouraged. The most serious over-grazing occurs around villages where there is pressure both from village and nomadic stock. Some form of stock number control is necessary around villages, particularly in relation to goats. All grazing land is Government owned and the right of any tribe to graze a certain area is only held by tradition or usufructuary rights. In these circumstances it is very difficult to encourage planning for the long-term maintenance or improvement of the range.

Browse plants play a major part in the nutrition of camels, sheep and goats and to a smaller extent of cattle. For much of the year sheep gain most of their protein from this source.

Thickets of woody species, especially Acacias, occur in many

areas and some thinning of these would be beneficial but over-clearing must be avoided at all costs as trees prevent erosion and also provide shade and shelter.

Very little improvement in pasture management on the open range is possible under nomadic conditions where emphasis is placed on the total number of stock owned rather than on quality and off-take. However, the closing down of water points in some areas, at strategic times, could prevent some of the damage at present resulting from over-grazing. The reseeding of open range country would be futile under present conditions but the closure of areas from grazing from one to two years allows the natural pasture to come back strongly[a].

2. 2 Ghazala Gawazat Research Station

The Government livestock and grassland research station was established in 1956 on an area of 20 square miles near Ed Da'ein in Darfur province. A total area of 210 square miles of sandy and clay soils classifed as "Baggara Repeating Pattern" has been reserved for converting this station to a commercial ranch.

Initial observations have been carried out on:-

(a) Herd management. Under the herding system of management at present practiced at Gawazat areas of heavy clay are avoided (Naga, Gardud and Buta soils) during the wet season as these soil types are subject to poaching. Sand areas can be grazed all the year round and cracking clays (Buta) can be grazed heavily once they have dried out after the wet season.

(b) The effect of grazing on pasture composition. Monechma hispidum and Zornia glochidiata are the first species to germinate on clay soils after rain and unless grazing is controlled stock will stay on these areas until they are

(a) Document DOX-SUD - A47 (February 1966) prepared for United Nations Special Fund. Report on Pastures and Livestock in the Project Area submitted by Dr. P. J. Skerman.

grazed bare. Both are annuals and seed must be allowed to fall each year. Of the grasses D. aegypticiun is the first grazed. A. gayanus is being grazed out under the present grazing management at Gawazat even though stock are grazed outside the existing ranch during the wet season.

(c) Reseeding trials. Over seventy different varieties of A. gayanus have been collected and reseeding trials have resulted in very poor germination even where good seed beds have been prepared. Oversowing without preparing a seed bed has proved a complete failure.

(d) New proved species. A small area has been set aside for introduction plots and these can be irrigated. Apart from the collection of small quantities of seed and of specimens for the herbarium, little has resulted from these plots.

(e) Bush clearance. A. mellifera is the main species causing problems in the area and it has been found that fire alone will not control it but after removal of the mature bushes fire is advantageous in controlling the regrowth.

(f) Fire control. Standard 20 metre wide fire lines are used on Gawazat, dividing the area into one square mile blocks. No serious fire outbreaks have occurred since these have been constructed.

2. 3 Ranch Development in the Babanusa Area

Eight ranches, of approximately 100 sq. km each, have been sited in the Babanusa-Muglad area by the Ministry of Co-operation and Rural Development (see Figure 5. 2, Vol. I). These areas are at present unstocked and are protected by perimeter fire lines. The three sites in the Abu Lagig-Tiboon area were selected because they contained good stands of the favoured perennial grass Andropogon gayanus[(a)] and

(a) Although this grass may be difficult to maintain in the pasture under ranching conditions.

are suitable for both cattle and sheep grazing. Some tree clearance may be necessary. The pasture is in good condition as lack of water has prevented overgrazing. The other five sites are in constantly over-grazed and burnt country characterized by the presence of Guiera senegalensis. Areas dominated by this species should be avoided for ranching purposes.

A legume establishment trial was conducted just north of Muglad on a very acid soil quite unsuited to legume growth.

The Ministry of Animal Production is in the process of evaluating an area of 144 square miles north-west of Babanusa known as the "Babanusa Ranch". It is planned to undertake aerial photography and soil surveys before a commitment is made to develop this area as a cattle ranch.

2.4 Cropping

Crops are grown throughout much of the rainfed country and the more efficient use of crop residues for livestock feeding should be encouraged. The main crops grown in these areas are Sorghum vulgare[(a)], Pennisetum typhoideum[(b)], Arachis hypogea[(c)], and Sesamum orientale[(d)].

In irrigated areas crop residues and fodder crops grown as part of the rotation are generally fully utilised but often in a haphazard manner. When irrigation water in the Gezira becomes available for 12 months of the year from the Sennar Dam, the extra two months of irrigation will be used mainly for fodder production and this could greatly assist in livestock production.

Fairly extensive areas of irrigated fodder sorghum[(e)] (Sorghum vulgare), lucerne (Medicago sativa)[(f)], Dolichos lab lab (lubia) and Clitoria ternatea are grown for stock at Soba, the Animal Production

(a) Sorghum - local name "dura".

(b) Millet - local name "dukhun".

(c) Groundnut, or peanut - local name "ful".

(d) Sesame - local name "simsim".

(e) Local name - Abu sabeen or Abu 70.

(f) Also known as alfalfa and as berseem in the Sudan but must not be confused with Trifolium alexandrium, the berseem clover of Egypt.

Corporation's stock finishing centre just south of Khartoum. Unfortunately the soil at Soba is alkaline and often highly saline and may not be suitable for continued irrigated cropping. Irrigated lucerne, fodder sorghum and maize (Zea mais) are grown successfully (for feeding to dairy cattle) on better soil than that mentioned above at Kuku in Khartoum North. (See Appendix VIII for more information on these soils.) Comparative yields for three crops grown at Soba and Kuku are:

Yields in tons dry matter/acre/annum

	Soba	Kuku
Lucerne	2.0	6.5
Dolichos lab lab	0.5	2.0
Fodder sorghum	1.5	4.0

3. PRESENT RESEARCH AND EXTENSION SERVICES

3.1 Pastures

The responsibility for this work is split between several ministries all working as isolated units and no real advance can be expected under these conditions. Planning, research and extension, in relation to pastures, should all be located in the one ministry and this should be closely linked to livestock production.

At Ghazala Gawazat, the Ministry of Animal Production's ranch in Darfur, a very useful herbarium has been assembled although accurate identification of many specimens is still awaited.

Apart from some analyses done by Boynes in 1955[(a)], little is known about the nutritive value of local pasture species. However, work done in Uganda[(b)] has shown that the dominant grasses on the black soil areas do not even provide sufficient protein for a maintenance ration for eight months of the year. The small scale planting of legumes

(a) Unpublished typescript tables entitled "Composition of Sudan Feeding Stuffs".

(b) R. M. Bredon, "The chemical composition and nutritive value of grasses from semi-arid areas of Karamoja as related to the ecology and types of soil" - East African Agricultural & Forestry Journal, 1963.

and grasses has been undertaken in introduction plots in several provincial areas, e. g. El Obeid, Ghazala Gawazat, Babanusa and Singa, but little or no follow up work has resulted.

3. 2 Crops

Both the University of Khartoum at Shambat and the Gezira Board's Research Station at Wad Medani are working on cropping practices, planting times, yield, fertiliser requirements and pest and disease control in relation to cash and fodder crops.

Extension work is very limited except in the main irrigation areas but recently some effort has been made to improve the methods used by rainland groundnut growers by distributing illustrated pamphlets showing the correct procedures.

4. DESCRIPTION OF SITES SELECTED FOR LIVESTOCK DEVELOPMENTS (Beef and Mutton)

4. 1 Mutton Sub-Project

4. 1. 1 Abu Gabra Holding Area

This proposed area is located either side of the Babanusa-Ed Da'ein railway line in the vicinity of the Abu Gabra siding, near the provincial boundary between Darfur and Kordofan. This area has a rainfall of approximately 500 mm per year.

Using the ecological classification of Harrison and Jackson, 1958, the area is low rainfall savanna on sand classified as 'Combretum cordofanum - Dalbergia - Albizzia sericocephela Savanna Woodland'.

When siting the actual boundaries the following are the better grasses and herbs that should be sought - Dactyloctenium aegyptium, Eragrostis tremula, Cenchrus biflorus, Andropogon gayanus, Blepharis linariifolia, Zornia glochidiate and Monechma hispidum.

4. 1. 2 Abu Sinun Holding Area

This holding area site is located some 32 km north-west of El Obeid where the average annual rainfall is 350-400 mm. The

vegetation has been described as low rainfall savanna on sand clasified as 'Acacia senegal savanna' (Harrison and Jackson).

Areas containing Eragrostis tremula and Cenchrus biflorus together with the herb Blepharis linariifolia should be sought in preference to areas of Aristida pallida which is an unpalatable grass that becomes dominant in this areas as grazing pressure increases.

4. 1. 3 Jebel Ed Dair Holding Area

This site is about 28 miles south-east of Er Rahad, between Khor Abu Habl and Khor Rigeila el Hamir. Rainfall averages about 600 mm.

The vegetation of this area was classified as "Acacia mellifera thornland" by Harrison and Jackson. The soil is generally a dark cracking clay, but there is sandy/stony soil close to the jebel.

4. 1. 4 Qala' en Nahl Sheep Ranches

Sheep breeding ranches will be located some 50 km south-west of Gedaref near Qala'en Nahl. The rainfall in this area is about 600 mm.

This area of low rainfall savanna on clay is classifed by Harrison and Jackson as 'Acacia seyal - Balanites savanna alternating with grass areas'. The soil is dark cracking clay.

The grass vegetation is dominated by tall rank growing tropical grasses represented by the following genera - Hyparrhenia, Setaria, Sorghum, Cymbopogon, Brachiara and Pennisetum. However, for sheep ranching areas should be selected where there is a reasonable percentage of shorter growing annual grasses and more browse plants.

4. 1. 5 Gezira Sheep Finishing Area

About 68, 000 feddans of the northern end of the scheme in the Faragin/El Laota area are to be progressively taken out of cotton as yields are uneconomically low. Five thousand feddans are already available and the Gezira Board has established a 700 feddan experimental mixed farm at Wad Busari to investigate the possibility of introducing

livestock as alternative enterprises. Soil survey data are already available for this area[a] and since lucerne is more susceptible to high sodium levels than cotton care will be needed to select areas which minimise this problem (see Appendix VIII). A further problem with fodders in this area will be that lucerne harbours some cotton pests and consequently the sites selected should be isolated as far as possible from areas which are to continue to grow cotton.

4. 2 Beef Sub-Project

4. 2. 1 Ghazala Gawazat Ranch

Ghazala Gawazat is located approximately 30 km east-north-east of Ed Da'ein on either side of the Ed Da'ein-Nyala railway line. The average annual rainfall is 459 mm.

The area reserved for the expansion of the existing research station of 210 quare miles is on the northern limit of the 'Baggara Repeating Pattern' which is characterised by irregular areas of sand and clay.

There is a good selection of the most desirable grasses and herbs[b] throughout the ranch area and the natural pasture should support one livestock unit per 25 acres without causing any pasture deterioration.

Several tree types are represented but Acacia mellifera (kitr) appears to be the only one causing problems at the present time, although reports that enclosure has resulted in this species spreading are not borne out by aerial inspection (there being no distinguishable difference in the density of kitr either side of the boundary fence). However, kitr tends to form thickets, particularly in lower lying areas where water collects, and some clearance may be advantageous. This is best done using a root rake on the front of a medium sized crawler

(a) FAO, Semi-detailed Soil Survey of Parts of the Central Clay Plain, (AGL:SF/SUD 15 Technical Report 3) Rome, 1970.

(b) These are listed in Chapter 1, Vol. II.

tractor. Being shallow rooted kitr can be pushed easily and stacked ready for burning. Spot spraying of regrowth with 2-4-5T may be necessary in some areas.

This ranch would be a suitable place to experiment with the cropping of groundnuts as an integrated enterprise with the cattle ranching. Provided that no area is cropped more frequently than once in three to four years, yields of up to 1,200 lbs of pods and 600 lbs dry matter of hay per feddan should be possible. Limited areas of groundnuts should be grown and thrashing should be done as soon as possible after digging so that a high quality hay can be made from the foliage.

Areas cropped in this way should then be sown to Cenchrus ciliarus and Stylosanthes mucronata at the beginning of the next wet season. If these species grow aggressively and dominate the native pasture species the area sown to them should be increased as quickly as possible. Some phosphatic fertiliser trials should be undertaken to observe its effect on the growth of S. mucronata.

4. 2. 2 El Meiram Ranches

Another area selected for cattle ranch development is situated south of Muglad, either side of the railway line, near El Meiram Station. The area receives about 700 mm of rainfall per year.

This area of low rainfall woodland savanna includes both the clays of the 'Raqaba Repeating Pattern' and the sand of the 'Terminalia - Sclerocaryea - Anogeissus - Prosopis Savanna Woodland' of Harrison and Jackson. The areas selected for ranches should keep in mind surface and underground water supplies, minimise timber treatment costs and provide approximately equal areas of sand and clay soil types to give the ranch maximum versatility. Areas that have been over-grazed will have a higher percentage of unpalatable grasses and should be avoided. The presence of the desirable herbs mentioned in Vol. II, Section 1. 11 should also be taken into account when the site is

being selected.

By selecting areas of sand and clay soils in a 700 mm rainfall zone a wide range of annual and perennial grasses will be represented and the ranches should support one livestock unit per 20 acres. Some thinning of tree stands on the sand areas may be desirable, if this is considered economically justified.

Groundnuts and fodder sorghum in particular could be grown on ranches in this area, but care would be necessary on the lighter soils to avoid the possibility of erosion.

The area offers the greatest scope of the sites selected for introducing new species of grasses and legumes (see Section 5. 3 below) since the rainfall is relatively high and there are areas of both sand and clay soils.

4. 2. 3 Doka Ranch

Doka is situated 70 km south-east of El Gedaref at latitude 13°23'N and longitude 35°45'E with an average annual rainfall of 737 mm. The siting of ranch boundaries will have to be done on the ground, taking into account water availability, density of tree growth, general topography and the presence of good stands of palatable grasses.

This area of low rainfall savanna on clay is classified by Harrison and Jackson as '*Acacia seyal*, *Balanites* Savanna alternating with grass areas' and merges with '*Anogeissus* - *Combretum hartmanni-anum* Savanna Woodland'. The soil can be described as black cotton or cracking clay and is similar to that being used for mechanised grain sorghum production. The land is almost flat with the only relief being a few khors[(a)] and jebels.

Roads remain impassable for most of the wet season and farm work is normally impossible during at least July and August.

Tree density varies throughout this area and there are often

(a) Watercourses which carry water only during the wet season.

large, almost treeless grass areas. These would be most suited to cultivation as tree clearance will be unnecessary for grazing areas unless unusually dense stands of Acacia seyal (Taleh) are encountered. If sufficient area of treeless plain cannot be found for cropping purposes, heavy equipment will have to be used to clear the trees.

The grass association is one of the tall growing tropical grasses mentioned in Section 4. 1. 4 above and should support one livestock unit to 20 acres throughout the year, with protein supplement. Additional cattle could be carried during June, July and August when the grasses are making their main growth and the quality of the feed would be improved by heavier stocking at this time. The pastures should support one livestock unit per 10 acres during this three month period.

In this area the most suitable crop to grow in conjunction with ranching would be grain sorghum. This would be harvested mechanically and then stock would be allowed to graze the stubble. Sorghum could be planted both at the beginning and towards the end of the wet season to give two harvests and thus two periods when fresh stubble was available for the cattle. However, early planting gives a higher yield of grain.

Sorghum planted at 15 lb per acre of seed should give an average yield of 1, 200 lb/acre and also supply 1. 5 tons of dry matter per acre from stubble.

Land would probably need fallowing for one year in four, even though the initial mineral status of the soil is high. Fertilisers may be required at a later stage and nitrogen is likely to be the first element to become a limiting factor. Fertiliser requirements for cropped areas should have been established on adjacent mechanised grain sorghum schemes by the time their use becomes necessary on the ranches.

Dolichos lab lab could be grown in rotation with grain sorghum and would help to maintain the nitrogen status of the soil. It would provide highly nutritious feed from September to December (yielding

1. 5 to 2 tons of dry matter per feddan if planted early in the wet season).

Trial plantings of Astrebla spp. (Mitchell grass) and Iseilema spp. (Flinders grass) should be undertaken in this area. Seed for the latter may be difficult to obtain.

5. PASTURE MANAGEMENT

5. 1 General Comments

All areas selected for ranching should be given one year's complete rest from grazing before the first stock are introduced unless they have previously been very lightly stocked. In any pasture system where all growth is made during, or just following, a short wet season, followed by seven or eight months with no rainfall, fire is a tremendous hazard as almost all fodder reserves are in the form of standing dry grass. Ranch areas, therefore, must be protected by fire lines around the perimeter and crossed by interior fire lines so that any accidental fire can quickly be isolated and brought under control.

Some form of pasture spelling and rotational grazing will be necessary and this should be controlled by fencing rather than herding. This is because to achieve a reasonable level of animal production stock will need to have pasture available to them for twenty-four hours a day, which means they cannot be shut in yards during the night. Just after the wet season stock should first graze areas watered by hafirs (earth tanks) until this water supply is exhausted.

The extent and timing of grazing will also depend on the species growing. Perennial grasses that tend to grow rank should be grazed heavily during their growing period and later allowed to seed. Annual grasses must not be grazed too heavily during the growing season as they must set a good supply of seed for the next year. Once they have seeded they can then be fully grazed whereas perennial grasses can never be grazed beyond about 40 per cent of their total dry matter yield if they are to persist in the same proportion in a pasture under these

conditions[a]. Experimental work should be undertaken to ascertain if greater production can be achieved from a mixture of annual and perennial grasses than from annual grasses alone under these environmental conditions[b].

Soil type also has a bearing on grazing management. During the wet season sandy soils should be used to avoid structural damage to the clay soils. Non-cracking soils should not be depleted of grass cover as they are very susceptible to wind erosion. Also if some grass stubble remains on them when the next rain falls it will assist moisture penetration. If any soils are to be completely grazed this should not be done until just before the start of the rainy season, to prevent wind erosion.

Some paddocks of pasture should be left ungrazed by the general flock or herd so that they can be used for special purposes such as weaning.

On Ghazala Gawazat particularly, the soil types coupled with availability of seasonal water will control the grazing management. Areas close to seasonal "hafirs" will have to be grazed first but no area should be completely denuded of grass and so exposed to erosion. Sand areas should be grazed during wet periods to avoid damage to clay areas. Management must also ensure that all grasses and legumes are allowed to set mature seed each year.

5. 2 The Use of Fire in Management

Burning should be avoided wherever possible in the management of the pastures in Darfur and Kordofan as grazing management should be used to control pastures. The only reason for using fire in the west would be to control bush regrowth on small areas. Limited areas

(a) Skerman, 1966, op. cit.

(b) To facilitate these management practices fence layout will be determined partly by the distribution of grass species, and not as at present by conforming to a grid pattern.

of the tall grasses in the Blue Nile area may have to be burnt or slashed in rotation if the feed has become too rank for the stock to utilise and while there is still enough moisture in the clay to encourage a green shoot. Fire will also be used to eliminate all the tall, rank, dry grass in these areas before the onset of the rainy season.

5. 3 Reseeding

The practice of planting improved pastures on a large scale on open range country could not be recommended at this stage nor is it likely to be of any real benefit until the basic problems of ranching and stock management have been solved. However, field trials should be initiated to test various species of grasses and legumes for their ability to establish and maintain productive stands in this environment. Once useful species have been identified seed production would have to be undertaken in the Sudan so that ample supplies of cheap seed would be available.

The first areas on which to try reseeding should be those that have been used for one crop of groundnuts, sorghum or millet. This land could be reseeded at the beginning of the following wet season. On sand or non-cracking clay areas Stylosanthes mucronata, S. humilis and Cenchrus ciliaris are suggested as the first species to try. If they establish well and flourish in this environment both are capable of quite rapid expansion. Mitchell grass (Astrebla spp.) grows well on deep cracking black clays in Australia under similar climatic conditions and together with Flinders grass (Iseilema spp.) and Urochloa mozambicensis it could be tried in the Blue Nile and Kassala provinces.

Large areas of non-cracking clay that forms an impervious surface layer when the first rain falls[(a)] occur in Kordofan and if these could be given a single ripping with a tyne implement and then planted to Buffel grass (C. ciliaris) it would not only bring them back into production but would help with moisture penetration in subsequent years

(a) "Gardud" soils.

5. 4 Timber Treatment

Timber treatment and bush control will be necessary in some areas where woody species have become so dense that they are greatly reducing grass growth through competition for light and moisture or where they are a mechanical obstruction to grazing. Great care should be taken that the land is not overcleared and that only the less desirable species are removed because trees are important in the prevention of erosion and also provide shade and shelter for stock[(a)]. Acacia seyal is used in Kenya for the drought feeding of cattle as they eat the bark and leaves when the tree is felled. This practice should only be regarded as a last resort in very bad years.

6. FODDERS AND FEEDSTUFFS

6. 1 Irrigated Fodders and Pastures

A recent study of the Gezira Scheme[(b)] stresses that additional fodder grown when year round water is made available[(c)] should be used to give a better ration to the livestock already in the area rather than trying to increase the number. At present all fodder crops, crop residues and volunteer growth on fallows and canal banks are already eaten by livestock or sold in large towns. Cotton pickers are attracted by allowing them to graze their stock within the area during the cotton picking season.

It is physically possible to grow large quantities of fodder which could either be grazed in situ or cut and carried to stock held in special enclosures. By-products and cash crop residues could be used to supplement this ration. It must be realised, however, that the good quality soils will have to be used for crop or pasture production if they are to be successful.

(a) Balanites aegyptiaca, which is difficult to clear by ring-barking or up-rooting, should be left as a shade tree.

(b) IBRD Gezira Study Mission, 1966, Annex II - Appendix 4, Livestock.

(c) Possibly from summer 1972 with the completion of work on the control gates at Sennar.

In this report schemes are proposed for both milk and meat production using irrigated fodders. In the case of dairying, provided that soils suitable for long term irrigation are chosen, any of the irrigated crops and pastures mentioned below would be suitable for dairy production, but the best milk yields would be obtained by feeding lucerne.

6. 1. 1 Lucerne/Berseem (Medicago sativa)

This is the most promising fodder crop as establishment costs can be spread over the three to four years of its life and with twenty-four waterings a year, yields of one to two tons per acre of green material can be expected per cut in the first year and three to four tons per acre per cut in subsequent years. Ten to twelve cuts per year can be obtained with the highest yields occurring in March and April and the lowest yields in October and November. Closer ridge spacings (or use of border check irrigation) and the use of fertilisers could further increase these yields. Some doubt seems to exist as to whether lucerne acts as a host to some cotton pests[(a)] and if this is the case it could limit the use of this crop in the Gezira area.

Lucerne should be planted in November and 20 lbs of seed per acre should be ample. With regular irrigation the first harvest should come in March and the stand should remain good for four years. Normally old stands would be ploughed out in September to allow time for land preparation and re-levelling before replanting in November. Provided weeds and disease do not become a problem there is no reason for fallowing well-drained sandy soils. All seed should be inoculated with the correct rhyzobium just before planting and fertiliser requirements will have to be established on the site. Where feed is cut and carted off the land, phosphate fertiliser will have to be used regularly and responses may also be gained from potassium, nitrogen and some of the minor elements. An annual top dressing of 80 kg single superphosphate, 20 kg of potassium chloride and 80 kg of urea per acre is suggested. Half of this should be applied in March and the other half in September.

(a) Such as a leaf worm (Prodenia) common in Egypt, white flies and a cut worm.

All animal manure from feed lots should be returned to lucerne areas.

Under good management the following yield pattern over four years should be obtained.

Lucerne Yield in tons of Dry Matter per acre

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Year 1	-	-	0. 50	0. 50	0. 5	0. 5	0. 5	0. 5	0. 5	0. 5	0. 5	1. 00
Year 2	1. 00	1. 00	1. 00	1. 00	1. 0	0. 5	0. 5	0. 5	0. 5	0. 5	0. 5	1. 00
Year 3	1. 00	1. 00	1. 00	1. 00	1. 0	0. 5	0. 5	0. 5	0. 5	0. 5	0. 5	0. 75
Year 4	0. 75	0. 75	0. 75	0. 75	0. 5	0. 5	0. 5	0. 5	-	-	-	-
Totals	2. 75	2. 75	3. 25	3 25	3. 0	2. 0	2. 0	2. 0	1. 5	1. 5	1. 5	2. 75

6. 1. 2 Fodder Sorghums

Abu sabeen is already grown widely in the Sudan and yields 10 ton green matter/acre at the first cut 75-80 days after planting, and then a further 5 tons of green matter/acre results from the total of two of three subsequent cuts. At Soba only 6 tons green matter/acre was claimed and at Shambat average yields as low as 3 tons per acre were quoted. Many other varieties of fodder sorghum and Sudan Grass (Sorghum sudanese) are also grown but varieties low in HCN must be selected to safeguard livestock. All sorghum varieties grow best in the summer.

6. 1. 3 Lubia (Dolichos lab lab)[a]

This legume has given best results in the Gezira area when planted in September but no irrigation has been allowed after January. With the prospect of year round water the Gezira Board has initiated trials varying the planting time to obtain data on yields and damage caused by pests and diseases. Yields of 4 metric tons per feddan of hay equivalent should be possible, although only half of this is being obtained at present[b].

(a) Now more correctly named Lablab niger.

(b) IBRD Gezira Study Mission.

6. 1. 4 Phillipesara (Phaseolus trilobus)

This legume can be planted in the summer and good growth can be obtained from rainfall alone but supplementary irrigation at a later stage would increase yields. Trials are also being conducted by the Gezira Board on this crop but little reliable yield data is available at present. However, seven to eight tons of green matter per acre could be expected.

6. 1. 5 Clitoria (Clitoria ternatea)

A perennial legume giving its main growth in the summer and a total yield higher than that obtained from Dolichos lab lab[(a)]. It is not favoured in cotton growing areas because of the difficulty in eradicating the root system. This legume has little trouble from pests and diseases.

6. 1. 6 Maize

This crop has only recently gained some popularity in the Sudan, and when planted in the winter it will outyield the fodder sorghums[(b)]. It is already being used successfully in the Kuku scheme.

6. 1. 7 Perennial Pastures

High levels of animal production could be obtained from irrigated pastures of grass/legume mixtures provided that soil types suitable for long term irrigation are selected. Adequate water would be required for year round irrigation and soil fertility would have to be maintained, as necessary, with fertilisers. Irrigated pastures are most suited to dairy production followed by sheep and then cattle in the Sudan.

No work of any consequence has been done in the Sudan on the growing of perennial pastures (except lucerne) in irrigation areas but it appears that legume/grass pastures or grass pastures fertilised with nigrogen could produce large quantities of relatively cheap fodder.

(a) University of Khartoum, Faculty of Agriculture - unpublished data.

(b) Yields of up to 20 tons green matter/feddan have been achieved at Shambat.

Using a border check or contour check system of irrigation, animals could graze these areas five to seven days after watering without damaging the soil and thus eliminate most of the harvesting costs. In the Gezira to keep in line with present soil management these pastures would not be irrigated in their fourth year so that the soil could dry out and crack to depth and the pasture would then be replanted the next year, after ploughing, levelling and bank repair had been carried out as necessary.

Experimental work should be initiated immediately to test the various tropical pasture species under local conditions. Plants that are already yielding commercially in other areas of similar climate, and of which seed is readily available, should be concentrated upon at the beginning. Pasture species should be selected for rapid establishment, high yield over the three to four year period of growth and for freedom from pests and diseases. Simple pasture mixtures will be easier to manage than more complex ones and they should be compared with pure stands of lucerne for yield and animal production results. One advantage over lucerne will be the reduction or abolition of bloat risk.

The following pasture alternatives are suggested:-

(i) Grass/Legume Mixture

6 lbs Lucerne

4 lbs Green Panic (Panicum maximum var trichoglume c. v. Petrie)

½ lb Buffel Grass (Cenchrus ciliaris)

This pasture should meet all the above requirements and should be able to carry at least one and a half livestock equivalents per acre the year round with approximately twenty waterings a year.

No fertiliser should be required in the early stages but for optimum production in later years application of phosphate and nitrogen may be necessary. Only local experimental work can establish these requirements.

(ii) Pangola Grass (Digitaria decumbens)

A pure stand of this highly digestible and nutritious grass would have to be planted from cuttings spread on the surface and lightly disced in ahead of irrigation. It is a very efficient user of nitrogenous fertilisers and levels of up to 200-400 lbs N/acre/annum could probably be used economically in split dressings (optimum levels being established by local experimental work). Sulphate of Ammonia should be tried in preference to urea because of the high soil pH.

Under irrigation and with such a reasonably heavy application of nitrogen as well as maintenance dressings of phosphate a high carrying capacity of at least 2 livestock units/feddan should be achieved on this grass. Bryan and Evans[(a)] achieved liveweight gains with cattle of 1, 100 kg/ha and 700 kg/ha with applications of 449 and 168 kg N/ha/year respectively under rainfed conditions in an area with an average rainfall of 1, 650 mm.

Unfortunately a virus disease has made this grass unproductive in parts of the Caribbean area but is still very productive in other parts of the world. Great care should be taken that healthy plants are chosen for the original planting material. Australia would be one of the safest sources for this material. One advantage of using this grass in an agricultural area is that it does not set any viable seed and once destroyed by a fallow it will not cause a weed problem in subsequent crops. Pangola grass is also reasonably tolerant of moderately high soil alkalinity and sodium levels.

6. 2 Crop Residues and By-products

The following crop residues and by-products are available for livestock feed:-

(i) Grain sorghum stubble.

(ii) Wheat straw.

(iii) Sugar cane tops and bagasse.

(a) W. W. Bryan and T. R. Evans, "A Comparison of Beef Production from Nitrogen Fertilised Pangola Grass and from a Pangola Grass Legume Pasture", Tripical Grasslands Vol. 5 No. 2, July 1971.

(iv) Groundnut hay and hulls.

(v) Oil-seed cakes (particularly cotton-seed cake).

(vi) Wheat bran.

(vii) Molasses.

(viii) Cereal grains unsuitable for human consumption or export (e. g. split sorghum grain).

Rainland grain sorghum is planted as soon as possible after the start of the wet season and harvesting commences in December. From this time on there is an abundance of sorghum stubble which is only partially used by the small numbers of local stock and in the Gedaref area by nomadic herds moving south from the Butana Plain. This roughage feed is therefore available at a time when stock throughout the savanna belt are generally losing weight and movement on the hoof from the western areas becomes impossible due to the shortage of feed and water. Large numbers of sheep and cattle could be finished in the Gedaref area to even out the supply for export during this period. There are direct rail links between Gedaref and the major livestock areas and to Port Sudan.

Yields of stubble should range between one and two tons dry matter per acre. As well as the sorghum stubble the fallow areas carry a heavy body of dry grass after the rainy season and although this becomes rank and coarse it also could be utilised to some extent. These low protein roughage feeds would have to be used with some supplements to obtain best results.

At present the main source of protein supplement is cotton-seed cake, but the continued use of this commodity is questionable on economic grounds. This is because there is a good export market available at an attractive price and consequently this oil-seed is an important foreign exchange earner. It would be preferable to concentrate on providing protein from other sources.

7. APPLIED RESEARCH PROGRAMME

7.1 Regional Pasture Evaluation

Pasture research is required to evaluate native grasses already present in the development areas and to compare their performance with introduced grasses and legumes. This will entail:

(a) A general soil survey to identify the major soil types in the area.

(b) Pasture trials to demonstrate the suitability of species for different soil types.

(c) The establishment of species evaluation plots on the major soil groups.

After selection of the most promising grasses and legumes, either native or introduced, they should be combined as a pasture mixture on a larger scale. When the pastures are established they should be subjected to intermittent grazing.

In the El Meiram and Gawazat areas the following grasses and legumes should be tested:-

(i) Grasses

Buffel grass (Cenchrus ciliaris) - a variety trial of the full range of the eight to ten varieties including tall, short and rhizomatous forms.

(ii) Legumes

Stylosanthes humilis - annual short season varieties, possibly 'Green Vale'; Stylosanthes guyanensis - perennial, possibly Cook, Endeavour or Schofield varieties; Stylosanthes mucronata - local variety; Phaseolus atropurpureus (Siratro) or P. lathyroides; and Cajanus cajan (Pigeon pea, shrub legume).

Nutrient trials should be incorporated with all these pasture evaluation trials. The main area of investigation would be the phosphate response at varying levels of application.

On the dark cracking clay soils of the Gedaref area, tests should be made with the following grasses:-

Urochloa mosambicensis; Urochloa bolbodes; Urochloa pullulans; Panicum colaratum, Variety Makarikariense; Panicum maximum, (Variety - Green Panic); and Chloris gayana (Rhodes grass).

Legumes should include:- Phaseolus lathyroides and/or Siratro; Dolichos axillaris; and Centrosema pubescens.

Initially all these trials can be on a small scale in order to minimise cost. The major costs will include seed, fertiliser and supervision. At a later date when the most promising species have been selected, larger scale trials will be required in areas where either sheep or cattle can be used to evaluate the grazing potential. The costs associated with this research would be similar to the normal costs of development recommended in the report. It is possible that research could be conducted within established facilities.

7.2 Carrying capacity trials on dryland pasture

These trials could be incorporated within the development of the proposed ranch areas and would involve very little additional cost. They should include:

(i) a test of the carrying capacity of a perennial Andropogon guyanensis grass pasture compared with a sown annual grass pasture; and

(ii) a comparison between native pasture performance at varying stocking rates and the performance gained from grass - legume pastures.

7.3 Irrigated Pasture Research

A specific trial is recommended to compare the performances of irrigated lucerne and irrigated pangola grass (the latter with applications of nitrogen). A grazing trial should be carried out with rotational crash grazing. The lucerne should be treated with phosphorus and potassium fertiliser and the pangola grass with nitrogen, phosphorus and potassium. Nitrogen should be added at the rate of 400 lbs/feddan/annum. A low, medium and high stocking rate with yearling to 18 month old male cattle or yearling to 18 month old sheep should be completed with two replications at the following stocking rates:

Low stocking intensity	-	1 L.S.E./feddan/annum
Medium stocking intensity	-	2 L.S.E./feddan/annum
High stocking intensity	-	3 L.S.E./feddan/annum

This research should commence as soon as possible on a reasonably large scale initially to test performance of the recommended pastures. In estimating total research investment requirements (Volume II, section 2.6), provision has been made for the cost of the seed, cultivation, fertiliser and stocking which will be necessary to implement this trial.

APPENDIX II

BEEF, MUTTON AND MILK PRODUCTION

1. PRESENT SITUATION

1.1 Beef

The following information was extracted from the 1970/71 records of Ghazal Gawazat:-

(i) Reproduction

Average age at first calving[(a)]	4 years 2 months
Calving interval[(b)]	19.4 months
Mortality to 18 months of 1970 calf crop	11.6%

(ii) Average Liveweight, 1970 calf crop

	Male (kg)	Female (kg)
Weight at weaning (c.7 months)	90.12	87.18
Weight at 12 months	115.30	106.57
Weight at 18 months	148.97	137.54

1.2 Mutton

A list of the principal sheep breeds and the tribes which own them is given in Table A2.1.

(a) Based on an average of 53 out of a random selection of 63 breeders in the Gawazat herd.

(b) Based on an average of 26 out of a random selection of 63 breeders.

TABLE A2.1 Producers of Ecotype 'Sudan Desert' Sheep

Ecotype 'Sudan Desert' Tribal Breed Sub-Divisions	Tribes Included	Area Covered
Good mutton types:		
(i) Kababish	Kakabish Hamar Kawahla Beni Garar Howawir Bediriya Dar Hamid Hassariya Gawamaa	From the White Nile to the Darfur uplands and North of the Kosti - Nyala railway line.
(ii) Butana	Shukriya	North of the Kassala - Gedaref railway line between the main Nile and Atbara rivers.
(iii) Gezira	Rufa'a (Fung) - el Sherig - el Hoi White Nile Baggara - Seleim - Ahamda - Muharib	Concentrated in or around the Gezira Scheme.
(iv) Watish	Watish (Fung)	Northern Upper Nile Province to Sennar
Lesser mutton types:		
(v) Meidob		Meidob Hills in N.E. Darfur.
(vi) North Riverine Wooled		Lower reaches of Main Nile.
(vii) Beja	Beja - Hadendowa - Besharin - Beni Amer - Amarar - Rashaida	Red Sea Coast, nearby hills and Atbai plain.

Source: McLeroy, G.B. (1961) The Sheep of Sudan (2). Ecotypes and Tribal Breeds. Sudan J. Vet. Sci. & Anim. Husb. Vol. 2 No. 2 101-165.

2. PROJECT CONSTRUCTION REQUIREMENTS

2.1 Ranches

Paddocks: Maximum paddock size for breeding herds should be 5,000 feddans in the case of cattle and 4,500 feddans in the case of sheep. Small paddocks will be required near dip yards for the purpose of weaning and other husbandry procedures. In the initial stages of development it may be advisable to have larger paddocks for dry cattle (i.e. one to three year old turn-off cattle and following heifers).

External Fencing: It is proposed to fence ranches externally with a four strand barbed-wire for cattle and six strands for sheep. The fence should be constructed in quarter mile strains with cement strainer posts and cement or steel intermediate posts 22 ft apart. It is suggested that steel intermediate posts be used in the initial stages of development. Some experimentation should also be done on the construction of cement posts with a small amount of re-inforcement. The low price of cement and the possibility that sufficient gravel and sand will be available locally could result in cheaper fences. The mixture for these cement posts would be one part cement, $1\frac{1}{2}$ parts sand, 3 parts of metal or gravel.

Internal Fencing: It is proposed that the internal fencing of cattle ranches be 3 barbed-wire suspension fence constructed in quarter mile strains with cement orsteel intermediate posts 40 yards apart. This fence should be supported between intermediate posts with 26" droppers.

The internal fencing of sheep ranches should be with 6 strands of plain wire, with strainer posts every $\frac{1}{2}$ mile, posts 22 feet apart and with one dropper between each pair of posts.

Watering Points: It is every important that a reliable and adequate source of year round water is available. Ranches have been proposed in areas where bore water can be made available. Bore holes should be

cased with 5" casing and equipped with pumps that can deliver a minimum of 1,000 gallons per hour. Water will be stored at the borehead in earth tanks constructed in areas of clay soil. The capacity of these storages will be about 300,000 gallons. This water will be reticulated in 2" polythene pipes to watering points in each of the paddocks. If possible, cattle should not have to walk more than four miles from feed to water.

Yards: Three sets of yards with plunge dip are to be constructed on each cattle ranch. One set will be constructed at the central buildings and the other two at outstations. It is suggested that the yards be built of railway line upright posts set in cement with round timber rails. These round timber rails should be treated with a preservative before construction.

2.2 Sheep Assembly and Finishing Areas

The three sheep assembly areas will be externally and internally fenced with six strand plain wire as described above for sheep ranches.

The only site suitable for the sinking of deep bores is Abu Gabra (Umm Ruwaba formation). The Jebel Abu Sinun and Jebel ed Dair sites overlie pre-cambrian basement complex, but both contain clay areas which are suitable for the construction of hafirs.

The sheep finishing area is to be ring-fenced and internally sub-divided into four 250 feddan paddocks. Further sub-division to facilitate intensive grazing management will be by means of movable electrical fences.

2.3 Cattle Feedlot

Railway line will probably be the cheapest and most efficient material for yard construction, although consideration should be given to using lighter steel piping if this is readily available. Upright posts should be set in concrete and two rails welded in turn to these uprights. A system of swinging gates and laneways should be installed to facilitate handling of cattle in the feedlot.

The yard in each feedlot will be large enough to accommodate about 2,400 head. Each of the feedlot pens (48 in all) is planned to be 54' x 66', giving it a capacity to hold 50 head of cattle of 18-30 months of age. Each pen should be provided with a separate watering facility and with self-feeders supplied by an automatic feeding system. Costs of the plant and equipment required are detailed in Appendix IX.

3. CATTLE MANAGEMENT

3.1 Breeding Programme

A controlled mating for a minimum of 3 months and a maximum of 4 months is recommended at the time of the year when most cows will be cycling, i.e. July-October. A desirable percentage of bulls to cows in herds of 100 or more would be 3-4 per cent. Two months after the bulls are removed all mated cows and heifers should be pregnancy tested. They should then be divided into early and late calving groups. Persistently non-pregnant cows should be culled.

At an average of 3-4 months of age all calves must be dehorned, earmarked and branded. All bull calves should be castrated except for replacement bulls.

An April-July calving will mean that most calves will be dropped either just before the rainy season or soon after it starts. By the time the calf is 2-3 months old and making an increasing demand on its dam for milk, the pasture quality will be at its peak to supply the cow with requisite nutrients. Experience under similar conditions in Australia has shown that late calving (Oct-Jan.) results in the dam having to supply milk to a 3-4 month old calf, when the requirement is at a maximum, during the nutritionally worst months of the year. This results in possible breeder mortality, a lapse of two years before the cow breeds again, and a reduced weaning weight of the calf.

Controlled mating (hence controlled calving) means that weaning can be carried out at one time, thereby reducing the total time and manpower required. Under the expected management conditions weaning is redommended

when calves are 6-8 months old, though earlier weaning at 5-7 months could increase calving percentages, since it would enable cows to be in better condition to conceive when mated. A good time to wean would be when cows are pregnancy tested.

On weaning calves should be placed on an area of fresh pasture which has been rested since the wet season. It would be advisable to feed 2-3 lbs/ day of a mixture of dura, urea and dicalcium phosphate for 2-3 weeks after weaning (see below). This will help overcome the severe nutritional stress at this time.

3.2 Supplementary Feeding

To achieve the projected performance from the breeding herd it will be necessary to provide supplementary feeding at various levels, according to the class of stock and the area concerned. The recommended supplements, which have been taken into account in estimating annual costs, are:-

(i) Phosphate Supplement. All females above the age of 12 months will be given free access to dicalcium phosphate for the whole year. It will have to be fed out in covered troughs to protect it from rain during the wet season. It has been asuumed that each beast will consume $\frac{1}{2}$ oz per day for the full twelve months.

(ii) Protein and Energy Supplement, consisting of a mixture of:

Dura	20 per cent
Urea	8 per cent
Dicalcium phosphate	52 per cent
Salt	20 per cent

Heavily pregnant cows and early calving cows should be fed 1 lb. per day of this ration for three months (April-June) at Gawazat and El Meiram and for four months (February-May) at Doka. All weaners should be fed $\frac{1}{2}$ lb. per day from weaning in December until the season breaks in June. The ration for working bulls should be $1\frac{1}{2}$ lb. per day for two months prior to mating.

3.3 Feedlot Rations

The cheapest and most efficient finishing ration at Gedaref has been formulated after due consideration of available feedstuffs (nutritional values and costs of alternative feedstuffs are given in Tables A2.2-4). It is based on locally grown dura stubble and rolled whole grain with molasses. There is a strong possibility that cracked grain from the harvest could be used in this ration. It would cost about half as much as whole grain and have the same nutritional value. This would improve the profitability of the feedlot appreciably. The ration on which cost calculations have been based consists of:-

	Ration Fed (kg/day)	Dry Matter (kg)
Grain - dura	3.18	2.86
Molasses	3.18	2.39
Milled dura stubble	2.72	2.45
Urea, Dicalcium Phosphate	.15	.15
Vitamin A	20,000 I.U. per day	
Antibiotic		
Total	9.23	7.85

With a projected throughput of 2,400 cattle approximately 2,000 tons of dura stubble will have to be baled every year.

On entry to the feedlot cattle will be fed a plain ration of dura stubble. Over the initial two week period grain will be added gradually to the dura stubble until at the end cattle will be consuming the required grain supplement.

It has been assumed that all animals entering the feedlot would have an average liveweight of 250 kg and carcase weight of 125 kg. With a daily weight gain of 0.9 kg, total liveweight gain during the 122 days when the animal is in the feedlot will be 110 kg; the carcase weight gain is expected to be 75 kg (68 per cent of the liveweight gain). Thus, on leaving the feedlot the beast should average 360 kg liveweight and 200 kg carcase weight.

TABLE A2.2 Nutritional Values - Local Sudanese Feedstuffs (1)

Feedstuff	Dry Matter %	Crude Protein %	Digestible Crude Protein %	Total Digestible Nutrients %
Oil Seed Cakes				
Cottonseed Cake (undecorticated)	93	23.0	18.0	60.0
Groundnut Cake (undecorticated)	93	33.0	26.4	62.0
Groundnut Cake (decorticated)	93	45.0	40.0	75.0
Sesame Cake	92	46.0	40.0	75.0
Grains				
Dura	90	13.0	10.4	80.0
Wheat	90	12.0	10.0	80.0
Roughages and Hay				
Groundnut Hay	90	10.5	4.7	40.0
Groundnut Hulls	95	6.0	1.6	18.0
Abu Sabeen Green	25	1.5	0.8	17.3
Dura Straw (gassab)	95	5.1	2.0	53.0
Dura Hay	90	6.2	3.3	
Sudan Grass Hay	90	6.8	2.5	
Wheat Straw	90	3.9	0.3	40.0
Wheat Bran	90	16.0	12.0	70.0
Lubia - Green	24	4.0	2.5	13.0
Lubia - Hay	90	14.0	10.0	50.0
Berseem - Green	24	4.1	2.6	13.5
Berseem - Hay	90	16.0	12.0	51.0
Clitoria - Green	24	4.0	2.5	13.0
Clitoria - Hay	90	15.0	11.0	50.0
Molasses	74	3.0	0.0	54.0

References: Morrison - Feeds and Feeding.

Nutrition Section - Merck Veterinary Manual.

Boynes - Table provided by Range Management Section, R. W. & D. C. - Composition of Sudan Feeding Stuffs.

Dr. Fadel Sheikh - Ph. D. thesis, Faculty of Agriculture, Univers of Khartoum.

TABLE A2.3 Nutritional Values - Local Sudanese Feed Stuffs (2)

Ingredient	Crude Protein	Moisture	Fibre	Nitrogen Free Extract	Oil
	%	%	%	%	%
Meatmeal	43.9	25.9	-	3.4	21.8
Bloodmeal	82.8	8.1	-	0.6	8.1
Bonemeal	27.9	5.8	-	3.7	5.8
Ground nutcake	-	-	-	-	-
Decorticated	36.3	4.4	10.3	30.7	11.9
Undecorticated	22.8	3.7	24.5	28.9	14.0
Cottonseed Cake					
Undecorticated	25.9	3.0	24.1	35.5	6.5
Sesame Cake	46.2	3.8	7.6	14.0	11.9
Dura	14.0	6.2	1.6	73.4	2.9
Wheat Bran	16.8	5.3	6.9	63.8	3.2

Bonemeal	Calcium	Phosphorus
	19.3%	13.5%

Source: Analyses done in U.K. of Sudanese feedstuffs collected by O.D.A. Poultry Adviser G. Goddard - 1970.

Notes:

Animal Protein

(i) Meatmeal - very low crude protein and poor quality due to primitive processing.

(ii) Maximum moisture in meatmeal is 10 per cent. Above this mould forms.

(iii) A high phosphorus in bonemeal recorded.

Vegetable Protein

(i) Oilseed cakes if high in oil have a reduced protein.

(ii) Sesame cake high in methionine.

TABLE A2.4 Unit Cost of Feedstuffs 1971-72

Ingredient	Cost per long ton (LS)	Cost per lb. (piastres) C.P.	D.C.P.	T.D.N.	D.M.
Cottonseed Cake - Undecorticated	17.50	3.40	4.35	1.30	0.90
Groundnut Cake - Undecorticated	19.00	2.55	3.20	1.35	0.90
Groundnut Cake - Decorticated	22.00	2.20	2.50	1.30	1.10
Sesame Cake	23.00	2.25	2.55	1.35	1.10
Dura Grain	20.00	6.90	8.55	1.10	1.00
Wheat Bran	11.50	3.20	4.30	0.75	0.55
Peanut Hulls	3.50	2.60	9.75	0.90	0.15
Gassab Hay	6.20	4.50	8.35	0.50	0.30
Green Chop Berseem (i.e. cost of production on dry matter basis)	4.40	1.30	1.70	0.40	0.20
Molasses	5.00	-	-	0.40	0.30
Urea	41.00	0.70	0.70	-	-

C.P. - Crude Protein

D.C.P. - Digestible Crude Protein

T.D.N. - Total Digestible Nutrients

D.M. - Dry Matter

3.4 Disease and Parasite Control

Systemic Diseases: Vaccination should be carried out on the ranch against all currently endemic diseases, viz: rinderpest, contagious bovine pleuro-pneumonia, anthrax, haemorragic septacaemia and blackleg.

Once all cattle on the ranch have been brought fully under control they should be tested for tuberculosis regularly and all reactors slaughtered. Sufficient amounts of Ethidium Bromide should be on hand to handle any outbreaks of Trypanosomiasis that may occur.

Infertility Diseases: The occurrence of Brucellosis in the herds should be investigated fully by carrying out blood tests on the breeders. There is a plan incorporated in the current Rinderpest Eradication Scheme (JP15) to test immunity afforded by tissue culture vaccination. This involves the taking of blood samples. When the cows are tested in this programme some of the sera from this sample could be used for the Brucella test.

All heifers should be vaccinated with Strain 19 between the ages of 6-8 months in order to control Brucellosis.

When the Veterinary Research Laboratory at Soba is completed, a simple Tampon test for Vibriosis should be run on the cows to ascertain the incidence of this disease. An efficient vaccine can be used to control this disease if it is present.

External Parasites (Ticks and Biting Flies): During the wet season all cattle should be dipped at least once a month for tick and fly control. It would be advisable to set up a mister over the crush leading out of the dip for the application of a specialised spray to give added protection against biting flies.

Internal Parasites: All young cattle should be injected at weaning with a suitable anthelmintic for worm control.

4. BEEF HERD PROJECTIONS

The detailed projections for the beef herd build-up on the proposed ranches is given in Table A2.5 and the co-efficients on which they are based are shown in Table A2.6. The two subsequent tables (A2.7-8) show the herd projections on which the sensitivity analyses in Volume II, Section 3.2.3, are based. The first indicates the pattern of a more rapid build-up of herd numbers than that adopted in the proposal and the second relates to the effect of increasing the store trading element on the beef ranches.

TABLE A2.5 Herd Projection Cattle Sub-Project

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18-20
3 year Cows	92	117	172	142	1,190	289	363	1,562	1,136	3,902	4,595	2,795	1,301	1,481	2,485	2,901	2,477	2,478
4 year Cows	80	84	234	1,333	135	1,131	274	345	2,504	1,036	3,596	4,278	2,608	252	287	681	1,632	2,355
5 year Cows	102	397	79	222	1,267	128	1,820	261	328	2,284	955	3,348	4,067	2,479	239	272	648	1,551
6 year Cows	82	94	370	75	211	2,176	122	1,730	248	299	2,105	889	3,183	3,866	2,357	227	259	616
7 year Cows	82	76	87	352	72	201	2,069	116	1,644	226	276	1,960	845	3,026	3,675	2,240	216	246
8 year Cows	73	76	71	82	334	69	191	1,967	111	1,499	208	257	1,863	804	2,876	3,494	2,130	206
9 year Cows	60	63	66	66	76	308	64	176	1,813	96	1,295	180	237	221	324	2,650	3,220	1,963
Bulls	28	44	49	98	143	187	229	294	375	451	617	626	642	601	612	603	528	522
Heifers 0-1	167	180	333	419	906	1,312	1,734	2,125	2,666	2,190	2,880	4,553	5,152	4,765	4,766	4,925	4,890	4,582
Heifers 1-2	191	155	167	313	394	852	1,233	1,630	1,997	2,479	2,037	2,678	4,280	4,843	4,479	4,480	4,629	4,597
Heifers 2-3	125	183	149	162	304	382	826	1,196	1,581	1,917	2,380	1,956	1,948	2,906	3,054	2,607	2,608	3,627
Steers 0-1	167	180	333	419	906	1,312	1,734	2,125	2,666	2,190	2,880	4,553	5,152	4,765	4,766	4,925	4,890	4,582
Steers 1-2	191	155	167	313	394	852	1,233	1,630	1,997	2,479	2,037	2,678	4,280	4,843	4,479	4,480	4,629	4,597
Steers 2-3	61	90	73	79	148	187	404	585	774	938	1,165	957	1,272	2,033	2,300	2,127	2,128	2,199
Others	41	41	42	51	51	59	239	50	137	1,218	64	870	140	-	-	251	2,056	2,498
Store Cattle	-	2,300	7,000	10,400	14,500	15,200	15,700	16,000	15,500	12,000	8,500	5,000	2,000	2,000	2,000	2,000	2,000	2,000
Total Cows	571	907	1,079	2,272	3,285	4,302	4,903	6,157	7,784	9,342	13,029	13,707	14,104	12,129	12,243	12,465	10,582	9,415
Targets (LSE)	1,300	4,000	9,000	14,000	20,000	23,000	26,000	29,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
Total (LSE)	1,300	4,000	9,000	14,000	20,000	23,000	26,000	29,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
Numbers Sold each Year																		
3 year Cows	4	4	3	3	3	23	6	7	30	55	150	132	103	1,010	1,150	1,729	1,182	48
4 year Cows	5	3	2	5	26	3	22	5	7	120	40	104	83	51	5	6	13	32
5 year Cows	4	4	11	2	4	25	2	35	5	16	88	28	65	79	48	5	5	13
6 year Cows	4	3	3	7	1	4	42	2	34	12	11	61	17	62	75	46	4	5
7 year Cows	4	3	2	2	7	1	4	40	2	79	9	8	38	16	59	71	43	4
8 year Cows	7	7	7	3	4	16	3	9	95	11	144	20	12	1,586	456	140	169	103
9 year Cows	17	17	18	13	13	15	60	12	34	522	28	373	35	230	214	63	514	625
Bulls	18	5	9	10	19	28	37	45	58	73	88	121	123	126	118	120	118	103
Heifers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	650	1,246	1,644	1,738	1,738	863
Heifers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	557	370	276	-	-	-
Steers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 1-2	61	90	73	80	149	187	405	586	774	939	1,165	958	1,272	2,033	2,301	2,128	2,128	2,199
Steers 2-3	67	59	86	71	77	144	181	392	567	743	900	1,118	928	1,234	1,972	2,231	2,063	2,064
Others	34	39	39	41	49	49	57	232	48	132	1,169	61	844	136	-	-	243	1,994
Store Cattle	-	2,300	7,000	10,400	14,500	15,200	15,700	16,000	15,500	12,000	8,500	5,000	2,000	2,000	2,000	2,000	2,000	2,000
Total Sales	225	2,534	7,253	10,637	14,852	15,695	16,519	17,365	17,154	14,702	12,292	7,984	6,727	10,179	10,318	10,277	10,220	10,053
Numbers Purchased each Year																		
3 year Cows	-	-	-	-	1,036	-	-	777	-	2,416	2,792	558	-	-	-	-	-	-
4 year Cows	-	-	125	1,169	-	-	-	-	1,019	-	-	-	-	-	-	-	-	-
5 year Cows	-	323	-	-	-	-	745	-	-	-	-	-	-	-	-	-	-	-
6 year Cows	-	-	-	-	-	972	-	-	-	-	-	-	-	-	-	-	-	-
Bulls	-	22	15	60	66	75	83	115	145	157	263	142	152	98	141	123	55	108
Heifers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Store Cattle	-	2,300	7,000	10,400	14,500	15,200	15,700	16,000	15,500	12,000	8,500	5,000	2,000	2,000	2,000	2,000	2,000	2,000
Total Purchases	-	2,645	7,140	11,629	15,602	16,247	16,528	16,892	16,664	14,573	11,555	5,700	2,152	2,098	2,141	2,123	2,055	2,108

TABLE A2.6 Herd Performance Data - Cattle Sub-Project

	Year: 1-3	4-20
Death Rates (Per cent)		
Cows	4	3
Bulls	2	2
Heifers 0-1	7	6
Heifers 1-2	4	3
Heifers 2-3	6	5
Steers 0-1	7	6
Steers 1-2	6	5
Steers 2-3	4	3
Others	4	3

Branding Percentages	Year: 1	2	3	4	5	6-20
Heifers 2-3	33	33	35	70	70	70
3 year Cows	50	55	63	63	70	75
Others	60	65	75	75	80	80

Culling Rates (Per cent)	Year: 1	2	3	4-20
Cows	5	4	3	2
8 year Cows	10	10	10	5
9 year Cows	30	30	30	20
Bulls	20	20	20	20
Heifers	-	-	-	-
Steers 0-1	-	-	-	-
Steers 1-2	50	50	50	50
Steers 2-3	100	100	100	100
Others	100	100	100	100

Livestock Conversion Factors	
Cows, Calves 2-3 & others	1.0
Bulls	1.5
Calves 0-1	.5
Calves 1-2	.75

Percentage of Bulls to Cows	Years: 1-4	5-20
	4%	3%

TABLE A2.7 Herd Projection Reflecting Increased Development Intensity - Cattle Sub-Project

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18-20
3 year Cows	92	117	172	142	1,190	289	363	1,562	1,136	3,902	4,594	2,795	1,301	1,481	2,485	2,901	2,477	2,478
4 year Cows	80	84	234	1,333	135	1,131	274	345	2,504	1,036	3,596	4,278	2,608	252	287	681	1,632	2,355
5 year Cows	102	397	79	222	1,267	128	1,820	261	328	2,284	955	3,348	4,067	2,479	239	272	648	1,551
6 year Cows	82	94	370	75	211	2,176	122	1,730	248	299	2,105	889	3,183	3,866	2,357	227	259	616
7 year Cows	82	76	87	352	72	201	2,069	116	1,644	226	276	1,960	845	3,026	3,675	2,240	216	246
8 year Cows	73	76	71	82	334	69	191	1,967	111	1,499	208	257	1,863	804	2,876	3,494	2,130	206
9 year Cows	60	63	66	66	76	308	64	176	1,813	96	1,295	180	237	221	324	2,650	3,220	1,963
Bulls	28	44	49	98	143	187	229	294	375	451	617	626	642	601	612	603	528	522
Heifers 0-1	167	180	333	419	906	1,312	1,734	2,125	2,666	2,190	2,880	4,553	5,152	4,765	4,766	4,925	4,890	4,582
Heifers 1-2	191	155	167	313	394	852	1,233	1,630	1,997	2,479	2,037	2,678	4,280	4,843	4,479	4,480	4,629	4,597
Heifers 2-3	125	183	149	162	304	382	826	1,196	1,581	1,917	2,380	1,956	1,948	2,906	3,054	2,607	2,608	3,627
Steers 0-1	167	180	333	419	906	1,312	1,734	2,125	2,666	2,190	2,880	4,553	5,152	4,765	4,766	4,925	2,890	4,582
Steers 1-2	191	155	167	313	394	852	1,233	1,630	1,997	2,479	2,037	2,678	4,280	4,843	4,479	4,480	4,629	4,597
Steers 2-3	61	90	73	79	148	187	404	585	774	938	1,165	957	1,272	2,033	2,300	2,127	2,128	2,199
Others	41	41	42	51	51	59	239	50	137	1,218	64	870	140	-	-	251	2,056	2,498
Store Cattle	-	2,300	11,000	16,400	22,500	21,200	19,700	18,000	15,500	12,000	8,500	5,000	2,000	2,000	2,000	2,000	2,000	2,000
Total Cows	571	907	1,079	2,272	3,285	4,302	4,903	6,157	7,784	9,342	13,029	13,707	14,104	12,129	12,243	12,465	10,582	9,415
Targets (LSE)	1,300	4,000	13,000	20,000	28,000	29,000	30,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
Total (LSE)	1,300	4,000	13,000	20,000	28,000	29,000	30,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
Numbers Sold each Year																		
3 year Cows	4	4	3	3	3	23	6	7	30	55	150	132	103	1,010	1,150	1,729	1,182	48
4 year Cows	5	3	2	5	26	3	22	5	7	120	40	104	83	51	5	6	13	32
5 year Cows	4	4	11	2	4	25	2	35	5	16	88	28	65	79	48	5	5	13
6 year Cows	4	3	3	7	1	4	42	2	34	12	11	61	17	62	75	46	4	5
7 year Cows	4	3	2	2	7	1	4	40	2	79	9	8	38	16	59	71	43	4
8 year Cows	7	7	7	3	4	16	3	9	95	11	144	20	12	1,586	456	140	169	103
9 year Cows	17	17	18	13	13	15	60	12	34	522	28	373	35	230	214	63	514	625
Bulls	18	5	9	10	19	28	37	45	58	73	88	121	123	126	118	120	118	103
Heifers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	650	1,246	1,644	1,738	1,738	863
Heifers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	557	370	276	-	-	-
Steers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 1-2	61	90	73	80	149	187	405	586	774	939	1,165	958	1,272	2,033	2,301	2,128	2,128	2,199
Steers 2-3	67	59	86	71	77	144	181	392	567	743	900	1,118	928	1,234	1,972	2,231	2,063	2,064
Others	34	39	39	41	49	49	57	232	48	132	1,169	61	844	136	-	-	243	1,994
Store Cattle	-	2,300	11,000	16,400	22,500	21,200	19,700	18,000	15,500	12,000	8,500	5,000	2,000	2,000	2,000	2,000	2,000	2,000
Total Sales	225	2,534	11,253	16,637	22,852	21,695	20,519	19,365	17,154	12,702	12,292	7,984	6,727	10,179	10,318	10,277	10,220	10,053
Numbers Purchased each Year																		
3 year Cows	-	-	-	-	1,036	-	-	777	-	2,416	2,792	558	-	-	-	-	-	-
4 year Cows	-	-	125	1,169	-	-	-	-	1,019	-	-	-	-	-	-	-	-	-
5 year Cows	-	323	-	-	-	-	745	-	-	-	-	-	-	-	-	-	-	-
6 year Cows	-	-	-	-	-	972	-	-	-	-	-	-	-	-	-	-	-	-
Bulls	-	22	15	60	66	75	83	115	145	157	263	142	152	98	141	123	55	108
Heifers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Store Cattle	-	2,300	11,000	16,400	22,500	21,200	19,700	18,000	15,500	12,000	8,500	5,000	2,000	2,000	2,000	2,000	2,000	2,000
Total Purchases	-	2,645	11,140	17,629	23,602	22,247	20,528	18,892	16,664	14,573	11,555	5,700	2,152	2,098	2,141	1,123	2,055	2,108

TABLE A2.8 Herd Projection Reflecting Increased Store Trading Percentage - Cattle Sub-Project

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18-20
3 year Cows	92	117	172	142	414	289	363	1,565	631	3,016	3,730	2,419	1,477	1,244	2,060	2,499	2,534	2,583
4 year Cows	80	84	234	484	135	394	274	345	2,578	576	2,779	3,474	2,299	1,183	454	1,263	1,332	2,409
5 year Cows	102	397	79	222	460	128	1,554	261	328	2,351	531	2,588	3,303	2,185	1,125	431	1,200	1,266
6 year Cows	82	94	370	75	211	1,629	122	1,477	248	299	2,167	495	2,460	3,140	2,077	1,069	410	1,141
7 year Cows	82	76	87	352	72	201	1,548	116	1,404	226	276	2,018	470	2,338	2,985	1,975	1,016	390
8 year Cows	73	76	71	82	334	69	191	1,472	111	1,281	208	257	1,918	447	2,223	2,837	1,878	966
9 year Cows	60	63	66	66	76	308	64	176	1,357	96	1,107	180	237	1,767	412	2,048	2,614	1,731
Bulls	28	44	49	64	80	136	186	243	312	376	511	524	552	589	559	592	548	533
Heifers 0-1	167	180	333	419	583	729	1,245	1,728	2,213	1,870	2,420	2,775	4,439	4,874	4,969	4,820	4,869	4,817
Heifers 1-2	191	155	167	313	394	548	685	1,170	1,624	2,058	1,739	2,251	3,548	4,173	4,582	4,671	4,531	4,577
Heifers 2-3	125	183	149	162	304	382	532	664	1,135	1,559	1,976	1,669	1,637	2,409	2,631	2,667	2,719	2,850
Steers 0-1	167	180	333	419	583	729	1,245	1,728	2,213	1,870	2,420	3,775	4,439	4,874	4,969	4,820	4,869	4,817
Steers 1-2	191	155	167	313	394	548	685	1,170	1,624	2,058	1,739	2,251	3,548	4,173	4,582	4,671	4,531	4,577
Steers 2-3	61	90	73	79	148	187	260	325	555	763	967	817	1,069	1,685	1,982	2,176	2,218	2,152
Others	41	41	42	51	51	59	239	50	137	912	64	744	140	184	1,371	320	1,590	2,029
Store Cattle	-	2,300	7,000	11,300	16,500	17,600	18,300	18,700	18,400	15,400	12,400	9,400	6,400	3,400	2,000	2,000	2,000	2,000
Total Cows	571	907	1,079	1,423	1,702	3,018	4,116	5,412	6,657	7,845	10,798	11,431	12,164	12,304	11,336	12,122	10,984	10,486
Targets (LSE)	1,300	4,000	9,000	14,000	20,000	23,000	26,000	29,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
Total (LSE)	1,300	4,000	9,000	14,000	20,000	23,000	26,000	29,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
Numbers Sold each Year																		
3 year Cows	4	4	3	3	3	8	6	7	30	30	116	107	47	250	753	735	1,092	49
4 year Cows	5	3	2	5	9	3	8	5	7	124	22	80	67	45	23	9	25	26
5 year Cows	4	3	11	2	4	9	2	30	5	16	90	15	50	64	42	22	8	23
6 year Cows	4	4	3	7	1	4	32	2	29	12	11	62	10	48	61	40	21	8
7 year Cows	4	3	2	2	7	1	4	30	2	67	9	8	39	9	45	58	38	20
8 year Cows	7	7	7	3	4	16	3	9	71	11	123	20	12	93	22	108	138	91
9 year Cows	17	17	18	13	13	15	60	12	34	391	28	319	35	46	343	80	397	507
Bulls	18	5	9	10	13	16	27	36	48	61	74	100	103	108	115	110	116	107
Heifers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	546	1,033	1,417	1,778	1,812	1,545
Heifers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	109	311	229	-	-	-
Steers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 1-2	61	90	73	80	149	187	261	326	556	764	968	818	1,069	1,686	1,982	2,177	2,219	2,152
Steers 2-3	67	59	86	71	77	144	181	252	315	531	732	928	792	1,037	1,634	1,923	2,111	2,151
Others	34	39	39	41	49	49	57	232	48	132	876	61	722	136	178	1,330	310	1,542
Store Cattle	-	2,300	7,000	11,300	16,500	17,600	18,300	18,700	18,400	15,400	12,400	9,400	6,400	3,400	2,000	2,000	2,000	2,000
Total Sales	225	2,534	7,253	11,537	16,729	18,052	18,941	19,641	19,545	17,539	15,449	11,918	10,001	8,266	8,844	10,370	10,287	10,221
Numbers Purchased each Year																		
3 year Cows	-	-	-	-	260	-	-	1,060	-	1,949	2,265	562	-	-	-	-	-	-
4 year Cows	-	-	125	320	-	-	-	-	1,090	-	-	-	-	-	-	-	-	-
5 year Cows	-	323	-	-	-	-	1,180	-	-	-	-	-	-	-	-	-	-	-
6 year Cows	-	-	-	-	-	1,192	-	-	-	-	-	-	-	-	-	-	-	-
Bulls	-	22	15	26	30	74	80	97	122	131	217	123	141	156	97	154	84	103
Heifers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Store Cattle	-	2,300	7,000	11,300	16,500	17,600	18,300	18,900	18,400	15,400	12,400	9,400	6,400	3,400	2,000	2,000	2,000	2,000
Total Purchases	-	2,645	7,140	11,646	16,790	18,866	19,560	19,857	19,612	17,480	14,882	10,085	6,541	3,556	2,097	2,154	2,084	2,103

5. SHEEP MANAGEMENT

5.1 Breeding Programme

After being drenched and quarantined on arrival at the ranch, breeding ewes should be separated into pregnant and non-pregnant flocks. The plane of nutrition should then be adjusted gradually according to whether they are to be flushed or maintained purely on a gestating diet. After three weeks, provided that no disease is apparent, the non-gestating ewes will be placed into the breeding block.

Feeding of ewes should be controlled to provide them with high or low planes of nutrition as follows:-

(i) Three weeks prior to mating feed $\frac{1}{4}$ lb of supplement/head/day.

(ii) First twelve weeks of gestation feed $\frac{1}{2}$ lb of supplement/head/day.

(iii) Last six weeks of gestation feed $\frac{1}{4}$ lb of supplement/head/day.

(iv) First 10-12 weeks of lactation feed $\frac{1}{2}$ lb/head/day.

The supplement should be as follows:-

Urea	-	6.5 per cent
Dura	-	55 per cent
Sesame cake	-	35 per cent
Salt with Vitamin A	-	3.5 per cent

Details of nutrient requirements are given in Table A2.9.

The rams which have been selected from the assembly areas on a basis of conformation, age and fertility (checked by palpating the testicles) will be maintained on an adequate diet at breeding units without being allowed to get too fat. Free breeding will be allowed at first to enable some estimation of any seasonal peaks[(a)]. By the division of sheep into flocks, according to their date of parturition, a definite pattern can be established. Batches of ewes which fail to conceive should be mated once again with new rams over a period of three oestrus cycles (about 42 days)

(a) A system of recording which rams are in with the ewes should be maintained in order to show up unproductive rams.

TABLE A2.9 Nutrient Levels for Different Classes of Sheep[(a)]

	Live weight (kg)	Energy (kg)	Dig. Prot. (gm)	Ca (gm)	P (gm)	Carotene (gm)	Feed (kg dry matter)
1. Dry ewes - First 15 weeks of gestation (slightly above maintenance)							
	35	0.38	40	3.0	2.5	1.5	1.1
	40	0.42	45	3.2	2.6	2.0	1.2
	45	0.47	50	3.2	2.7	2.0	1.3
	50	0.51	55	3.5	2.8	2.2	1.4
	55	0.54	55	3.9	2.9	2.3	1.4
2. Ewes - During last six weeks of gestation							
	35	0.60	65	4.0	3.0	5.0	1.5
	40	0.70	73	4.2	3.2	6.0	1.7
	45	0.76	80	4.3	3.5	6.5	1.8
	50	0.82	85	4.5	3.6	7.0	1.9
	55	0.86	88	4.8	3.7	8.0	2.1
	60	0.90	90	5.0	3.8	9.0	2.1
3. Ewes - First ten to twelve weeks of lactation							
	35	0.80	85	6.0	4.5	5.0	1.8
	40	0.92	95	6.5	4.5	6.0	2.0
	45	1.00	105	6.0	4.5	6.5	2.2
	50	1.10	110	6.5	4.5	7.0	2.3
	55	1.15	115	7.0	5.0	8.0	2.4
	60	1.20	120	7.0	5.0	9.0	2.5
4. Lambs - Female replacements							
	25	0.50	70	3.0	2.8	1.6	1.1
	30	0.58	68	3.0	2.8	2.0	1.3
	35	0.64	65	3.2	3.0	3.0	1.5
	40	0.65	65	3.5	3.0	3.5	1.5
5. Lambs - Fattening							
	25	0.55	75	3.0	2.8	1.0	1.2
	30	0.65	80	3.0	2.8	1.2	1.4
	35	0.80	85	3.2	3.0	1.4	1.5
	40	0.90	90	3.5	3.0	1.5	1.8
	50	1.20	90	3.5	3.0	1.9	2.1

Source: Faculty of Veterinary Science, University of Khartoum, Shambat.

(a) The above figures are slightly lower than those quoted for European sheep, and it is probable that experiments would show actual maintenance requirements to be lower (Williamson, G., and Payne, W.J.A. (1959) An Introduction to Animal Husbandry in the Tropics, Longmans).

in case the fault lies with the ram or other environmental factors. Any ewes which persistently fail to conceive should be culled as soon as possible.

Lambs should be weighed and securely ear-tagged as soon as they are born, and males castrated at four to six weeks of age to encourage maximum liveweight gains. Any heavy birth-weight males born as twins from good ewes may be kept entire and liveweight gains recorded so that the best performing rams are used for breeding. The potential breeding ram lambs should be grouped together in a separate pen or flock with their mothers and weaned at a later age. Any poor developers should be castrated and put in with the remaining lamb flock. Initially, lambs should be weaned at 4-5 months old when they are 15 to 20 kilogrammes liveweight. Two to three weeks prior to this the rams should be put in with the ewes. As management improves and the sheep become fully acclimatised, lambs can be weaned at three to three and a half months old.

Ewes that have to be culled can be sold or slaughtered immediately after weaning if in suitable condition. Alternatively, they may benefit by fattening for about a month. The culling policy should be so adjusted that rams and ewes are still in good condition when sold. Factors extending their productive life would be a shortage of breeding stock or a prevailing purchasing price. In this case the productive life might initially be six years, falling to five years as the supply is augmented from females bred on the units. Ultimately surplus female lambs could be slaughtered, sold to producers or exchanged for males on a ratio of say two females to three males.

5.2 Sheep Assembly Areas

Store sheep purchased in western Sudan will be taken to the nearest assembly area and be vaccinated and drenched on arrival. Animals would be held for one month on average, but this would depend on pasture availability and market requirements. This period could be extended for stock not ready for finishing.

One paddock should be grazed each month in a rotation that varies each year to enable annual grasses to mature and drop their seed. As sheep are not subjected to very great stress if watered every two or three days, a walk of ten kilometres from water to pasture is not considered excessive and the plan is therefore to maintain twenty-four hour grazing with a mounted shepherd as a guard who will camp with the flock. During the rains it may not be necessary to return to the central water supply, and grazing could extend further by utilising any available water in depressions. When grazing becomes a limiting factor, the assembly areas will be destocked with the transfer of animals by rail to the finishing area. The stocking rate at Jebel Abu Sinun may be controlled as the dry season advances by forwarding surplus sheep that require further holding to Jebel ed Dair.

5.3 Sheep Finishing Area

Suitable stock from assembly areas and from breeding units will be finished on berseem and/or Lubia/Abu 70 for varying periods up to six weeks depending upon age and quality. A gradual initiation period of approximately ten to fourteen days should be allowed for the introduction of sheep to any new rations. Trials on finishing on berseem and/or feed-lotting on concentrates should be established to estimate the most economic period and type of ration.

5.4 Sheep Flock Projections

The detailed projections for the sheep flock build-up on the proposed Qala' en Nahl ranches is given in Table A2.10 and the co-efficients on which they are based are explained in Table A2.11. The two subsequent tables (A2.12-13) show the flock projections on which the sensitivity analyses in Volume II, Chapter 3, are based. The first indicates the pattern of a more rapid build-up of flock numbers than that adopted in the proposal and the second relates to the effect of increasing the store trading element on the sheep ranches.

TABLE A2.10 Flock Projection Sheep Sub-Project

	1	2	3	4	5	6	7	8	9	10	11	12	13	14-20
2 year Ewes	1,000		1,000	2,758	3,053	4,254	5,836	9,750	11,396	11,520	20,136	15,488	17,931	
3 year Ewes	1,000	940	1,000	1,950	3,620	2,930	4,343	5,600	9,360	10,940	11,059	15,330	12,868	
4 year Ewes	1,000	940	883	1,450	2,352	3,475	2,812	4,169	5,376	8,985	10,502	10,616	11,717	
5 year Ewes	-	940	883	838	1,378	2,258	3,336	1,670	-	460	2,625	8,081	8,191	
6 year Ewes	-	-	883	838	796	1,323	-	-	-	-	-	-	-	
7 year Ewes	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rams	150	176	341	561	894	1,034	1,246	1,304	1,531	1,861	2,230	2,139	2,163	
Ewe Lambs	-	1,410	1,722	3,533	6,333	10,581	12,366	12,500	21,850	24,315	26,800	24,147	22,338	
Ewe Hoggets	-		1,325	1,635	3,528	6,079	10,157	11,871	12,000	20,976	21,342	19,720	18,181	
Wether Lambs	-	200	861	1,762	3,166	5,291	7,863	9,750	10,925	15,157	18,400	22,073	21,169	
Wether Hoggets	-	-	-	-	-	-	-	-	-	-	-	-	-	
Store Sheep	-	-	-	2,200	1,600	-	-	-	-	-	-	-	-	
Total Breeders	3,000	3,528	6,835	11,231	17,893	25,880	31,167	36,810	51,059	62,038	74,354	71,308	71,226	
Total (LSE)	3,225	4,000	8,000	16,000	24,000	32,000	40,000	48,000	64,000	80,000	96,000	96,200	96,000	
Target (LSE)	-	4,000	8,000	16,000	24,000	32,000	40,000	48,000	64,000	80,000	96,000	96,000	96,000	
Turnoff:														
Stock 3-7 years	-	-	-	838	796	978	3,688	4,500	3,867	5,067	6,887	14,055	16,269	12,000
Stock 1-2 years	-	1,210	1,049	2,580	4,839	8,329	15,762	23,126	20,285	31,646	44,950	65,737	67,359	70,000
Total:	-	1,210	1,049	3,418	5,635	9,307	19,450	27,626	24,152	36,713	51,837	79,792	83,628	82,000
Purchases:														
Rams	150	36	176	237	361	391	492	208	736	759	884	534	590	600
Ewes	3,000	-	2,000	3,000	3,000	1,000	-	-	-	-	-	-	-	-
Store Sheep	-	-	-	2,200	1,600	-	-	-	-	-	-	-	-	-
Total:	3,150	36	2,176	5,437	4,961	1,391	492	208	736	759	884	534	590	600

TABLE A2.11 Flock Performance Data - Sheep Sub-Project

	Year:	1 and 2	3 and 4	5-20
Death Rates (Per cent)				
Ewes		6	5	4
Rams		5	4	4
Ewe lambs		7	6	5
Ewe hoggets		6	5	4
Wether lamb		7	6	5
Wether hoggets		6	5	4

Marking Percentage	Year:	1	2	3	4	5-20
Ewe hoggets		50	50	50	50	50
2 year Ewes		90	100	105	115	120
Others		100	105	110	120	125

Culling Rates (Per cent)	Year:	1	2	3	4-20
Ewes (2-5 years)		3	2	2	2
6 year Ewes		10	25	50	100
7 year Ewes		100	100	100	100
Rams		20	20	20	20
Ewe lambs		2	2	2	2
Ewe hoggets		50	50	50	50
Wether lambs		2	2	2	2
Wether hoggets		100	100	100	100

Livestock Conversion Factors	
Ewes and Hoggets	1.0
Rams	1.5
Lambs	.5

Percentage Rams to Ewes	Year:	1 & 2	3 & 4	5-20
		6	5	4

TABLE A2.12 Flock Projection Reflecting Increased Development Intensity - Sheep Sub-Project

	1	2	3	4	5	6	7	8	9	10	11	12-20
2 year Ewes	1,000	-	1,000	2,758	3,053	5,524	7,836	11,752	15,257	15,902	15,927	
3 year Ewes	1,000	940	1,000	1,950	3,620	3,930	6,304	9,523	11,282	14,647	14,266	
4 year Ewes	1,000	940	883	1,450	2,352	3,475	4,273	6,552	8,183	10,831	13,062	
5 year Ewes	-	940	883	838	1,378	2,258	3,336	4,103	6,290	7,856	10,398	
6 year Ewes	-	-	883	838	796	1,323	2,168	3,203	-	1,000	-	
7 year Ewes	-	-	-	-	-	-	-	-	-	-	-	
Rams	150	176	341	561	894	1,394	1,674	1,858	2,257	2,116	2,168	
Ewe Lambs	-	1,410	1,722	3,533	6,333	10,581	16,554	24,850	28,783	24,687	23,891	
Ewe Hoggets	-	-	1,325	1,635	3,528	6,079	10,158	15,892	23,856	17,632	15,700	
Wether Lambs	-	200	861	1,762	3,166	5,291	8,277	12,425	18,392	22,348	20,945	
Wether Hoggets	-	-	-	-	-	-	-	-	-	-	-	
Store Sheep	-	-	-	2,200	1,600	12,700	19,400	18,800	-	-	-	
Total Breeders	3,000	3,528	6,835	11,231	17,893	27,880	41,852	61,950	75,260	70,555	72,298	
Total (LSE)	3,225	4,000	8,000	16,000	24,000	48,000	72,000	96,000	96,000	96,000	96,000	
Target (LSE)	-	4,000	8,000	16,000	24,000	48,000	72,000	96,000	96,000	96,000	96,000	
Turn-off:												
Stock 3-7 years	-	-	-	838	796	978	1,605	2,484	7,460	12,581	12,010	12,000
Stock 1-2 years	-	1,210	1,049	2,580	4,839	8,329	13,357	20,371	38,319	70,005	68,399	70,000
Total:	-	1,210	1,049	3,418	5,635	9,307	14,422	22,855	45,779	82,586	80,409	82,000
Purchases:												
Rams	150	36	176	237	361	750	670	652	919	490	620	
Ewes	3,000	-	2,000	3,000	3,000	3,000	3,000	3,000	-	-	-	
Store Sheep	-	-	-	2,200	1,600	12,700	19,400	18,800	-	-	-	
Total:	3,150	36	2,176	5,437	4,961	16,450	23,070	22,452	919	490	620	

TABLE A2.13 Flock Projection Reflecting Increased Store Trading Percentage - Sheep Sub-Project

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18-20
2 year Ewes	1,000		2,000	2,628	2,679	3,545	4,365	5,408	6,500	7,763	8,972	10,339	12,800	13,738	13,724	13,094	14,132	
3 year Ewes	1,000	1,204	1,000	2,400	2,996	3,072	3,903	4,690	5,691	6,740	7,952	9,113	11,252	12,788	13,189	13,176	12,571	
4 year Ewes	1,000	940	1,131	1,450	2,780	3,376	3,449	4,246	5,002	5,463	6,970	8,134	9,977	11,502	12,277	12,662	12,649	
5 year Ewes	-	940	883	1,074	1,378	2,668	3,241	3,345	4,076	4,801	5,724	6,691	7,808	9,578	11,042	11,786	12,156	
6 year Ewes	-	-	883	838	1,020	1,323	2,561	3,111	3,211	3,913	4,608	5,495	6,423	7,496	9,195	6,600	5,815	
7 year Ewes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rams	150	154	327	455	623	658	842	1,019	914	1,093	1,287	1,504	1,814	2,075	2,191	2,161	2,157	
Ewe Lambs	-	705	753	1,695	2,567	3,698	4,883	6,255	7,566	9,049	10,818	12,739	14,890	11,957	20,543	21,463	21,386	
Ewe Hoggets	-	-	-	715	1,610	2,464	3,550	4,688	6,004	7,263	8,687	10,385	12,229	14,295	13,639	14,720	14,600	
Wether Lambs	-	705	753	1,695	2,567	3,698	4,883	6,255	7,568	9,049	10,818	12,739	14,890	17,957	20,543	21,463	21,386	
Wether Hoggets	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Store Sheep	-	-	200	4,500	8,000	10,900	12,800	14,700	24,600	32,900	40,500	30,800	17,900	5,700	-	-	-	
Total Breeders	3,000	3,084	6,559	9,105	12,463	16,448	21,069	25,488	30,484	36,443	42,913	50,157	60,489	69,197	73,066	72,038	71,923	
Total (LSE)	3,225	4,000	8,000	16,000	24,000	32,000	40,000	48,000	64,000	80,000	96,000	96,000	96,000	96,000	96,000	96,000	96,000	
Target (LSE)	-	4,000	8,000	16,000	24,000	32,000	40,000	48,000	64,000	80,000	96,000	96,000	96,000	96,000	96,000	96,000	96,000	
Turnoff:																		
Stock 3-7 years	-	-	-	838	796	1,098	1,401	2,620	3,181	3,258	3,965	4,671	5,563	6,515	7,595	13,248	12,251	12,000
Stock 1-2 years	-	1,410	2,168	4,105	6,746	9,860	13,316	17,198	21,138	25,361	30,323	35,863	42,011	50,209	61,918	67,646	69,372	70,000
Total:	-	1,410	2,168	4,943	7,542	10,958	14,717	19,818	24,319	28,619	32,488	40,534	47,574	56,724	69,513	80,894	81,623	82,000
Purchases:																		
Rams	150	13	183	745	168	179	337	372	132	391	447	517	659	681	597	481	497	
Ewes	3,000	264	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	-	-	-	-	
Store Sheep	-	-	200	4,500	8,000	10,900	12,800	14,700	24,600	32,900	40,500	30,800	17,900	5,700	-	-	-	
Total:	3,150	277	3,383	7,645	11,168	14,079	16,137	18,072	27,732	36,291	43,947	34,317	21,559	6,481	597	481	497	

6. DAIRY HERD PROJECTIONS

6.1 El Qureshi Expansion

The total number of cows in the Qureshi herd has increased only slightly over recent years. In February 1966 there were 432 cows in milk, compared with 480 in milk in January 1972. There appears to be little difficulty in achieving an average life of 6 lactations. Zebu cattle attain their maximum yield between the 4th and 6th lactations while European cattle under Australian conditions also achieve their maximum yield in the 5th or 6th lactation. Many of the cattle in the herd at the present time have a productive life in excess of six lactations. Despite poor feet and loss of udder conformation, good cows can be retained in the herd to a considerable age due to zero grazing and hand milking.

Crossbred cattle in the Sudan calve at an average age of 33.8 months[(a)]. Thus, assuming an average productive life of six years and a first calf at 36 months, the herd could be expanded to 900 dairy cows in 7 or 8 years by retaining the maximum number of heifer calves for the first four years of the expansion programme (Table A2.14). The quality of the replacements reared during the expansion phase will depend largely on the herd sires. Only proven sires should be used and the opportunity should be taken to realise the advantages of imported semen from progeny tested animals obtained from reputable sources of supply.

In year 6 of the expansion phase more careful selection of replacement calves may commence and in year 7 the culling policy can be intensified.

In view of the low culling rate necessary to build up the herd in the early years, it may be necessary to return to a heavier culling programme later. From year 8 onwards the number of heifers reared will allow either replacement of 25 per cent of the adult cows or more careful selection of heifers.

(a) Danasoury, M.S., J. Anim. Prod., U.A.R., 1962, 2, 179-193.

TABLE A2.14 Projected Expansion of the El Qureshi Crossbred Milking Herd

Year:	1	2	3	4	5	6	7	8	9	10
Herd Composition										
Total cows	600	600	600	670	740	790	860	900	900	900
(Cows in milk)	(480)	(480)	(480)	(480)	(520)	(555)	(600)	(630)	(675)	(720)
Heifers over 2 years	150	150	225	225	225	255	285	285	285	285
Heifers 1-2 years	160	240	240	240	270	300	300	300	300	300
Heifers under 1 year	270	270	270	300	335	355	385	405	405	405
Coefficients										
Mortality of cows and 3 year old heifers	(40)	(40)	(45)	(45)	(50)	(55)	(60)	(60)	(60)	(60)
Cows culled	(110)	(110)	(110)	(110)	(125)	(130)	(185)	(225)	(225)	(225)
Mortality of heifers aged 1-2 years	(10)	(15)	(15)	(15)	(15)	(15)	(15)	(15)	(15)	(15)
Heifer calf mortality	(30)	(30)	(30)	(30)	(35)	(35)	(40)	(40)	(40)	(40)
Percent culling rate of mature cows	17	17	17	17	17	17	21.5	25	25	25
Percent total wastage of mature cows (culling and mortality)	25	25	26	23	23.5	23.5	28.5	31.5	31.5	31.5
Sales										
Milk - Daily (gals)	960	960	960	960	1,040	1,110	1,200	1,260	1,350	1,440
Annual (th. gals)	350.4	350.4	350.4	350.4	379.6	405.2	438.0	459.9	492.8	525.6
Male calves	270	270	270	300	335	355	385	405	405	405
Heifers	-	-	-	-	-	20	45	65	65	65
Revenue (LS)										
Milk at 25 pt/gal	87,600	87,600	87,600	87,600	94,900	101,300	109,500	114,975	123,200	131,400
Cull cows and heifers at LS 30	3,300	3,300	3,300	3,300	3,750	4,500	6,900	8,700	8,700	8,700
Bull calves at LS 5	1,350	1,350	1,350	1,500	1,675	1,775	1,925	2,025	2,025	2,025
Total:	92,250	92,250	92,250	92,400	100,325	107,575	118,325	125,700	133,925	142,125
Increase on present	-	-	-	150	8,075	15,325	26,075	33,450	41,675	49,875

The assessment of the milk produced by the El Qureshi herd is based on the present herd average yield of 600 gallons per lactation. At the present time 80 per cent of the cows are lactating, but this has been reduced to 70 per cent during the period when the herd is expanding rapidly.

It is anticipated that total milk production will rise to 1,440 gallons daily in year 10 of the expansion programme, of which 480 gallons would be attributable to the expansion programme.

The increase in herd numbers will necessitate the construction of more stockyards and buildings and increased fodder production will require more tillage equipment.

6.2 Establishment of Wad Medani and Atbara Crossbred Herds

The herd projections, resulting revenue and the coefficients assumed for the establishment of these two dairy herds are shown in Tables A2.15 and A2.16.

The breeding programme is based on the purchase of 2-3 year old heifers of the Kenana (or Butana) breeds and mating them with Friesian bulls (either obtained from El Qureshi or imported for the purpose). Artificial insemination could also be used and by this means semen from a much wider selection of proven bulls could be used. The feasibility of using A. I. to establish these herds will depend on the results achieved at Kuku with the present A.I. programme.

As crossbred cows come into milk in sufficient numbers local cows will be culled and the herd will gradually switch over to having only crossbreds in milk by year eight. When crossbred heifers are being mated, crossbred bulls, or crossbred semen, will be used to maintain the exotic Friesian blood in the herd at about 50 per cent.

Adequate skilled management and veterinary services are assumed to be provided where crossbred cattle are in use. Tick control must be efficient as exotic breeds and their crosses are particularly susceptible to tick borne diseases.

TABLE A2.15 Target Programme for Establishment of Wad Medani Crossbred Milking Herd (Zebu x Friesian)

Year:	1	2	3	4	5	6	7	8 (onwards)
Herd Composition								
Cows: Total	-	250	500	500	500	500	500	500
Zebu	-	250	500	500	418	257	99	-
Crossbred	-	-	-	-	82	243	401	500
Cows in milk: Total	-	175	350	350	350	350	350	350
Zebu	-	175	350	350	293	180	69	-
Crossbred	-	-	-	-	57	170	281	350
Heifers: 2-3 years	260	275	30	84	168	168	168	168
1-2 years	-	-	87	174	174	174	174	174
Less than 1 year	-	90	180	180	180	180	180	180
Bulls[a]	10	10	10	10	5	5	5	5
Livestock Units	145	425	620	690	730	730	730	730
Purchases								
Zebu heifers (2-3 years)	260	275	30	-	-	-	-	-
Bulls	10	-	-	5	-	-	-	-
Sales								
Milk - Daily (gals)	-	175	350	350	407	520	631	700
Annual (th. gals): Total	-	63.9	127.8	127.8	148.6	189.8	230.3	255.5
Zebu	-	63.9	127.8	127.8	106.9	65.7	25.2	-
Crossbred	-	-	-	-	41.6	124.1	205.1	255.5
Male calves	-	90	190	190	190	190	190	190
Cull cows and heifers	-	10	20	71	153	153	148	153
Bulls	-	-	-	10	-	-	5	-
Revenue (LS)								
Milk (25 pt/gal)	-	15,975	21,950	31,950	37,150	47,450	57,575	63,875
Male calves (LS 5/head)	-	450	950	950	950	950	950	950
Cull cows and heifers (LS 20/head)	-	200	400	1,420	3,060	3,060	3,060	3,060
Bulls (LS 30/head)	-	-	-	300	-	-	150	-
Total:	-	16,625	33,300	34,620	41,160	51,460	61,735	67,885

Coefficients

Average age at first calf	- 3½ years
Calving interval	- 15 months
Calving rate	- 80 per cent
Cows in milk	- 70 per cent
Lactation length	- 300 days
Milk yield (excl. calf milk): Zebu	- 1 gal/day
Zebu x Friesian	- 2 gal/day

Mortality Rates:

Calves (unweaned)	10 per cent
Heifers	3 per cent
Cows	2 per cent
Cow culling rate	20 per cent

Livestock Unit (LSU) Conversion Factors

Cow	1
Bull	1.25
Heifers 2-3 years	0.5
1-2 years	0.5
Less than 1 year	0.25

(a) Could be reduced more rapidly if A. I. is introduced successfully.

TABLE A2. 16 Target Programme for Establishment of Atbara Crossbred Milking Herd (Zebu x Friesian)

Year:	1	2	3	4	5	6	7	8 (onwards)
Herd Composition								
Cows: Total	-	350	700	700	700	700	700	700
Zebu	-	350	700	700	585	360	139	-
Crossbred	-	-	-	-	115	340	561	700
Cows in Milk: Total	-	245	490	490	490	490	490	490
Zebu	-	245	490	490	410	252	97	-
Crossbred	-	-	-	-	80	238	393	490
Heifers: 2-3 years	364	385	42	118	235	235	235	235
1-2 years	-	-	122	244	244	244	244	244
Less than 1 year	-	126	252	252	252	252	252	252
Bulls[a]	14	14	14	14	7	7	7	7
Livestock Units	200	595	870	965	1,020	1,020	1,020	1,020
Purchases								
Zebu heifers (2-3 years)	364	378	42	-	-	-	-	-
Bulls	14	-	-	7	-	-	-	-
Sales								
Milk - Daily (gals)	-	245	490	490	570	728	883	980
Annual (th. gals): Total	-	89.5	178.9	178.9	208.0	265.7	322.4	357.7
Zebu	-	89.5	178.9	178.9	149.6	91.9	35.2	-
Crossbred	-	-	-	-	58.2	173.7	287.1	357.7
Male calves	-	126	266	266	266	266	266	266
Cull cows and heifers	-	14	28	99	214	214	207	214
Bulls	-	-	-	14	-	-	7	-
Revenue (LS)								
Milk (25 pt/gal)	-	22,375	44,725	44,725	52,000	66,425	80,600	89,425
Male calves (LS 5/head)	-	630	1,330	1,330	1,330	1,330	1,330	1,330
Cull cows and heifers (LS 20/head)	-	280	560	1,980	4,280	4,280	4,140	4,280
Bulls (LS 30/head)	-	-	-	420	-	-	210	-
Total:	-	23,285	46,615	48,455	57,610	72,035	86,280	95,035

Coefficients - as for Wad Medani herd projection.

(a) Could be reduced more rapidly if A. I. is successful.

7. RESEARCH

The following research should be conducted as soon as possible in the fields of beef and mutton production:

(i) Weight performance: A comparison should be made of weight performance of livestock travelling on the hoof or by rail from various points in the producing areas to central Sudan; also of livestock travelling from Khartoum to Port Sudan and Jeddah. Trials should be conducted at different times of the year to determine seasonal effects and note should be taken of age and initial conformation. These tests could most conveniently be carried out by the Marketing Agency.

(ii) Reproductive Performance of Cows: Groups of 50 to 80 yearling unmated Baggara heifers should be purchased (in addition to those required as base stock for the ranches) for the following treatments: (a) a control group, to run with Butana bulls on native pasture only, with no feed supplement; (b) a group to run with Butana bulls on native pasture and a protein-phosphate supplement as recommended in the proposal; and (c) later, once sufficient improved grass/legume pastures have been established, a repetition of the experiment on these improved pastures. This would be a long-term experiment, but would provide invaluable information for the future beef ranching potential of the Sudan.

(iii) Reproductive Performance of Ewes: Ewes and breeding rams of different ecotypes should be selected for detailed recording of reproductive performance under varying climatic and soil conditions and different planes of nutrition. A few years' records should reveal the most profitable ecotypes.

(iv) Feedlotting of sheep: A small pilot feedlot should be incorporated under the Gedaref feedlot management. Experimental work on finishing Sudanese desert sheep has so far been confined to short periods on small samples purchased direct from traditional producers (Volume I, Section 4.3.1). More information should be available from the livestock farm at El Masid and the new El Huda sheep research station before the project commences. Feedlotting would have to be in the form of a small scale trial at first to test whether an expensive high protein/energy or a cheaper low protein/energy ration would be more economic in terms of cost related to liveweight gain. The feed conversion ratio of desert sheep is not high and the ration constituents must be of low cost per lb. of protein. The ration must be compound and fed so that excessive fat is not deposited. Young animals are particularly suited to this system and the required immature stock should be available from assembly area purchases.

(v) Infertility diseases in cattle: This trial should be designed to establish the incidence of infertility diseases in base cows likely to be used in the stocking of development ranches, and can be conducted on the basis of routine testing. Diseases to be investigated will include: Brucellosis, caused by the bacteria Brucella abortis; Vibriosis, caused by a number of strains of the bacterium Vibrio; Leptospirosis, caused by strains of the bacterium Leptospira; and Trichomoniasis, caused by the protozoa Trichomonas.

The whole of the recommended production research can be integrated with the development programme outlined in the report. The only funds required in addition to those budgeted for the production sub-projects will be for the purchase of heifers in the reproduction experiment, since the class of stock required will not be the same as those likely to be purchased as base stock for the ranches. Provision has been made for this and for the necessary supervision of all experimental work in estimating the total research investment requirements (Volume II, Section 2.6).

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APPENDIX I

PASTURES, RANGE MANAGEMENT, FODDERS AND FEEDSTUFFS

1. GEOGRAPHY AND PHYSICAL FACTORS

This appendix refers to areas within the savanna belt of the Sudan between latitudes 10°N and 16°N in the provinces of Darfur, Kordofan, Khartoum, Blue Nile and Kassala. The area is flat to gently undulating with occasional stony hill outcrops at an altitude lying between 400 and 600 metres A. S. L.

There is a reasonably reliable summer rainfall of from 150 mm to 800 mm increasing from north to south (Tables A1. 1 and A1. 2). Mean daily maximum temperatures range from about 42°C in the summer to 30°C in the winter while mean daily minimum temperatures range from about 24°C to 14°C.

The soils in general range from sand in the north and west to clay in the central, southern and eastern areas with narrow belts of alluvial soils along the major rivers. Stabilised sand dune areas called "Qoz" support good vegetation in low rainfall areas because the plants are able to make full use of available moisture. In comparison the non-cracking clays support only limited vegetation because of their inability to absorb moisture.

The self-mulching dark cracking clay soils found in the eastern region have a good mineral status and absorb moisture well until the cracks close. Surface flooding may occur above 600 mm of rainfall[(a)].

Soils are described in more detail in "Agriculture in the Sudan" edited by J. D. Tothill, 1948.

The vegetation varies greatly with rainfall and soil type but in

(a) W. O. Shepherd, FAO Publication No. TA2468, 1968. Range and Pasture Management.

TABLE A1.1 Annual Rainfall 1958-1970 (mm)

	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Gedaref	-	-	-	599.9	573.7	743.3	555.1	599.3	617.0	662.5	550.5	451.2	518.0	-
Ed Da'ein	-	-	-	501.0	657.0	394.5	555.0	572.2	433.5	387.0	425.0	429.5	443.0	-
Ghazala Gawazat	576.5	390.5	512.4	408.3	537.5	-	-	-	564.2	441.0	451.4	412.2	495.1	371.5
Muglad	-	-	-	650.0	561.5	509.0	-	-	471.0	-	-	-	-	-
Wad Medani	-	-	-	366.9	436.0	391.0	422.4	312.0	269.5	504.1	348.7	261.8	325.6	-

Source: Meteorological Department.

TABLE A1.2 Monthly Rainfall Averages (mm)

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Gedaref[(a)]	0	Tr	1	4	31	84	161	193	113	22	5	0	614
Doka[(a)]	0	0	0	4	36	139	195	215	118	27	3	0	737
Ed Da'ein[(b)]													480
Ghazala Gawazat[(c)]	0	0	2.8	7.5	13.6	69.7	102.7	157.3	85.2	20.6	0	0	459
Wad Medani[(a)]	Tr	Tr	Tr	1	15	29	116	133	48	19	1	Tr	362

Source: Meteorological Department.

(a) Average over 30 year period to 1970.

(b) Average for 10 years 1961 to 1970.

(c) Average for years 1958 to 1971 excluding 1964 and 1965.

Tr = Trace.

general there is good grazing on annual and perennial grasses and herbs during and just following the wet season. Heavy grazing plus the persistent use of fire has virtually eliminated perennial species from many areas.

Acacia is the most common genus of woody plants throughout the savanna area although many others occur in association with it.

M. N. Harrison and J. K. Jackson, 1958, "Ecological Classification of the Vegetation of the Sudan" is a very useful reference for further detail on vegetation.

2. PRESENT LAND USE

2. 1 Traditional Grazing

An unknown number of livestock graze, mainly nomadically, throughout the country and the over-grazing of many areas is very common, although some areas are under-utilised through lack of water. Over-grazing coupled with the indiscriminate use of fire has left many of the pasture areas in a very poor state and erosion, particularly wind erosion, is becoming a serious problem. The incidence of fire is slowly being reduced by the construction of fire lines and this policy should be encouraged. The most serious over-grazing occurs around villages where there is pressure both from village and nomadic stock. Some form of stock number control is necessary around villages, particularly in relation to goats. All grazing land is Government owned and the right of any tribe to graze a certain area is only held by tradition or usufructuary rights. In these circumstances it is very difficult to encourage planning for the long-term maintenance or improvement of the range.

Browse plants play a major part in the nutrition of camels, sheep and goats and to a smaller extent of cattle. For much of the year sheep gain most of their protein from this source.

Thickets of woody species, especially Acacias, occur in many

areas and some thinning of these would be beneficial but over-clearing must be avoided at all costs as trees prevent erosion and also provide shade and shelter.

Very little improvement in pasture management on the open range is possible under nomadic conditions where emphasis is placed on the total number of stock owned rather than on quality and off-take. However, the closing down of water points in some areas, at strategic times, could prevent some of the damage at present resulting from over-grazing. The reseeding of open range country would be futile under present conditions but the closure of areas from grazing from one to two years allows the natural pasture to come back strongly[(a)].

2. 2 Ghazala Gawazat Research Station

The Government livestock and grassland research station was established in 1956 on an area of 20 square miles near Ed Da'ein in Darfur province. A total area of 210 square miles of sandy and clay soils classifed as "Baggara Repeating Pattern" has been reserved for converting this station to a commercial ranch.

Initial observations have been carried out on:-

(a) Herd management. Under the herding system of management at present practiced at Gawazat areas of heavy clay are avoided (Naga, Gardud and Buta soils) during the wet season as these soil types are subject to poaching. Sand areas can be grazed all the year round and cracking clays (Buta) can be grazed heavily once they have dried out after the wet season.

(b) The effect of grazing on pasture composition. Monechma hispidum and Zornia glochidiata are the first species to germinate on clay soils after rain and unless grazing is controlled stock will stay on these areas until they are

(a) Document DOX-SUD - A47 (February 1966) prepared for United Nations Special Fund. Report on Pastures and Livestock in the Project Area submitted by Dr. P. J. Skerman.

grazed bare. Both are annuals and seed must be allowed to fall each year. Of the grasses D. aegypticiun is the first grazed. A. gayanus is being grazed out under the present grazing management at Gawazat even though stock are grazed outside the existing ranch during the wet season.

(c) Reseeding trials. Over seventy different varieties of A. gayanus have been collected and reseeding trials have resulted in very poor germination even where good seed beds have been prepared. Oversowing without preparing a seed bed has proved a complete failure.

(d) New proved species. A small area has been set aside for introduction plots and these can be irrigated. Apart from the collection of small quantities of seed and of specimens for the herbarium, little has resulted from these plots.

(e) Bush clearance. A. mellifera is the main species causing problems in the area and it has been found that fire alone will not control it but after removal of the mature bushes fire is advantageous in controlling the regrowth.

(f) Fire control. Standard 20 metre wide fire lines are used on Gawazat, dividing the area into one square mile blocks. No serious fire outbreaks have occurred since these have been constructed.

2. 3 Ranch Development in the Babanusa Area

Eight ranches, of approximately 100 sq. km each, have been sited in the Babanusa-Muglad area by the Ministry of Co-operation and Rural Development (see Figure 5. 2, Vol. I). These areas are at present unstocked and are protected by perimeter fire lines. The three sites in the Abu Lagig-Tiboon area were selected because they contained good stands of the favoured perennial grass Andropogon gayanus[(a)] and

(a) Although this grass may be difficult to maintain in the pasture under ranching conditions.

are suitable for both cattle and sheep grazing. Some tree clearance may be necessary. The pasture is in good condition as lack of water has prevented overgrazing. The other five sites are in constantly over-grazed and burnt country characterized by the presence of Guiera senegalensis. Areas dominated by this species should be avoided for ranching purposes.

A legume establishment trial was conducted just north of Muglad on a very acid soil quite unsuited to legume growth.

The Ministry of Animal Production is in the process of evaluating an area of 144 square miles north-west of Babanusa known as the "Babanusa Ranch". It is planned to undertake aerial photography and soil surveys before a commitment is made to develop this area as a cattle ranch.

2.4 Cropping

Crops are grown throughout much of the rainfed country and the more efficient use of crop residues for livestock feeding should be encouraged. The main crops grown in these areas are Sorghum vulgare[(a)], Pennisetum typhoideum[(b)], Arachis hypogea[(c)], and Sesamum orientale[(d)].

In irrigated areas crop residues and fodder crops grown as part of the rotation are generally fully utilised but often in a haphazard manner. When irrigation water in the Gezira becomes available for 12 months of the year from the Sennar Dam, the extra two months of irrigation will be used mainly for fodder production and this could greatly assist in livestock production.

Fairly extensive areas of irrigated fodder sorghum[(e)] (Sorghum vulgare), lucerne (Medicago sativa)[(f)], Dolichos lab lab (lubia) and Clitoria ternatea are grown for stock at Soba, the Animal Production

(a) Sorghum - local name "dura".

(b) Millet - local name "dukhun".

(c) Groundnut, or peanut - local name "ful".

(d) Sesame - local name "simsim".

(e) Local name - Abu sabeen or Abu 70.

(f) Also known as alfalfa and as berseem in the Sudan but must not be confused with Trifolium alexandrium, the berseem clover of Egypt.

Corporation's stock finishing centre just south of Khartoum. Unfortunately the soil at Soba is alkaline and often highly saline and may not be suitable for continued irrigated cropping. Irrigated lucerne, fodder sorghum and maize (Zea mais) are grown successfully (for feeding to dairy cattle) on better soil than that mentioned above at Kuku in Khartoum North. (See Appendix VIII for more information on these soils.) Comparative yields for three crops grown at Soba and Kuku are:

Yields in tons dry matter/acre/annum

	Soba	Kuku
Lucerne	2.0	6.5
Dolichos lab lab	0.5	2.0
Fodder sorghum	1.5	4.0

3. PRESENT RESEARCH AND EXTENSION SERVICES

3.1 Pastures

The responsibility for this work is split between several ministries all working as isolated units and no real advance can be expected under these conditions. Planning, research and extension, in relation to pastures, should all be located in the one ministry and this should be closely linked to livestock production.

At Ghazala Gawazat, the Ministry of Animal Production's ranch in Darfur, a very useful herbarium has been assembled although accurate identification of many specimens is still awaited.

Apart from some analyses done by Boynes in 1955[(a)], little is known about the nutritive value of local pasture species. However, work done in Uganda[(b)] has shown that the dominant grasses on the black soil areas do not even provide sufficient protein for a maintenance ration for eight months of the year. The small scale planting of legumes

(a) Unpublished typescript tables entitled "Composition of Sudan Feeding Stuffs".

(b) R. M. Bredon, "The chemical composition and nutritive value of grasses from semi-arid areas of Karamoja as related to the ecology and types of soil" - East African Agricultural & Forestry Journal, 1963.

and grasses has been undertaken in introduction plots in several provincial areas, e.g. El Obeid, Ghazala Gawazat, Babanusa and Singa, but little or no follow up work has resulted.

3.2 Crops

Both the University of Khartoum at Shambat and the Gezira Board's Research Station at Wad Medani are working on cropping practices, planting times, yield, fertiliser requirements and pest and disease control in relation to cash and fodder crops.

Extension work is very limited except in the main irrigation areas but recently some effort has been made to improve the methods used by rainland groundnut growers by distributing illustrated pamphlets showing the correct procedures.

4. DESCRIPTION OF SITES SELECTED FOR LIVESTOCK DEVELOPMENTS (Beef and Mutton)

4.1 Mutton Sub-Project

4.1.1 Abu Gabra Holding Area

This proposed area is located either side of the Babanusa-Ed Da'ein railway line in the vicinity of the Abu Gabra siding, near the provincial boundary between Darfur and Kordofan. This area has a rainfall of approximately 500 mm per year.

Using the ecological classification of Harrison and Jackson, 1958, the area is low rainfall savanna on sand classified as 'Combretum cordofanum - Dalbergia - Albizzia sericocephela Savanna Woodland'.

When siting the actual boundaries the following are the better grasses and herbs that should be sought - Dactyloctenium aegyptium, Eragrostis tremula, Cenchrus biflorus, Andropogon gayanus, Blepharis linariifolia, Zornia glochidiate and Monechma hispidum.

4.1.2 Abu Sinun Holding Area

This holding area site is located some 32 km north-west of El Obeid where the average annual rainfall is 350-400 mm. The

vegetation has been described as low rainfall savanna on sand clasified as 'Acacia senegal savanna' (Harrison and Jackson).

Areas containing Eragrostis tremula and Cenchrus biflorus together with the herb Blepharis linariifolia should be sought in preference to areas of Aristida pallida which is an unpalatable grass that becomes dominant in this areas as grazing pressure increases.

4. 1. 3 Jebel Ed Dair Holding Area

This site is about 28 miles south-east of Er Rahad, between Khor Abu Habl and Khor Rigeila el Hamir. Rainfall averages about 600 mm.

The vegetation of this area was classified as "Acacia mellifera thornland" by Harrison and Jackson. The soil is generally a dark cracking clay, but there is sandy/stony soil close to the jebel.

4. 1. 4 Qala' en Nahl Sheep Ranches

Sheep breeding ranches will be located some 50 km south-west of Gedaref near Qala'en Nahl. The rainfall in this area is about 600 mm.

This area of low rainfall savanna on clay is classifed by Harrison and Jackson as 'Acacia seyal - Balanites savanna alternating with grass areas'. The soil is dark cracking clay.

The grass vegetation is dominated by tall rank growing tropical grasses represented by the following genera - Hyparrhenia, Setaria, Sorghum, Cymbopogon, Brachiara and Pennisetum. However, for sheep ranching areas should be selected where there is a reasonable percentage of shorter growing annual grasses and more browse plants.

4. 1. 5 Gezira Sheep Finishing Area

About 68, 000 feddans of the northern end of the scheme in the Faragin/El Laota area are to be progressively taken out of cotton as yields are uneconomically low. Five thousand feddans are already available and the Gezira Board has established a 700 feddan experimental mixed farm at Wad Busari to investigate the possibility of introducing

livestock as alternative enterprises. Soil survey data are already available for this area[(a)] and since lucerne is more susceptible to high sodium levels than cotton care will be needed to select areas which minimise this problem (see Appendix VIII). A further problem with fodders in this area will be that lucerne harbours some cotton pests and consequently the sites selected should be isolated as far as possible from areas which are to continue to grow cotton.

4. 2 Beef Sub-Project

4. 2. 1 Ghazala Gawazat Ranch

Ghazala Gawazat is located approximately 30 km east-north-east of Ed Da'ein on either side of the Ed Da'ein-Nyala railway line. The average annual rainfall is 459 mm.

The area reserved for the expansion of the existing research station of 210 quare miles is on the northern limit of the 'Baggara Repeating Pattern' which is characterised by irregular areas of sand and clay.

There is a good selection of the most desirable grasses and herbs[(b)] throughout the ranch area and the natural pasture should support one livestock unit per 25 acres without causing any pasture deterioration.

Several tree types are represented but Acacia mellifera (kitr) appears to be the only one causing problems at the present time, although reports that enclosure has resulted in this species spreading are not borne out by aerial inspection (there being no distinguishable difference in the density of kitr either side of the boundary fence). However, kitr tends to form thickets, particularly in lower lying areas where water collects, and some clearance may be advantageous. This is best done using a root rake on the front of a medium sized crawler

(a) FAO, Semi-detailed Soil Survey of Parts of the Central Clay Plain, (AGL:SF/SUD 15 Technical Report 3) Rome, 1970.

(b) These are listed in Chapter 1, Vol. II.

tractor. Being shallow rooted kitr can be pushed easily and stacked ready for burning. Spot spraying of regrowth with 2-4-5T may be necessary in some areas.

This ranch would be a suitable place to experiment with the cropping of groundnuts as an integrated enterprise with the cattle ranching. Provided that no area is cropped more frequently than once in three to four years, yields of up to 1, 200 lbs of pods and 600 lbs dry matter of hay per feddan should be possible. Limited areas of groundnuts should be grown and thrashing should be done as soon as possible after digging so that a high quality hay can be made from the foliage.

Areas cropped in this way should then be sown to Cenchrus ciliarus and Stylosanthes mucronata at the beginning of the next wet season. If these species grow aggressively and dominate the native pasture species the area sown to them should be increased as quickly as possible. Some phosphatic fertiliser trials should be undertaken to observe its effect on the growth of S. mucronata.

4. 2. 2 El Meiram Ranches

Another area selected for cattle ranch development is situated south of Muglad, either side of the railway line, near El Meiram Station. The area receives about 700 mm of rainfall per year.

This area of low rainfall woodland savanna includes both the clays of the 'Raqaba Repeating Pattern' and the sand of the 'Terminalia - Sclerocaryea - Anogeissus - Prosopis Savanna Woodland' of Harrison and Jackson. The areas selected for ranches should keep in mind surface and underground water supplies, minimise timber treatment costs and provide approximately equal areas of sand and clay soil types to give the ranch maximum versatility. Areas that have been over-grazed will have a higher percentage of unpalatable grasses and should be avoided. The presence of the desirable herbs mentioned in Vol. II, Section 1. 11 should also be taken into account when the site is

being selected.

By selecting areas of sand and clay soils in a 700 mm rainfall zone a wide range of annual and perennial grasses will be represented and the ranches should support one livestock unit per 20 acres. Some thinning of tree stands on the sand areas may be desirable, if this is considered economically justified.

Groundnuts and fodder sorghum in particular could be grown on ranches in this area, but care would be necessary on the lighter soils to avoid the possibility of erosion.

The area offers the greatest scope of the sites selected for introducing new species of grasses and legumes (see Section 5. 3 below) since the rainfall is relatively high and there are areas of both sand and clay soils.

4. 2. 3 Doka Ranch

Doka is situated 70 km south-east of El Gedaref at latitude $13^{o}23'N$ and longitude $35^{o}45'E$ with an average annual rainfall of 737 mm. The siting of ranch boundaries will have to be done on the ground, taking into account water availability, density of tree growth, general topography and the presence of good stands of palatable grasses.

This area of low rainfall savanna on clay is classified by Harrison and Jackson as '*Acacia seyal*, *Balanites* Savanna alternating with grass areas' and merges with '*Anogeissus* - *Combretum hartmannianum* Savanna Woodland'. The soil can be described as black cotton or cracking clay and is similar to that being used for mechanised grain sorghum production. The land is almost flat with the only relief being a few khors[(a)] and jebels.

Roads remain impassable for most of the wet season and farm work is normally impossible during at least July and August.

Tree density varies throughout this area and there are often

(a) Watercourses which carry water only during the wet season.

large, almost treeless grass areas. These would be most suited to cultivation as tree clearance will be unnecessary for grazing areas unless unusually dense stands of Acacia seyal (Taleh) are encountered. If sufficient area of treeless plain cannot be found for cropping purposes, heavy equipment will have to be used to clear the trees.

The grass association is one of the tall growing tropical grasses mentioned in Section 4. 1. 4 above and should support one livestock unit to 20 acres throughout the year, with protein supplement. Additional cattle could be carried during June, July and August when the grasses are making their main growth and the quality of the feed would be improved by heavier stocking at this time. The pastures should support one livestock unit per 10 acres during this three month period.

In this area the most suitable crop to grow in conjunction with ranching would be grain sorghum. This would be harvested mechanically and then stock would be allowed to graze the stubble. Sorghum could be planted both at the beginning and towards the end of the wet season to give two harvests and thus two periods when fresh stubble was available for the cattle. However, early planting gives a higher yield of grain.

Sorghum planted at 15 lb per acre of seed should give an average yield of 1, 200 lb/acre and also supply 1. 5 tons of dry matter per acre from stubble.

Land would probably need fallowing for one year in four, even though the initial mineral status of the soil is high. Fertilisers may be required at a later stage and nitrogen is likely to be the first element to become a limiting factor. Fertiliser requirements for cropped areas should have been established on adjacent mechanised grain sorghum schemes by the time their use becomes necessary on the ranches.

Dolichos lab lab could be grown in rotation with grain sorghum and would help to maintain the nitrogen status of the soil. It would provide highly nutritious feed from September to December (yielding

1. 5 to 2 tons of dry matter per feddan if planted early in the wet season).

Trial plantings of Astrebla spp. (Mitchell grass) and Iseilema spp. (Flinders grass) should be undertaken in this area. Seed for the latter may be difficult to obtain.

5. PASTURE MANAGEMENT

5. 1 General Comments

All areas selected for ranching should be given one year's complete rest from grazing before the first stock are introduced unless they have previously been very lightly stocked. In any pasture system where all growth is made during, or just following, a short wet season, followed by seven or eight months with no rainfall, fire is a tremendous hazard as almost all fodder reserves are in the form of standing dry grass. Ranch areas, therefore, must be protected by fire lines around the perimeter and crossed by interior fire lines so that any accidental fire can quickly be isolated and brought under control.

Some form of pasture spelling and rotational grazing will be necessary and this should be controlled by fencing rather than herding. This is because to achieve a reasonable level of animal production stock will need to have pasture available to them for twenty-four hours a day, which means they cannot be shut in yards during the night. Just after the wet season stock should first graze areas watered by hafirs (earth tanks) until this water supply is exhausted.

The extent and timing of grazing will also depend on the species growing. Perennial grasses that tend to grow rank should be grazed heavily during their growing period and later allowed to seed. Annual grasses must not be grazed too heavily during the growing season as they must set a good supply of seed for the next year. Once they have seeded they can then be fully grazed whereas perennial grasses can never be grazed beyond about 40 per cent of their total dry matter yield if they are to persist in the same proportion in a pasture under these

conditions[a]. Experimental work should be undertaken to ascertain if greater production can be achieved from a mixture of annual and perennial grasses than from annual grasses alone under these environmental conditions[b].

Soil type also has a bearing on grazing management. During the wet season sandy soils should be used to avoid structural damage to the clay soils. Non-cracking soils should not be depleted of grass cover as they are very susceptible to wind erosion. Also if some grass stubble remains on them when the next rain falls it will assist moisture penetration. If any soils are to be completely grazed this should not be done until just before the start of the rainy season, to prevent wind erosion.

Some paddocks of pasture should be left ungrazed by the general flock or herd so that they can be used for special purposes such as weaning.

On Ghazala Gawazat particularly, the soil types coupled with availability of seasonal water will control the grazing management. Areas close to seasonal "hafirs" will have to be grazed first but no area should be completely denuded of grass and so exposed to erosion. Sand areas should be grazed during wet periods to avoid damage to clay areas. Management must also ensure that all grasses and legumes are allowed to set mature seed each year.

5. 2 The Use of Fire in Management

Burning should be avoided wherever possible in the management of the pastures in Darfur and Kordofan as grazing management should be used to control pastures. The only reason for using fire in the west would be to control bush regrowth on small areas. Limited areas

(a) Skerman, 1966, op. cit.

(b) To facilitate these management practices fence layout will be determined partly by the distribution of grass species, and not as at present by conforming to a grid pattern.

of the tall grasses in the Blue Nile area may have to be burnt or slashed in rotation if the feed has become too rank for the stock to utilise and while there is still enough moisture in the clay to encourage a green shoot. Fire will also be used to eliminate all the tall, rank, dry grass in these areas before the onset of the rainy season.

5. 3 Reseeding

The practice of planting improved pastures on a large scale on open range country could not be recommended at this stage nor is it likely to be of any real benefit until the basic problems of ranching and stock management have been solved. However, field trials should be initiated to test various species of grasses and legumes for their ability to establish and maintain productive stands in this environment. Once useful species have been identified seed production would have to be undertaken in the Sudan so that ample supplies of cheap seed would be available.

The first areas on which to try reseeding should be those that have been used for one crop of groundnuts, sorghum or millet. This land could be reseeded at the beginning of the following wet season. On sand or non-cracking clay areas Stylosanthes mucronata, S. humilis and Cenchrus ciliaris are suggested as the first species to try. If they establish well and flourish in this environment both are capable of quite rapid expansion. Mitchell grass (Astrebla spp.) grows well on deep cracking black clays in Australia under similar climatic conditions and together with Flinders grass (Iseilema spp.) and Urochloa mozambicensis it could be tried in the Blue Nile and Kassala provinces.

Large areas of non-cracking clay that forms an impervious surface layer when the first rain falls[(a)] occur in Kordofan and if these could be given a single ripping with a tyne implement and then planted to Buffel grass (C. ciliaris) it would not only bring them back into production but would help with moisture penetration in subsequent years

(a) "Gardud" soils.

5. 4 Timber Treatment

Timber treatment and bush control will be necessary in some areas where woody species have become so dense that they are greatly reducing grass growth through competition for light and moisture or where they are a mechanical obstruction to grazing. Great care should be taken that the land is not overcleared and that only the less desirable species are removed because trees are important in the prevention of erosion and also provide shade and shelter for stock[(a)]. Acacia seyal is used in Kenya for the drought feeding of cattle as they eat the bark and leaves when the tree is felled. This practice should only be regarded as a last resort in very bad years.

6. FODDERS AND FEEDSTUFFS

6. 1 Irrigated Fodders and Pastures

A recent study of the Gezira Scheme[(b)] stresses that additional fodder grown when year round water is made available[(c)] should be used to give a better ration to the livestock already in the area rather than trying to increase the number. At present all fodder crops, crop residues and volunteer growth on fallows and canal banks are already eaten by livestock or sold in large towns. Cotton pickers are attracted by allowing them to graze their stock within the area during the cotton picking season.

It is physically possible to grow large quantities of fodder which could either be grazed in situ or cut and carried to stock held in special enclosures. By-products and cash crop residues could be used to supplement this ration. It must be realised, however, that the good quality soils will have to be used for crop or pasture production if they are to be successful.

(a) Balanites aegyptiaca, which is difficult to clear by ring-barking or up-rooting, should be left as a shade tree.

(b) IBRD Gezira Study Mission, 1966, Annex II - Appendix 4, Livestock.

(c) Possibly from summer 1972 with the completion of work on the control gates at Sennar.

In this report schemes are proposed for both milk and meat production using irrigated fodders. In the case of dairying, provided that soils suitable for long term irrigation are chosen, any of the irrigated crops and pastures mentioned below would be suitable for dairy production, but the best milk yields would be obtained by feeding lucerne.

6. 1. 1 Lucerne/Berseem (Medicago sativa)

This is the most promising fodder crop as establishment costs can be spread over the three to four years of its life and with twenty-four waterings a year, yields of one to two tons per acre of green material can be expected per cut in the first year and three to four tons per acre per cut in subsequent years. Ten to twelve cuts per year can be obtained with the highest yields occurring in March and April and the lowest yields in October and November. Closer ridge spacings (or use of border check irrigation) and the use of fertilisers could further increase these yields. Some doubt seems to exist as to whether lucerne acts as a host to some cotton pests[(a)] and if this is the case it could limit the use of this crop in the Gezira area.

Lucerne should be planted in November and 20 lbs of seed per acre should be ample. With regular irrigation the first harvest should come in March and the stand should remain good for four years. Normally old stands would be ploughed out in September to allow time for land preparation and re-levelling before replanting in November. Provided weeds and disease do not become a problem there is no reason for fallowing well-drained sandy soils. All seed should be inoculated with the correct rhyzobium just before planting and fertiliser requirements will have to be established on the site. Where feed is cut and carted off the land, phosphate fertiliser will have to be used regularly and responses may also be gained from potassium, nitrogen and some of the minor elements. An annual top dressing of 80 kg single superphosphate, 20 kg of potassium chloride and 80 kg of urea per acre is suggested. Half of this should be applied in March and the other half in September.

(a) Such as a leaf worm (Prodenia) common in Egypt, white flies and a cut worm.

All animal manure from feed lots should be returned to lucerne areas.

Under good management the following yield pattern over four years should be obtained.

Lucerne Yield in tons of Dry Matter per acre

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Year 1	-	-	0. 50	0. 50	0. 5	0. 5	0. 5	0. 5	0. 5	0. 5	0. 5	1. 00
Year 2	1. 00	1. 00	1. 00	1. 00	1. 0	0. 5	0. 5	0. 5	0. 5	0. 5	0. 5	1. 00
Year 3	1. 00	1. 00	1. 00	1. 00	1. 0	0. 5	0. 5	0. 5	0. 5	0. 5	0. 5	0. 75
Year 4	0. 75	0. 75	0. 75	0. 75	0. 5	0. 5	0. 5	0. 5	-	-	-	-
Totals	2. 75	2. 75	3. 25	3 25	3. 0	2. 0	2. 0	2. 0	1. 5	1. 5	1. 5	2. 75

6. 1. 2 Fodder Sorghums

Abu sabeen is already grown widely in the Sudan and yields 10 ton green matter/acre at the first cut 75-80 days after planting, and then a further 5 tons of green matter/acre results from the total of two of three subsequent cuts. At Soba only 6 tons green matter/acre was claimed and at Shambat average yields as low as 3 tons per acre were quoted. Many other varieties of fodder sorghum and Sudan Grass (Sorghum sudanese) are also grown but varieties low in HCN must be selected to safeguard livestock. All sorghum varieties grow best in the summer.

6. 1. 3 Lubia (Dolichos lab lab)(a)

This legume has given best results in the Gezira area when planted in September but no irrigation has been allowed after January. With the prospect of year round water the Gezira Board has initiated trials varying the planting time to obtain data on yields and damage caused by pests and diseases. Yields of 4 metric tons per feddan of hay equivalent should be possible, although only half of this is being obtained at present(b).

(a) Now more correctly named Lablab niger.

(b) IBRD Gezira Study Mission.

6. 1. 4 Phillipesara (Phaseolus trilobus)

This legume can be planted in the summer and good growth can be obtained from rainfall alone but supplementary irrigation at a later stage would increase yields. Trials are also being conducted by the Gezira Board on this crop but little reliable yield data is available at present. However, seven to eight tons of green matter per acre could be expected.

6. 1. 5 Clitoria (Clitoria ternatea)

A perennial legume giving its main growth in the summer and a total yield higher than that obtained from Dolichos lab lab[(a)]. It is not favoured in cotton growing areas because of the difficulty in eradicating the root system. This legume has little trouble from pests and diseases.

6. 1. 6 Maize

This crop has only recently gained some popularity in the Sudan, and when planted in the winter it will outyield the fodder sorghums[(b)]. It is already being used successfully in the Kuku scheme.

6. 1. 7 Perennial Pastures

High levels of animal production could be obtained from irrigated pastures of grass/legume mixtures provided that soil types suitable for long term irrigation are selected. Adequate water would be required for year round irrigation and soil fertility would have to be maintained, as necessary, with fertilisers. Irrigated pastures are most suited to dairy production followed by sheep and then cattle in the Sudan.

No work of any consequence has been done in the Sudan on the growing of perennial pastures (except lucerne) in irrigation areas but it appears that legume/grass pastures or grass pastures fertilised with nigrogen could produce large quantities of relatively cheap fodder.

(a) University of Khartoum, Faculty of Agriculture - unpublished data.

(b) Yields of up to 20 tons green matter/feddan have been achieved at Shambat.

Using a border check or contour check system of irrigation, animals could graze these areas five to seven days after watering without damaging the soil and thus eliminate most of the harvesting costs. In the Gezira to keep in line with present soil management these pastures would not be irrigated in their fourth year so that the soil could dry out and crack to depth and the pasture would then be replanted the next year, after ploughing, levelling and bank repair had been carried out as necessary.

Experimental work should be initiated immediately to test the various tropical pasture species under local conditions. Plants that are already yielding commercially in other areas of similar climate, and of which seed is readily available, should be concentrated upon at the beginning. Pasture species should be selected for rapid establishment, high yield over the three to four year period of growth and for freedom from pests and diseases. Simple pasture mixtures will be easier to manage than more complex ones and they should be compared with pure stands of lucerne for yield and animal production results. One advantage over lucerne will be the reduction or abolition of bloat risk.

The following pasture alternatives are suggested:-

(i) Grass/Legume Mixture

6 lbs Lucerne

4 lbs Green Panic (Panicum maximum var trichoglume c. v. Petrie)

½ lb Buffel Grass (Cenchrus ciliaris)

This pasture should meet all the above requirements and should be able to carry at least one and a half livestock equivalents per acre the year round with approximately twenty waterings a year.

No fertiliser should be required in the early stages but for optimum production in later years application of phosphate and nitrogen may be necessary. Only local experimental work can establish these requirements.

(ii) Pangola Grass (Digitaria decumbens)

A pure stand of this highly digestible and nutritious grass would have to be planted from cuttings spread on the surface and lightly disced in ahead of irrigation. It is a very efficient user of nitrogenous fertilisers and levels of up to 200-400 lbs N/acre/annum could probably be used economically in split dressings (optimum levels being established by local experimental work). Sulphate of Ammonia should be tried in preference to urea because of the high soil pH.

Under irrigation and with such a reasonably heavy application of nitrogen as well as maintenance dressings of phosphate a high carrying capacity of at least 2 livestock units/feddan should be achieved on this grass. Bryan and Evans[(a)] achieved liveweight gains with cattle of 1, 100 kg/ha and 700 kg/ha with applications of 449 and 168 kg N/ha/year respectively under rainfed conditions in an area with an average rainfall of 1, 650 mm.

Unfortunately a virus disease has made this grass unproductive in parts of the Caribbean area but is still very productive in other parts of the world. Great care should be taken that healthy plants are chosen for the original planting material. Australia would be one of the safest sources for this material. One advantage of using this grass in an agricultural area is that it does not set any viable seed and once destroyed by a fallow it will not cause a weed problem in subsequent crops. Pangola grass is also reasonably tolerant of moderately high soil alkalinity and sodium levels.

6. 2 Crop Residues and By-products

The following crop residues and by-products are available for livestock feed:-

(i) Grain sorghum stubble.

(ii) Wheat straw.

(iii) Sugar cane tops and bagasse.

(a) W. W. Bryan and T. R. Evans, "A Comparison of Beef Production from Nitrogen Fertilised Pangola Grass and from a Pangola Grass Legume Pasture", Tripical Grasslands Vol. 5 No. 2, July 1971.

(iv) Groundnut hay and hulls.

(v) Oil-seed cakes (particularly cotton-seed cake).

(vi) Wheat bran.

(vii) Molasses.

(viii) Cereal grains unsuitable for human consumption or export (e. g. split sorghum grain).

Rainland grain sorghum is planted as soon as possible after the start of the wet season and harvesting commences in December. From this time on there is an abundance of sorghum stubble which is only partially used by the small numbers of local stock and in the Gedaref area by nomadic herds moving south from the Butana Plain. This roughage feed is therefore available at a time when stock throughout the savanna belt are generally losing weight and movement on the hoof from the western areas becomes impossible due to the shortage of feed and water. Large numbers of sheep and cattle could be finished in the Gedaref area to even out the supply for export during this period. There are direct rail links between Gedaref and the major livestock areas and to Port Sudan.

Yields of stubble should range between one and two tons dry matter per acre. As well as the sorghum stubble the fallow areas carry a heavy body of dry grass after the rainy season and although this becomes rank and coarse it also could be utilised to some extent. These low protein roughage feeds would have to be used with some supplements to obtain best results.

At present the main source of protein supplement is cotton-seed cake, but the continued use of this commodity is questionable on economic grounds. This is because there is a good export market available at an attractive price and consequently this oil-seed is an important foreign exchange earner. It would be preferable to concentrate on providing protein from other sources.

7. APPLIED RESEARCH PROGRAMME

7.1 Regional Pasture Evaluation

Pasture research is required to evaluate native grasses already present in the development areas and to compare their performance with introduced grasses and legumes. This will entail:

(a) A general soil survey to identify the major soil types in the area.

(b) Pasture trials to demonstrate the suitability of species for different soil types.

(c) The establishment of species evaluation plots on the major soil groups.

After selection of the most promising grasses and legumes, either native or introduced, they should be combined as a pasture mixture on a larger scale. When the pastures are established they should be subjected to intermittent grazing.

In the El Meiram and Gawazat areas the following grasses and legumes should be tested:-

(i) Grasses

Buffel grass (Cenchrus ciliaris) - a variety trial of the full range of the eight to ten varieties including tall, short and rhizomatous forms.

(ii) Legumes

Stylosanthes humilis - annual short season varieties, possibly 'Green Vale'; Stylosanthes guyanensis - perennial, possibly Cook, Endeavour or Schofield varieties; Stylosanthes mucronata - local variety; Phaseolus atropurpureus (Siratro) or P. lathyroides; and Cajanus cajan (Pigeon pea, shrub legume).

Nutrient trials should be incorporated with all these pasture evaluation trials. The main area of investigation would be the phosphate response at varying levels of application.

On the dark cracking clay soils of the Gedaref area, tests should be made with the following grasses:-

Urochloa mosambicensis; Urochloa bolbodes; Urochloa pullulans; Panicum colaratum, Variety Makarikariense; Panicum maximum, (Variety - Green Panic); and Chloris gayana (Rhodes grass).

Legumes should include:- Phaseolus lathyroides and/or Siratro; Dolichos axillaris; and Centrosema pubescens.

Initially all these trials can be on a small scale in order to minimise cost. The major costs will include seed, fertiliser and supervision. At a later date when the most promising species have been selected, larger scale trials will be required in areas where either sheep or cattle can be used to evaluate the grazing potential. The costs associated with this research would be similar to the normal costs of development recommended in the report. It is possible that research could be conducted within established facilities.

7.2 Carrying capacity trials on dryland pasture

These trials could be incorporated within the development of the proposed ranch areas and would involve very little additional cost. They should include:

(i) a test of the carrying capacity of a perennial Andropogon guyanensis grass pasture compared with a sown annual grass pasture; and

(ii) a comparison between native pasture performance at varying stocking rates and the performance gained from grass-legume pastures.

7.3 Irrigated Pasture Research

A specific trial is recommended to compare the performances of irrigated lucerne and irrigated pangola grass (the latter with applications of nitrogen). A grazing trial should be carried out with rotational crash grazing. The lucerne should be treated with phosphorus and potassium fertiliser and the pangola grass with nitrogen, phosphorus and potassium. Nitrogen should be added at the rate of 400 lbs/feddan/annum. A low, medium and high stocking rate with yearling to 18 month old male cattle or yearling to 18 month old sheep should be completed with two replications at the following stocking rates:

Low stocking intensity - 1 L.S.E./feddan/annum
Medium stocking intensity - 2 L.S.E./feddan/annum
High stocking intensity - 3 L.S.E./feddan/annum

This research should commence as soon as possible on a reasonably large scale initially to test performance of the recommended pastures. In estimating total research investment requirements (Volume II, section 2.6), provision has been made for the cost of the seed, cultivation, fertiliser and stocking which will be necessary to implement this trial.

APPENDIX II

BEEF, MUTTON AND MILK PRODUCTION

1. PRESENT SITUATION

1.1 Beef

The following information was extracted from the 1970/71 records of Ghazal Gawazat:-

(i) Reproduction

Average age at first calving[(a)]	4 years 2 months
Calving interval[(b)]	19.4 months
Mortality to 18 months of 1970 calf crop	11.6%

(ii) Average Liveweight, 1970 calf crop

	Male (kg)	Female (kg)
Weight at weaning (c. 7 months)	90.12	87.18
Weight at 12 months	115.30	106.57
Weight at 18 months	148.97	137.54

1.2 Mutton

A list of the principal sheep breeds and the tribes which own them is given in Table A2.1.

(a) Based on an average of 53 out of a random selection of 63 breeders in the Gawazat herd.

(b) Based on an average of 26 out of a random selection of 63 breeders.

TABLE A2.1 Producers of Ecotype 'Sudan Desert' Sheep

Ecotype 'Sudan Desert'			
Tribal Breed Sub-Divisions		Tribes Included	Area Covered
Good mutton types:			
(i)	Kababish	Kakabish Hamar Kawahla Beni Garar Howawir Bediriya Dar Hamid Hassariya Gawamaa	From the White Nile to the Darfur uplands and North of the Kosti - Nyala railway line.
(ii)	Butana	Shukriya	North of the Kassala - Gedaref railway line between the main Nile and Atbara rivers.
(iii)	Gezira	Rufa'a (Fung) - el Sherig - el Hoi White Nile Baggara - Seleim - Ahamda - Muharib	Concentrated in or around the Gezira Scheme.
(iv)	Watish	Watish (Fung)	Northern Upper Nile Province to Sennar
Lesser mutton types:			
(v)	Meidob		Meidob Hills in N.E. Darfur.
(vi)	North Riverine Wooled		Lower reaches of Main Nile.
(vii)	Beja	Beja - Hadendowa - Besharin - Beni Amer - Amarar - Rashaida	Red Sea Coast, nearby hills and Atbai plain.

Source: McLeroy, G.B. (1961) The Sheep of Sudan (2). Ecotypes and Tribal Breeds. Sudan J. Vet. Sci. & Anim. Husb. Vol. 2 No. 2 101-165.

2. PROJECT CONSTRUCTION REQUIREMENTS

2.1 Ranches

Paddocks: Maximum paddock size for breeding herds should be 5,000 feddans in the case of cattle and 4,500 feddans in the case of sheep. Small paddocks will be required near dip yards for the purpose of weaning and other husbandry procedures. In the initial stages of development it may be advisable to have larger paddocks for dry cattle (i.e. one to three year old turn-off cattle and following heifers).

External Fencing: It is proposed to fence ranches externally with a four strand barbed-wire for cattle and six strands for sheep. The fence should be constructed in quarter mile strains with cement strainer posts and cement or steel intermediate posts 22 ft apart. It is suggested that steel intermediate posts be used in the initial stages of development. Some experimentation should also be done on the construction of cement posts with a small amount of re-inforcement. The low price of cement and the possibility that sufficient gravel and sand will be available locally could result in cheaper fences. The mixture for these cement posts would be one part cement, $1\frac{1}{2}$ parts sand, 3 parts of metal or gravel.

Internal Fencing: It is proposed that the internal fencing of cattle ranches be 3 barbed-wire suspension fence constructed in quarter mile strains with cement orsteel intermediate posts 40 yards apart. This fence should be supported between intermediate posts with 26" droppers.

The internal fencing of sheep ranches should be with 6 strands of plain wire, with strainer posts every $\frac{1}{2}$ mile, posts 22 feet apart and with one dropper between each pair of posts.

Watering Points: It is every important that a reliable and adequate source of year round water is available. Ranches have been proposed in areas where bore water can be made available. Bore holes should be

cased with 5" casing and equipped with pumps that can deliver a minimum of 1,000 gallons per hour. Water will be stored at the borehead in earth tanks constructed in areas of clay soil. The capacity of these storages will be about 300,000 gallons. This water will be reticulated in 2" polythene pipes to watering points in each of the paddocks. If possible, cattle should not have to walk more than four miles from feed to water.

Yards: Three sets of yards with plunge dip are to be constructed on each cattle ranch. One set will be constructed at the central buildings and the other two at outstations. It is suggested that the yards be built of railway line upright posts set in cement with round timber rails. These round timber rails should be treated with a preservative before construction.

2.2 Sheep Assembly and Finishing Areas

The three sheep assembly areas will be externally and internally fenced with six strand plain wire as described above for sheep ranches.

The only site suitable for the sinking of deep bores is Abu Gabra (Umm Ruwaba formation). The Jebel Abu Sinun and Jebel ed Dair sites overlie pre-cambrian basement complex, but both contain clay areas which are suitable for the construction of hafirs.

The sheep finishing area is to be ring-fenced and internally sub-divided into four 250 feddan paddocks. Further sub-division to facilitate intensive grazing management will be by means of movable electrical fences.

2.3 Cattle Feedlot

Railway line will probably be the cheapest and most efficient material for yard construction, although consideration should be given to using lighter steel piping if this is readily available. Upright posts should be set in concrete and two rails welded in turn to these uprights. A system of swinging gates and laneways should be installed to facilitate handling of cattle in the feedlot.

The yard in each feedlot will be large enough to accommodate about 2,400 head. Each of the feedlot pens (48 in all) is planned to be 54' x 66', giving it a capacity to hold 50 head of cattle of 18-30 months of age. Each pen should be provided with a separate watering facility and with self-feeders supplied by an automatic feeding system. Costs of the plant and equipment required are detailed in Appendix IX.

3. CATTLE MANAGEMENT

3.1 Breeding Programme

A controlled mating for a minimum of 3 months and a maximum of 4 months is recommended at the time of the year when most cows will be cycling, i.e. July-October. A desirable percentage of bulls to cows in herds of 100 or more would be 3-4 per cent. Two months after the bulls are removed all mated cows and heifers should be pregnancy tested. They should then be divided into early and late calving groups. Persistently non-pregnant cows should be culled.

At an average of 3-4 months of age all calves must be dehorned, earmarked and branded. All bull calves should be castrated except for replacement bulls.

An April-July calving will mean that most calves will be dropped either just before the rainy season or soon after it starts. By the time the calf is 2-3 months old and making an increasing demand on its dam for milk, the pasture quality will be at its peak to supply the cow with requisite nutrients. Experience under similar conditions in Australia has shown that late calving (Oct-Jan.) results in the dam having to supply milk to a 3-4 month old calf, when the requirement is at a maximum, during the nutritionally worst months of the year. This results in possible breeder mortality, a lapse of two years before the cow breeds again, and a reduced weaning weight of the calf.

Controlled mating (hence controlled calving) means that weaning can be carried out at one time, thereby reducing the total time and manpower required. Under the expected management conditions weaning is redommended

when calves are 6-8 months old, though earlier weaning at 5-7 months could increase calving percentages, since it would enable cows to be in better condition to conceive when mated. A good time to wean would be when cows are pregnancy tested.

On weaning calves should be placed on an area of fresh pasture which has been rested since the wet season. It would be advisable to feed 2-3 lbs/ day of a mixture of dura, urea and dicalcium phosphate for 2-3 weeks after weaning (see below). This will help overcome the severe nutritional stress at this time.

3.2 Supplementary Feeding

To achieve the projected performance from the breeding herd it will be necessary to provide supplementary feeding at various levels, according to the class of stock and the area concerned. The recommended supplements, which have been taken into account in estimating annual costs,are:-

(i) Phosphate Supplement. All females above the age of 12 months will be given free access to dicalcium phosphate for the whole year. It will have to be fed out in covered troughs to protect it from rain during the wet season. It has been asuumed that each beast will consume $\frac{1}{2}$ oz per day for the full twelve months.

(ii) Protein and Energy Supplement, consisting of a mixture of:

Dura	20 per cent
Urea	8 per cent
Dicalcium phosphate	52 per cent
Salt	20 per cent

Heavily pregnant cows and early calving cows should be fed 1 lb. per day of this ration for three months (April-June) at Gawazat and El Meiram and for four months (February-May) at Doka. All weaners should be fed $\frac{1}{2}$ lb. per day from weaning in December until the season breaks in June. The ration for working bulls should be $1\frac{1}{2}$ lb. per day for two months prior to mating.

3.3 Feedlot Rations

The cheapest and most efficient finishing ration at Gedaref has been formulated after due consideration of available feedstuffs (nutritional values and costs of alternative feedstuffs are given in Tables A2.2-4). It is based on locally grown dura stubble and rolled whole grain with molasses. There is a strong possibility that cracked grain from the harvest could be used in this ration. It would cost about half as much as whole grain and have the same nutritional value. This would improve the profitability of the feedlot appreciably. The ration on which cost calculations have been based consists of:-

	Ration Fed (kg/day)	Dry Matter (kg)
Grain - dura	3.18	2.86
Molasses	3.18	2.39
Milled dura stubble	2.72	2.45
Urea, Dicalcium Phosphate	.15	.15
Vitamin A	20,000 I.U. per day	
Antibiotic		
Total	9.23	7.85

With a projected throughput of 2,400 cattle approximately 2,000 tons of dura stubble will have to be baled every year.

On entry to the feedlot cattle will be fed a plain ration of dura stubble. Over the initial two week period grain will be added gradually to the dura stubble until at the end cattle will be consuming the required grain supplement.

It has been assumed that all animals entering the feedlot would have an average liveweight of 250 kg and carcase weight of 125 kg. With a daily weight gain of 0.9 kg, total liveweight gain during the 122 days when the animal is in the feedlot will be 110 kg; the carcase weight gain is expected to be 75 kg (68 per cent of the liveweight gain). Thus, on leaving the feedlot the beast should average 360 kg liveweight and 200 kg carcase weight.

TABLE A2.2 Nutritional Values - Local Sudanese Feedstuffs (1)

Feedstuff	Dry Matter %	Crude Protein %	Digestible Crude Protein %	Total Digestible Nutrients %
Oil Seed Cakes				
Cottonseed Cake (undecorticated)	93	23.0	18.0	60.0
Groundnut Cake (undecorticated)	93	33.0	26.4	62.0
Groundnut Cake (decorticated)	93	45.0	40.0	75.0
Sesame Cake	92	46.0	40.0	75.0
Grains				
Dura	90	13.0	10.4	80.0
Wheat	90	12.0	10.0	80.0
Roughages and Hay				
Groundnut Hay	90	10.5	4.7	40.0
Groundnut Hulls	95	6.0	1.6	18.0
Abu Sabeen Green	25	1.5	0.8	17.3
Dura Straw (gassab)	95	5.1	2.0	53.0
Dura Hay	90	6.2	3.3	
Sudan Grass Hay	90	6.8	2.5	
Wheat Straw	90	3.9	0.3	40.0
Wheat Bran	90	16.0	12.0	70.0
Lubia - Green	24	4.0	2.5	13.0
Lubia - Hay	90	14.0	10.0	50.0
Berseem - Green	24	4.1	2.6	13.5
Berseem - Hay	90	16.0	12.0	51.0
Clitoria - Green	24	4.0	2.5	13.0
Clitoria - Hay	90	15.0	11.0	50.0
Molasses	74	3.0	0.0	54.0

References: Morrison - Feeds and Feeding.

Nutrition Section – Merck Veterinary Manual.

Boynes - Table provided by Range Management Section, R. W. & D. C. - Composition of Sudan Feeding Stuffs.

Dr. Fadel Sheikh - Ph. D. thesis, Faculty of Agriculture, University of Khartoum.

TABLE A2.3 Nutritional Values - Local Sudanese Feed Stuffs (2)

Ingredient	Crude Protein	Moisture	Fibre	Nitrogen Free Extract	Oil
	%	%	%	%	%
Meatmeal	43.9	25.9	-	3.4	21.8
Bloodmeal	82.8	8.1	-	0.6	8.1
Bonemeal	27.9	5.8	-	3.7	5.8
Ground nutcake	-	-	-	-	-
Decorticated	36.3	4.4	10.3	30.7	11.9
Undecorticated	22.8	3.7	24.5	28.9	14.0
Cottonseed Cake					
Undecorticated	25.9	3.0	24.1	35.5	6.5
Sesame Cake	46.2	3.8	7.6	14.0	11.9
Dura	14.0	6.2	1.6	73.4	2.9
Wheat Bran	16.8	5.3	6.9	63.8	3.2

Bonemeal	Calcium	Phosphorus
	19.3%	13.5%

Source: Analyses done in U.K. of Sudanese feedstuffs collected by O.D.A. Poultry Adviser G. Goddard - 1970.

Notes:

Animal Protein

(i) Meatmeal - very low crude protein and poor quality due to primitive processing.

(ii) Maximum moisture in meatmeal is 10 per cent. Above this mould forms.

(iii) A high phosphorus in bonemeal recorded.

Vegetable Protein

(i) Oilseed cakes if high in oil have a reduced protein.

(ii) Sesame cake high in methionine.

TABLE A2.4 Unit Cost of Feedstuffs 1971-72

Ingredient	Cost per long ton (LS)	Cost per lb. (piastres) C.P.	D.C.P.	T.D.N.	D.M.
Cottonseed Cake - Undecorticated	17.50	3.40	4.35	1.30	0.90
Groundnut Cake - Undecorticated	19.00	2.55	3.20	1.35	0.90
Groundnut Cake - Decorticated	22.00	2.20	2.50	1.30	1.10
Sesame Cake	23.00	2.25	2.55	1.35	1.10
Dura Grain	20.00	6.90	8.55	1.10	1.00
Wheat Bran	11.50	3.20	4.30	0.75	0.55
Peanut Hulls	3.50	2.60	9.75	0.90	0.15
Gassab Hay	6.20	4.50	8.35	0.50	0.30
Green Chop Berseem (i.e. cost of production on dry matter basis)	4.40	1.30	1.70	0.40	0.20
Molasses	5.00	-	-	0.40	0.30
Urea	41.00	0.70	0.70	-	-

C.P. - Crude Protein

D.C.P. - Digestible Crude Protein

T.D.N. - Total Digestible Nutrients

D.M. - Dry Matter

3.4 Disease and Parasite Control

Systemic Diseases: Vaccination should be carried out on the ranch against all currently endemic diseases, viz: rinderpest, contagious bovine pleuro-pneumonia, anthrax, haemorragic septacaemia and blackleg.

Once all cattle on the ranch have been brought fully under control they should be tested for tuberculosis regularly and all reactors slaughtered. Sufficient amounts of Ethidium Bromide should be on hand to handle any outbreaks of Trypanosomiasis that may occur.

Infertility Diseases: The occurrence of Brucellosis in the herds should be investigated fully by carrying out blood tests on the breeders. There is a plan incorporated in the current Rinderpest Eradication Scheme (JP15) to test immunity afforded by tissue culture vaccination. This involves the taking of blood samples. When the cows are tested in this programme some of the sera from this sample could be used for the Brucella test.

All heifers should be vaccinated with Strain 19 between the ages of 6-8 months in order to control Brucellosis.

When the Veterinary Research Laboratory at Soba is completed, a simple Tampon test for Vibriosis should be run on the cows to ascertain the incidence of this disease. An efficient vaccine can be used to control this disease if it is present.

External Parasites (Ticks and Biting Flies): During the wet season all cattle should be dipped at least once a month for tick and fly control. It would be advisable to set up a mister over the crush leading out of the dip for the application of a specialised spray to give added protection against biting flies.

Internal Parasites: All young cattle should be injected at weaning with a suitable anthelmintic for worm control.

4. BEEF HERD PROJECTIONS

The detailed projections for the beef herd build-up on the proposed ranches is given in Table A2.5 and the co-efficients on which they are based are shown in Table A2.6. The two subsequent tables (A2.7-8) show the herd projections on which the sensitivity analyses in Volume II, Section 3.2.3, are based. The first indicates the pattern of a more rapid build-up of herd numbers than that adopted in the proposal and the second relates to the effect of increasing the store trading element on the beef ranches.

TABLE A2.5 Herd Projection Cattle Sub-Project

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18-20
3 year Cows	92	117	172	142	1,190	289	363	1,562	1,136	3,902	4,595	2,795	1,301	1,481	2,485	2,901	2,477	2,478
4 year Cows	80	84	234	1,333	135	1,131	274	345	2,504	1,036	3,596	4,278	2,608	252	287	681	1,632	2,355
5 year Cows	102	397	79	222	1,267	128	1,820	261	328	2,284	955	3,348	4,067	2,479	239	272	648	1,551
6 year Cows	82	94	370	75	211	2,176	122	1,730	248	299	2,105	889	3,183	3,866	2,357	227	259	616
7 year Cows	82	76	87	352	72	201	2,069	116	1,644	226	276	1,960	845	3,026	3,675	2,240	216	246
8 year Cows	73	76	71	82	334	69	191	1,967	111	1,499	208	257	1,863	804	2,876	3,494	2,130	206
9 year Cows	60	63	66	66	76	308	64	176	1,813	96	1,295	180	237	221	324	2,650	3,220	1,963
Bulls	28	44	49	98	143	187	229	294	375	451	617	626	642	601	612	603	528	522
Heifers 0-1	167	180	333	419	906	1,312	1,734	2,125	2,666	2,190	2,880	4,553	5,152	4,765	4,766	4,925	4,890	4,582
Heifers 1-2	191	155	167	313	394	852	1,233	1,630	1,997	2,479	2,037	2,678	4,280	4,843	4,479	4,480	4,629	4,597
Heifers 2-3	125	183	149	162	304	382	826	1,196	1,581	1,917	2,380	1,956	1,948	2,906	3,054	2,607	2,608	3,627
Steers 0-1	167	180	333	419	906	1,312	1,734	2,125	2,666	2,190	2,880	4,553	5,152	4,765	4,766	4,925	4,890	4,582
Steers 1-2	191	155	167	313	394	852	1,233	1,630	1,997	2,479	2,037	2,678	4,280	4,843	4,479	4,480	4,629	4,597
Steers 2-3	61	90	73	79	148	187	404	585	774	938	1,165	957	1,272	2,033	2,300	2,127	2,128	2,199
Others	41	41	42	51	51	59	239	50	137	1,218	64	870	140	-	-	251	2,056	2,498
Store Cattle	-	2,300	7,000	10,400	14,500	15,200	15,700	16,000	15,500	12,000	8,500	5,000	2,000	2,000	2,000	2,000	2,000	2,000
Total Cows	571	907	1,079	2,272	3,285	4,302	4,903	6,157	7,784	9,342	13,029	13,707	14,104	12,129	12,243	12,465	10,582	9,415
Targets (LSE)	1,300	4,000	9,000	14,000	20,000	23,000	26,000	29,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
Total (LSE)	1,300	4,000	9,000	14,000	20,000	23,000	26,000	29,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
Numbers Sold each Year																		
3 year Cows	4	4	3	3	3	23	6	7	30	55	150	132	103	1,010	1,150	1,729	1,182	48
4 year Cows	5	3	2	5	26	3	22	5	7	120	40	104	83	51	5	6	13	32
5 year Cows	4	4	11	2	4	25	2	35	5	16	88	28	65	79	48	5	5	13
6 year Cows	4	3	3	7	1	4	42	2	34	12	11	61	17	62	75	46	4	5
7 year Cows	4	3	2	2	7	1	4	40	2	79	9	8	38	16	59	71	43	4
8 year Cows	7	7	7	3	4	16	3	9	95	11	144	20	12	1,586	456	140	169	103
9 year Cows	17	17	18	13	13	15	60	12	34	522	28	373	35	230	214	63	514	625
Bulls	18	5	9	10	19	28	37	45	58	73	88	121	123	126	118	120	118	103
Heifers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	650	1,246	1,644	1,738	1,738	863
Heifers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	557	370	276	-	-	-
Steers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 1-2	61	90	73	80	149	187	405	586	774	939	1,165	958	1,272	2,033	2,301	2,128	2,128	2,199
Steers 2-3	67	59	86	71	77	144	181	392	567	743	900	1,118	928	1,234	1,972	2,231	2,063	2,064
Others	34	39	39	41	49	49	57	232	48	132	1,169	61	844	136	-	-	243	1,994
Store Cattle	-	2,300	7,000	10,400	14,500	15,200	15,700	16,000	15,500	12,000	8,500	5,000	2,000	2,000	2,000	2,000	2,000	2,000
Total Sales	225	2,534	7,253	10,637	14,852	15,695	16,519	17,365	17,154	14,702	12,292	7,984	6,727	10,179	10,318	10,277	10,220	10,053
Numbers Purchased each Year																		
3 year Cows	-	-	-	-	1,036	-	-	777	-	2,416	2,792	558	-	-	-	-	-	-
4 year Cows	-	-	125	1,169	-	-	-	-	1,019	-	-	-	-	-	-	-	-	-
5 year Cows	-	323	-	-	-	-	745	-	-	-	-	-	-	-	-	-	-	-
6 year Cows	-	-	-	-	-	972	-	-	-	-	-	-	-	-	-	-	-	-
Bulls	-	22	15	60	66	75	83	115	145	157	263	142	152	98	141	123	55	108
Heifers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Store Cattle	-	2,300	7,000	10,400	14,500	15,200	15,700	16,000	15,500	12,000	8,500	5,000	2,000	2,000	2,000	2,000	2,000	2,000
Total Purchases	-	2,645	7,140	11,629	15,602	16,247	16,528	16,892	16,664	14,573	11,555	5,700	2,152	2,098	2,141	2,123	2,055	2,108

TABLE A2.6 Herd Performance Data - Cattle Sub-Project

	Year: 1-3	4-20
Death Rates (Per cent)		
Cows	4	3
Bulls	2	2
Heifers 0-1	7	6
Heifers 1-2	4	3
Heifers 2-3	6	5
Steers 0-1	7	6
Steers 1-2	6	5
Steers 2-3	4	3
Others	4	3

Branding Percentages	Year: 1	2	3	4	5	6-20
Heifers 2-3	33	33	35	70	70	70
3 year Cows	50	55	63	63	70	75
Others	60	65	75	75	80	80

Culling Rates (Per cent)	Year: 1	2	3	4-20
Cows	5	4	3	2
8 year Cows	10	10	10	5
9 year Cows	30	30	30	20
Bulls	20	20	20	20
Heifers	-	-	-	-
Steers 0-1	-	-	-	-
Steers 1-2	50	50	50	50
Steers 2-3	100	100	100	100
Others	100	100	100	100

Livestock Conversion Factors	
Cows, Calves 2-3 & others	1.0
Bulls	1.5
Calves 0-1	.5
Calves 1-2	.75

Percentage of Bulls to Cows	Years: 1-4	5-20
	4%	3%

TABLE A2.7 Herd Projection Reflecting Increased Development Intensity - Cattle Sub-Project

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18-20
3 year Cows	92	117	172	142	1,190	289	363	1,562	1,136	3,902	4,594	2,795	1,301	1,481	2,485	2,901	2,477	2,478
4 year Cows	80	84	234	1,333	135	1,131	274	345	2,504	1,036	3,596	4,278	2,608	252	287	681	1,632	2,355
5 year Cows	102	397	79	222	1,267	128	1,820	261	328	2,284	955	3,348	4,067	2,479	239	272	648	1,551
6 year Cows	82	94	370	75	211	2,176	122	1,730	248	299	2,105	889	3,183	3,866	2,357	227	259	616
7 year Cows	82	76	87	352	72	201	2,069	116	1,644	226	276	1,960	845	3,026	3,675	2,240	216	246
8 year Cows	73	76	71	82	334	69	191	1,967	111	1,499	208	257	1,863	804	2,876	3,494	2,130	206
9 year Cows	60	63	66	66	76	308	64	176	1,813	96	1,295	180	237	221	324	2,650	3,220	1,963
Bulls	28	44	49	98	143	187	229	294	375	451	617	626	642	601	612	603	528	522
Heifers 0-1	167	180	333	419	906	1,312	1,734	2,125	2,666	2,190	2,880	4,553	5,152	4,765	4,766	4,925	4,890	4,582
Heifers 1-2	191	155	167	313	394	852	1,233	1,630	1,997	2,479	2,037	2,678	4,280	4,843	4,479	4,480	4,629	4,597
Heifers 2-3	125	183	149	162	304	382	826	1,196	1,581	1,917	2,380	1,956	1,948	2,906	3,054	2,607	2,608	3,627
Steers 0-1	167	180	333	419	906	1,312	1,734	2,125	2,666	2,190	2,880	4,553	5,152	4,765	4,766	4,925	2,890	4,582
Steers 1-2	191	155	167	313	394	852	1,233	1,630	1,997	2,479	2,037	2,678	4,280	4,843	4,479	4,480	4,629	4,597
Steers 2-3	61	90	73	79	148	187	404	585	774	938	1,165	957	1,272	2,033	2,300	2,127	2,128	2,199
Others	41	41	42	51	51	59	239	50	137	1,218	64	870	140	-	-	251	2,056	2,498
Store Cattle	-	2,300	11,000	16,400	22,500	21,200	19,700	18,000	15,500	12,000	8,500	5,000	2,000	2,000	2,000	2,000	2,000	2,000
Total Cows	571	907	1,079	2,272	3,285	4,302	4,903	6,157	7,784	9,342	13,029	13,707	14,104	12,129	12,243	12,465	10,582	9,415
Targets (LSE)	1,300	4,000	13,000	20,000	28,000	29,000	30,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
Total (LSE)	1,300	4,000	13,000	20,000	28,000	29,000	30,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
Numbers Sold each Year																		
3 year Cows	4	4	3	3	3	23	6	7	30	55	150	132	103	1,010	1,150	1,729	1,182	48
4 year Cows	5	3	2	5	26	3	22	5	7	120	40	104	83	51	5	6	13	32
5 year Cows	4	4	11	2	4	25	2	35	5	16	88	28	65	79	48	5	5	13
6 year Cows	4	3	3	7	1	4	42	2	34	12	11	61	17	62	75	46	4	5
7 year Cows	4	3	2	2	7	1	4	40	2	79	9	8	38	16	59	71	43	4
8 year Cows	7	7	7	3	4	16	3	9	95	11	144	20	12	1,586	456	140	169	103
9 year Cows	17	17	18	13	13	15	60	12	34	522	28	373	35	230	214	63	514	625
Bulls	18	5	9	10	19	28	37	45	58	73	88	121	123	126	118	120	118	103
Heifers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	650	1,246	1,644	1,738	1,738	863
Heifers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	557	370	276	-	-	-
Steers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 1-2	61	90	73	80	149	187	405	586	774	939	1,165	958	1,272	2,033	2,301	2,128	2,128	2,199
Steers 2-3	67	59	86	71	77	144	181	392	567	743	900	1,118	928	1,234	1,972	2,231	2,063	2,064
Others	34	39	39	41	49	49	57	232	48	132	1,169	61	844	136	-	-	243	1,994
Store Cattle	-	2,300	11,000	16,400	22,500	21,200	19,700	18,000	15,500	12,000	8,500	5,000	2,000	2,000	2,000	2,000	2,000	2,000
Total Sales	225	2,534	11,253	16,637	22,852	21,695	20,519	19,365	17,154	12,702	12,292	7,984	6,727	10,179	10,318	10,277	10,220	10,053
Numbers Purchased each Year																		
3 year Cows	-	-	-	-	1,036	-	-	777	-	2,416	2,792	558	-	-	-	-	-	-
4 year Cows	-	-	125	1,169	-	-	-	-	1,019	-	-	-	-	-	-	-	-	-
5 year Cows	-	323	-	-	-	-	745	-	-	-	-	-	-	-	-	-	-	-
6 year Cows	-	-	-	-	-	972	-	-	-	-	-	-	-	-	-	-	-	-
Bulls	-	22	15	60	66	75	83	115	145	157	263	142	152	98	141	123	55	108
Heifers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Store Cattle	-	2,300	11,000	16,400	22,500	21,200	19,700	18,000	15,500	12,000	8,500	5,000	2,000	2,000	2,000	2,000	2,000	2,000
Total Purchases	-	2,645	11,140	17,629	23,602	22,247	20,528	18,892	16,664	14,573	11,555	5,700	2,152	2,098	2,141	1,123	2,055	2,108

TABLE A2.8 Herd Projection Reflecting Increased Store Trading Percentage - Cattle Sub-Project

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18-20
3 year Cows	92	117	172	142	414	289	363	1,565	631	3,016	3,730	2,419	1,477	1,244	2,060	2,499	2,534	2,583
4 year Cows	80	84	234	484	135	394	274	345	2,578	576	2,779	3,474	2,299	1,183	454	1,263	1,332	2,409
5 year Cows	102	397	79	222	460	128	1,554	261	328	2,351	531	2,588	3,303	2,185	1,125	431	1,200	1,266
6 year Cows	82	94	370	75	211	1,629	122	1,477	248	299	2,167	495	2,460	3,140	2,077	1,069	410	1,141
7 year Cows	82	76	87	352	72	201	1,548	116	1,404	226	276	2,018	470	2,338	2,985	1,975	1,016	390
8 year Cows	73	76	71	82	334	69	191	1,472	111	1,281	208	257	1,918	447	2,223	2,837	1,878	966
9 year Cows	60	63	66	66	76	308	64	176	1,357	96	1,107	180	237	1,767	412	2,048	2,614	1,731
Bulls	28	44	49	64	80	136	186	243	312	376	511	524	552	589	559	592	548	533
Heifers 0-1	167	180	333	419	583	729	1,245	1,728	2,213	1,870	2,420	2,775	4,439	4,874	4,969	4,820	4,869	4,817
Heifers 1-2	191	155	167	313	394	548	685	1,170	1,624	2,058	1,739	2,251	3,548	4,173	4,582	4,671	4,531	4,577
Heifers 2-3	125	183	149	162	304	382	532	664	1,135	1,559	1,976	1,669	1,637	2,409	2,631	2,667	2,719	2,850
Steers 0-1	167	180	333	419	583	729	1,245	1,728	2,213	1,870	2,420	3,775	4,439	4,874	4,969	4,820	4,869	4,817
Steers 1-2	191	155	167	313	394	548	685	1,170	1,624	2,058	1,739	2,251	3,548	4,173	4,582	4,671	4,531	4,577
Steers 2-3	61	90	73	79	148	187	260	325	555	763	967	817	1,069	1,685	1,982	2,176	2,218	2,152
Others	41	41	42	51	51	59	239	50	137	912	64	744	140	184	1,371	320	1,590	2,029
Store Cattle	-	2,300	7,000	11,300	16,500	17,600	18,300	18,700	18,400	15,400	12,400	9,400	6,400	3,400	2,000	2,000	2,000	2,000
Total Cows	571	907	1,079	1,423	1,702	3,018	4,116	5,412	6,657	7,845	10,798	11,431	12,164	12,304	11,336	12,122	10,984	10,486
Targets (LSE)	1,300	4,000	9,000	14,000	20,000	23,000	26,000	29,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
Total (LSE)	1,300	4,000	9,000	14,000	20,000	23,000	26,000	29,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
Numbers Sold each Year																		
3 year Cows	4	4	3	3	3	8	6	7	30	30	116	107	47	250	753	735	1,092	49
4 year Cows	5	3	2	5	9	3	8	5	7	124	22	80	67	45	23	9	25	26
5 year Cows	4	4	11	2	4	9	2	30	5	16	90	15	50	64	42	22	8	23
6 year Cows	4	3	3	7	1	4	32	2	29	12	11	62	10	48	61	40	21	8
7 year Cows	4	3	2	2	7	1	4	30	2	67	9	8	39	9	45	58	38	20
8 year Cows	7	7	7	3	4	16	3	9	71	11	123	20	12	93	22	108	138	91
9 year Cows	17	17	18	13	13	15	60	12	34	391	28	319	35	46	343	80	397	507
Bulls	18	5	9	10	13	16	27	36	48	61	74	100	103	108	115	110	116	107
Heifers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	546	1,033	1,417	1,778	1,812	1,545
Heifers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	109	311	229	-	-	-
Steers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 1-2	61	90	73	80	149	187	261	326	556	764	968	818	1,069	1,686	1,982	2,177	2,219	2,152
Steers 2-3	67	59	86	71	77	144	181	252	315	531	732	928	792	1,037	1,634	1,923	2,111	2,151
Others	34	39	39	41	49	49	57	232	48	132	876	61	722	136	178	1,330	310	1,542
Store Cattle	-	2,300	7,000	11,300	16,500	17,600	18,300	18,700	18,400	15,400	12,400	9,400	6,400	3,400	2,000	2,000	2,000	2,000
Total Sales	225	2,534	7,253	11,537	16,729	18,052	18,941	19,641	19,545	17,539	15,449	11,918	10,001	8,266	8,844	10,370	10,287	10,221
Numbers Purchased each Year																		
3 year Cows	-	-	-	-	260	-	-	1,060	-	1,949	2,265	562	-	-	-	-	-	-
4 year Cows	-	-	125	320	-	-	-	-	1,090	-	-	-	-	-	-	-	-	-
5 year Cows	-	323	-	-	-	-	1,180	-	-	-	-	-	-	-	-	-	-	-
6 year Cows	-	-	-	-	-	1,192	-	-	-	-	-	-	-	-	-	-	-	-
Bulls	-	22	15	26	30	74	80	97	122	131	217	123	141	156	97	154	84	103
Heifers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heifers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 0-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 1-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steers 2-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Store Cattle	-	2,300	7,000	11,300	16,500	17,600	18,300	18,900	18,400	15,400	12,400	9,400	6,400	3,400	2,000	2,000	2,000	2,000
Total Purchases	-	2,645	7,140	11,646	16,790	18,866	19,560	19,857	19,612	17,480	14,882	10,085	6,541	3,556	2,097	2,154	2,084	2,103

5. SHEEP MANAGEMENT

5.1 Breeding Programme

After being drenched and quarantined on arrival at the ranch, breeding ewes should be separated into pregnant and non-pregnant flocks. The plane of nutrition should then be adjusted gradually according to whether they are to be flushed or maintained purely on a gestating diet. After three weeks, provided that no disease is apparent, the non-gestating ewes will be placed into the breeding block.

Feeding of ewes should be controlled to provide them with high or low planes of nutrition as follows:-

(i) Three weeks prior to mating feed $\frac{1}{4}$ lb of supplement/head/day.

(ii) First twelve weeks of gestation feed $\frac{1}{2}$ lb of supplement/head/day.

(iii) Last six weeks of gestation feed $\frac{1}{4}$ lb of supplement/head/day.

(iv) First 10-12 weeks of lactation feed $\frac{1}{2}$ lb/head/day.

The supplement should be as follows:-

Urea	-	6.5 per cent
Dura	-	55 per cent
Sesame cake	-	35 per cent
Salt with Vitamin A	-	3.5 per cent

Details of nutrient requirements are given in Table A2.9.

The rams which have been selected from the assembly areas on a basis of conformation, age and fertility (checked by palpating the testicles) will be maintained on an adequate diet at breeding units without being allowed to get too fat. Free breeding will be allowed at first to enable some estimation of any seasonal peaks[(a)]. By the division of sheep into flocks, according to their date of parturition, a definite pattern can be established. Batches of ewes which fail to conceive should be mated once again with new rams over a period of three oestrus cycles (about 42 days)

(a) A system of recording which rams are in with the ewes should be maintained in order to show up unproductive rams.

TABLE A2.9 Nutrient Levels for Different Classes of Sheep[a]

	Live weight (kg)	Energy (kg)	Dig. Prot. (gm)	Ca (gm)	P (gm)	Carotene (gm)	Feed (kg dry matter)
1. Dry ewes - First 15 weeks of gestation (slightly above maintenance)							
	35	0.38	40	3.0	2.5	1.5	1.1
	40	0.42	45	3.2	2.6	2.0	1.2
	45	0.47	50	3.2	2.7	2.0	1.3
	50	0.51	55	3.5	2.8	2.2	1.4
	55	0.54	55	3.9	2.9	2.3	1.4
2. Ewes - During last six weeks of gestation							
	35	0.60	65	4.0	3.0	5.0	1.5
	40	0.70	73	4.2	3.2	6.0	1.7
	45	0.76	80	4.3	3.5	6.5	1.8
	50	0.82	85	4.5	3.6	7.0	1.9
	55	0.86	88	4.8	3.7	8.0	2.1
	60	0.90	90	5.0	3.8	9.0	2.1
3. Ewes - First ten to twelve weeks of lactation							
	35	0.80	85	6.0	4.5	5.0	1.8
	40	0.92	95	6.5	4.5	6.0	2.0
	45	1.00	105	6.0	4.5	6.5	2.2
	50	1.10	110	6.5	4.5	7.0	2.3
	55	1.15	115	7.0	5.0	8.0	2.4
	60	1.20	120	7.0	5.0	9.0	2.5
4. Lambs - Female replacements							
	25	0.50	70	3.0	2.8	1.6	1.1
	30	0.58	68	3.0	2.8	2.0	1.3
	35	0.64	65	3.2	3.0	3.0	1.5
	40	0.65	65	3.5	3.0	3.5	1.5
5. Lambs - Fattening							
	25	0.55	75	3.0	2.8	1.0	1.2
	30	0.65	80	3.0	2.8	1.2	1.4
	35	0.80	85	3.2	3.0	1.4	1.5
	40	0.90	90	3.5	3.0	1.5	1.8
	50	1.20	90	3.5	3.0	1.9	2.1

Source: Faculty of Veterinary Science, University of Khartoum, Shambat.

(a) The above figures are slightly lower than those quoted for European sheep, and it is probable that experiments would show actual maintenance requirements to be lower (Williamson, G., and Payne, W.J.A. (1959) An Introduction to Animal Husbandry in the Tropics, Longmans).

in case the fault lies with the ram or other environmental factors. Any ewes which persistently fail to conceive should be culled as soon as possible.

Lambs should be weighed and securely ear-tagged as soon as they are born, and males castrated at four to six weeks of age to encourage maximum liveweight gains. Any heavy birth-weight males born as twins from good ewes may be kept entire and liveweight gains recorded so that the best performing rams are used for breeding. The potential breeding ram lambs should be grouped together in a separate pen or flock with their mothers and weaned at a later age. Any poor developers should be castrated and put in with the remaining lamb flock. Initially, lambs should be weaned at 4-5 months old when they are 15 to 20 kilogrammes liveweight. Two to three weeks prior to this the rams should be put in with the ewes. As management improves and the sheep become fully acclimatised, lambs can be weaned at three to three and a half months old.

Ewes that have to be culled can be sold or slaughtered immediately after weaning if in suitable condition. Alternatively, they may benefit by fattening for about a month. The culling policy should be so adjusted that rams and ewes are still in good condition when sold. Factors extending their productive life would be a shortage of breeding stock or a prevailing purchasing price. In this case the productive life might initially be six years, falling to five years as the supply is augmented from females bred on the units. Ultimately surplus female lambs could be slaughtered, sold to producers or exchanged for males on a ratio of say two females to three males.

5.2 Sheep Assembly Areas

Store sheep purchased in western Sudan will be taken to the nearest assembly area and be vaccinated and drenched on arrival. Animals would be held for one month on average, but this would depend on pasture availability and market requirements. This period could be extended for stock not ready for finishing.

One paddock should be grazed each month in a rotation that varies each year to enable annual grasses to mature and drop their seed. As sheep are not subjected to very great stress if watered every two or three days, a walk of ten kilometres from water to pasture is not considered excessive and the plan is therefore to maintain twenty-four hour grazing with a mounted shepherd as a guard who will camp with the flock. During the rains it may not be necessary to return to the central water supply, and grazing could extend further by utilising any available water in depressions. When grazing becomes a limiting factor, the assembly areas will be destocked with the transfer of animals by rail to the finishing area. The stocking rate at Jebel Abu Sinun may be controlled as the dry season advances by forwarding surplus sheep that require further holding to Jebel ed Dair.

5.3 Sheep Finishing Area

Suitable stock from assembly areas and from breeding units will be finished on berseem and/or Lubia/Abu 70 for varying periods up to six weeks depending upon age and quality. A gradual initiation period of approximately ten to fourteen days should be allowed for the introduction of sheep to any new rations. Trials on finishing on berseem and/or feed-lotting on concentrates should be established to estimate the most economic period and type of ration.

5.4 Sheep Flock Projections

The detailed projections for the sheep flock build-up on the proposed Qala' en Nahl ranches is given in Table A2.10 and the co-efficients on which they are based are explained in Table A2.11. The two subsequent tables (A2.12-13) show the flock projections on which the sensitivity analyses in Volume II, Chapter 3, are based. The first indicates the pattern of a more rapid build-up of flock numbers than that adopted in the proposal and the second relates to the effect of increasing the store trading element on the sheep ranches.

TABLE A2.10 Flock Projection Sheep Sub-Project

	1	2	3	4	5	6	7	8	9	10	11	12	13	14-20
2 year Ewes	1,000		1,000	2,758	3,053	4,254	5,836	9,750	11,396	11,520	20,136	15,488	17,931	
3 year Ewes	1,000	940	1,000	1,950	3,620	2,930	4,343	5,600	9,360	10,940	11,059	15,330	12,868	
4 year Ewes	1,000	940	883	1,450	2,352	3,475	2,812	4,169	5,376	8,985	10,502	10,616	11,717	
5 year Ewes	-	940	883	838	1,378	2,258	3,336	1,670	-	460	2,625	8,081	8,191	
6 year Ewes	-	-	883	838	796	1,323	-	-	-	-	-	-	-	
7 year Ewes	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rams	150	176	341	561	894	1,034	1,246	1,304	1,531	1,861	2,230	2,139	2,163	
Ewe Lambs	-	1,410	1,722	3,533	6,333	10,581	12,366	12,500	21,850	24,315	26,800	24,147	22,338	
Ewe Hoggets	-		1,325	1,635	3,528	6,079	10,157	11,871	12,000	20,976	21,342	19,720	18,181	
Wether Lambs	-	200	861	1,762	3,166	5,291	7,863	9,750	10,925	15,157	18,400	22,073	21,169	
Wether Hoggets	-	-	-	-	-	-	-	-	-	-	-	-	-	
Store Sheep	-	-	-	2,200	1,600	-	-	-	-	-	-	-	-	
Total Breeders	3,000	3,528	6,835	11,231	17,893	25,880	31,167	36,810	51,059	62,038	74,354	71,308	71,226	
Total (LSE)	3,225	4,000	8,000	16,000	24,000	32,000	40,000	48,000	64,000	80,000	96,000	96,200	96,000	
Target (LSE)	-	4,000	8,000	16,000	24,000	32,000	40,000	48,000	64,000	80,000	96,000	96,000	96,000	
Turnoff:														
Stock 3-7 years	-	-	-	838	796	978	3,688	4,500	3,867	5,067	6,887	14,055	16,269	12,000
Stock 1-2 years	-	1,210	1,049	2,580	4,839	8,329	15,762	23,126	20,285	31,646	44,950	65,737	67,359	70,000
Total:	-	1,210	1,049	3,418	5,635	9,307	19,450	27,626	24,152	36,713	51,837	79,792	83,628	82,000
Purchases:														
Rams	150	36	176	237	361	391	492	208	736	759	884	534	590	600
Ewes	3,000	-	2,000	3,000	3,000	1,000	-	-	-	-	-	-	-	-
Store Sheep	-	-	-	2,200	1,600	-	-	-	-	-	-	-	-	-
Total:	3,150	36	2,176	5,437	4,961	1,391	492	208	736	759	884	534	590	600

TABLE A2.11 Flock Performance Data - Sheep Sub-Project

	Year: 1 and 2	3 and 4	5-20
Death Rates (Per cent)			
Ewes	6	5	4
Rams	5	4	4
Ewe lambs	7	6	5
Ewe hoggets	6	5	4
Wether lamb	7	6	5
Wether hoggets	6	5	4

Marking Percentage Year:	1	2	3	4	5-20
Ewe hoggets	50	50	50	50	50
2 year Ewes	90	100	105	115	120
Others	100	105	110	120	125

Culling Rates (Per cent) Year:	1	2	3	4-20
Ewes (2-5 years)	3	2	2	2
6 year Ewes	10	25	50	100
7 year Ewes	100	100	100	100
Rams	20	20	20	20
Ewe lambs	2	2	2	2
Ewe hoggets	50	50	50	50
Wether lambs	2	2	2	2
Wether hoggets	100	100	100	100

Livestock Conversion Factors	
Ewes and Hoggets	1.0
Rams	1.5
Lambs	.5

Percentage Rams to Ewes Year:	1 & 2	3 & 4	5-20
	6	5	4

TABLE A2.12 Flock Projection Reflecting Increased Development Intensity - Sheep Sub-Project

	1	2	3	4	5	6	7	8	9	10	11	12-20
2 year Ewes	1,000	-	1,000	2,758	3,053	5,524	7,836	11,752	15,257	15,902	15,927	
3 year Ewes	1,000	940	1,000	1,950	3,620	3,930	6,304	9,523	11,282	14,647	14,266	
4 year Ewes	1,000	940	883	1,450	2,352	3,475	4,273	6,552	8,183	10,831	13,062	
5 year Ewes	-	940	883	838	1,378	2,258	3,336	4,103	6,290	7,856	10,398	
6 year Ewes	-	-	883	838	796	1,323	2,168	3,203	-	1,000	-	
7 year Ewes	-	-	-	-	-	-	-	-	-	-	-	
Rams	150	176	341	561	894	1,394	1,674	1,858	2,257	2,116	2,168	
Ewe Lambs	-	1,410	1,722	3,533	6,333	10,581	16,554	24,850	28,783	24,687	23,891	
Ewe Hoggets	-	-	1,325	1,635	3,528	6,079	10,158	15,892	23,856	17,632	15,700	
Wether Lambs	-	200	861	1,762	3,166	5,291	8,277	12,425	18,392	22,348	20,945	
Wether Hoggets	-	-	-	-	-	-	-	-	-	-	-	
Store Sheep	-	-	-	2,200	1,600	12,700	19,400	18,800	-	-	-	
Total Breeders	3,000	3,528	6,835	11,231	17,893	27,880	41,852	61,950	75,260	70,555	72,298	
Total (LSE)	3,225	4,000	8,000	16,000	24,000	48,000	72,000	96,000	96,000	96,000	96,000	
Target (LSE)	-	4,000	8,000	16,000	24,000	48,000	72,000	96,000	96,000	96,000	96,000	
Turn-off:												
Stock 3-7 years	-	-	-	838	796	978	1,605	2,484	7,460	12,581	12,010	12,000
Stock 1-2 years	-	1,210	1,049	2,580	4,839	8,329	13,357	20,371	38,319	70,005	68,399	70,000
Total:	-	1,210	1,049	3,418	5,635	9,307	14,422	22,855	45,779	82,586	80,409	82,000
Purchases:												
Rams	150	36	176	237	361	750	670	652	919	490	620	
Ewes	3,000	-	2,000	3,000	3,000	3,000	3,000	3,000	-	-	-	
Store Sheep	-	-	-	2,200	1,600	12,700	19,400	18,800	-	-	-	
Total:	3,150	36	2,176	5,437	4,961	16,450	23,070	22,452	919	490	620	

TABLE A2.13 Flock Projection Reflecting Increased Store Trading Percentage - Sheep Sub-Project

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18-20
2 year Ewes	1,000		2,000	2,628	2,679	3,545	4,365	5,408	6,500	7,763	8,972	10,339	12,800	13,738	13,724	13,094	14,132	
3 year Ewes	1,000	1,204	1,000	2,400	2,996	3,072	3,903	4,690	5,691	6,740	7,952	9,113	11,252	12,788	13,189	13,176	12,571	
4 year Ewes	1,000	940	1,131	1,450	2,780	3,376	3,449	4,246	5,002	5,463	6,970	8,134	9,977	11,502	12,277	12,662	12,649	
5 year Ewes	-	940	883	1,074	1,378	2,668	3,241	3,345	4,076	4,801	5,724	6,691	7,808	9,578	11,042	11,786	12,156	
6 year Ewes	-	-	883	838	1,020	1,323	2,561	3,111	3,211	3,913	4,608	5,495	6,423	7,496	9,195	6,600	5,815	
7 year Ewes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rams	150	154	327	455	623	658	842	1,019	914	1,093	1,287	1,504	1,814	2,075	2,191	2,161	2,157	
Ewe Lambs	-	705	753	1,695	2,567	3,698	4,883	6,255	7,566	9,049	10,818	12,739	14,890	11,957	20,543	21,463	21,386	
Ewe Hoggets	-	-	-	715	1,610	2,464	3,550	4,688	6,004	7,263	8,687	10,385	12,229	14,295	13,639	14,720	14,600	
Wether Lambs	-	705	753	1,695	2,567	3,698	4,883	6,255	7,568	9,049	10,818	12,739	14,890	17,957	20,543	21,463	21,386	
Wether Hoggets	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Store Sheep	-	-	200	4,500	8,000	10,900	12,800	14,700	24,600	32,900	40,500	30,800	17,900	5,700	-	-	-	
Total Breeders	3,000	3,084	6,559	9,105	12,463	16,448	21,069	25,488	30,484	36,443	42,913	50,157	60,489	69,197	73,066	72,038	71,923	
Total (LSE)	3,225	4,000	8,000	16,000	24,000	32,000	40,000	48,000	64,000	80,000	96,000	96,000	96,000	96,000	96,000	96,000	96,000	
Target (LSE)	-	4,000	8,000	16,000	24,000	32,000	40,000	48,000	64,000	80,000	96,000	96,000	96,000	96,000	96,000	96,000	96,000	
Turnoff:																		
Stock 3-7 years	-	-	-	838	796	1,098	1,401	2,620	3,181	3,258	3,965	4,671	5,563	6,515	7,595	13,248	12,251	12,000
Stock 1-2 years	-	1,410	2,168	4,105	6,746	9,860	13,316	17,198	21,138	25,361	30,323	35,863	42,011	50,209	61,918	67,646	69,372	70,000
Total:	-	1,410	2,168	4,943	7,542	10,958	14,717	19,818	24,319	28,619	32,488	40,534	47,574	56,724	69,513	80,894	81,623	82,000
Purchases:																		
Rams	150	13	183	745	168	179	337	372	132	391	447	517	659	681	597	481	497	
Ewes	3,000	264	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	-	-	-	-	
Store Sheep	-	-	200	4,500	8,000	10,900	12,800	14,700	24,600	32,900	40,500	30,800	17,900	5,700	-	-	-	
Total:	3,150	277	3,383	7,645	11,168	14,079	16,137	18,072	27,732	36,291	43,947	34,317	21,559	6,481	597	481	497	

6. DAIRY HERD PROJECTIONS

6.1 El Qureshi Expansion

The total number of cows in the Qureshi herd has increased only slightly over recent years. In February 1966 there were 432 cows in milk, compared with 480 in milk in January 1972. There appears to be little difficulty in achieving an average life of 6 lactations. Zebu cattle attain their maximum yield between the 4th and 6th lactations while European cattle under Australian conditions also achieve their maximum yield in the 5th or 6th lactation. Many of the cattle in the herd at the present time have a productive life in excess of six lactations. Despite poor feet and loss of udder conformation, good cows can be retained in the herd to a considerable age due to zero grazing and hand milking.

Crossbred cattle in the Sudan calve at an average age of 33.8 months[(a)]. Thus, assuming an average productive life of six years and a first calf at 36 months, the herd could be expanded to 900 dairy cows in 7 or 8 years by retaining the maximum number of heifer calves for the first four years of the expansion programme (Table A2.14). The quality of the replacements reared during the expansion phase will depend largely on the herd sires. Only proven sires should be used and the opportunity should be taken to realise the advantages of imported semen from progeny tested animals obtained from reputable sources of supply.

In year 6 of the expansion phase more careful selection of replacement calves may commence and in year 7 the culling policy can be intensified.

In view of the low culling rate necessary to build up the herd in the early years, it may be necessary to return to a heavier culling programme later. From year 8 onwards the number of heifers reared will allow either replacement of 25 per cent of the adult cows or more careful selection of heifers.

(a) Danasoury, M.S., J. Anim. Prod., U.A.R., 1962, 2, 179-193.

TABLE A2.14 Projected Expansion of the El Qureshi Crossbred Milking Herd

Year:	1	2	3	4	5	6	7	8	9	10
Herd Composition										
Total cows	600	600	600	670	740	790	860	900	900	900
(Cows in milk)	(480)	(480)	(480)	(480)	(520)	(555)	(600)	(630)	(675)	(720)
Heifers over 2 years	150	150	225	225	225	255	285	285	285	285
Heifers 1-2 years	160	240	240	240	270	300	300	300	300	300
Heifers under 1 year	270	270	270	300	335	355	385	405	405	405
Coefficients										
Mortality of cows and 3 year old heifers	(40)	(40)	(45)	(45)	(50)	(55)	(60)	(60)	(60)	(60)
Cows culled	(110)	(110)	(110)	(110)	(125)	(130)	(185)	(225)	(225)	(225)
Mortality of heifers aged 1-2 years	(10)	(15)	(15)	(15)	(15)	(15)	(15)	(15)	(15)	(15)
Heifer calf mortality	(30)	(30)	(30)	(30)	(35)	(35)	(40)	(40)	(40)	(40)
Percent culling rate of mature cows	17	17	17	17	17	17	21.5	25	25	25
Percent total wastage of mature cows (culling and mortality)	25	25	26	23	23.5	23.5	28.5	31.5	31.5	31.5
Sales										
Milk - Daily (gals)	960	960	960	960	1,040	1,110	1,200	1,260	1,350	1,440
Annual (th. gals)	350.4	350.4	350.4	350.4	379.6	405.2	438.0	459.9	492.8	525.6
Male calves	270	270	270	300	335	355	385	405	405	405
Heifers	-	-	-	-	-	20	45	65	65	65
Revenue (LS)										
Milk at 25 pt/gal	87,600	87,600	87,600	87,600	94,900	101,300	109,500	114,975	123,200	131,400
Cull cows and heifers at LS 30	3,300	3,300	3,300	3,300	3,750	4,500	6,900	8,700	8,700	8,700
Bull calves at LS 5	1,350	1,350	1,350	1,500	1,675	1,775	1,925	2,025	2,025	2,025
Total:	92,250	92,250	92,250	92,400	100,325	107,575	118,325	125,700	133,925	142,125
Increase on present	-	-	-	150	8,075	15,325	26,075	33,450	41,675	49,875

The assessment of the milk produced by the El Qureshi herd is based on the present herd average yield of 600 gallons per lactation. At the present time 80 per cent of the cows are lactating, but this has been reduced to 70 per cent during the period when the herd is expanding rapidly.

It is anticipated that total milk production will rise to 1,440 gallons daily in year 10 of the expansion programme, of which 480 gallons would be attributable to the expansion programme.

The increase in herd numbers will necessitate the construction of more stockyards and buildings and increased fodder production will require more tillage equipment.

6.2 Establishment of Wad Medani and Atbara Crossbred Herds

The herd projections, resulting revenue and the coefficients assumed for the establishment of these two dairy herds are shown in Tables A2.15 and A2.16.

The breeding programme is based on the purchase of 2-3 year old heifers of the Kenana (or Butana) breeds and mating them with Friesian bulls (either obtained from El Qureshi or imported for the purpose). Artificial insemination could also be used and by this means semen from a much wider selection of proven bulls could be used. The feasibility of using A. I. to establish these herds will depend on the results achieved at Kuku with the present A.I. programme.

As crossbred cows come into milk in sufficient numbers local cows will be culled and the herd will gradually switch over to having only crossbreds in milk by year eight. When crossbred heifers are being mated, crossbred bulls, or crossbred semen, will be used to maintain the exotic Friesian blood in the herd at about 50 per cent.

Adequate skilled management and veterinary services are assumed to be provided where crossbred cattle are in use. Tick control must be efficient as exotic breeds and their crosses are particularly susceptible to tick borne diseases.

TABLE A2.15 Target Programme for Establishment of Wad Medani Crossbred Milking Herd (Zebu x Friesian)

Year:	1	2	3	4	5	6	7	8 (onwards)
Herd Composition								
Cows: Total	-	250	500	500	500	500	500	500
Zebu	-	250	500	500	418	257	99	-
Crossbred	-	-	-	-	82	243	401	500
Cows in milk: Total	-	175	350	350	350	350	350	350
Zebu	-	175	350	350	293	180	69	-
Crossbred	-	-	-	-	57	170	281	350
Heifers: 2-3 years	260	275	30	84	168	168	168	168
1-2 years	-	-	87	174	174	174	174	174
Less than 1 year	-	90	180	180	180	180	180	180
Bulls[a]	10	10	10	10	5	5	5	5
Livestock Units	145	425	620	690	730	730	730	730
Purchases								
Zebu heifers (2-3 years)	260	275	30	-	-	-	-	-
Bulls	10	-	-	5	-	-	-	-
Sales								
Milk - Daily (gals)	-	175	350	350	407	520	631	700
Annual (th. gals): Total	-	63.9	127.8	127.8	148.6	189.8	230.3	255.5
Zebu	-	63.9	127.8	127.8	106.9	65.7	25.2	-
Crossbred	-	-	-	-	41.6	124.1	205.1	255.5
Male calves	-	90	190	190	190	190	190	190
Cull cows and heifers	-	10	20	71	153	153	148	153
Bulls	-	-	-	10	-	-	5	-
Revenue (LS)								
Milk (25 pt/gal)	-	15,975	21,950	31,950	37,150	47,450	57,575	63,875
Male calves (LS 5/head)	-	450	950	950	950	950	950	950
Cull cows and heifers (LS 20/head)	-	200	400	1,420	3,060	3,060	3,060	3,060
Bulls (LS 30/head)	-	-	-	300	-	-	150	-
Total:	-	16,625	33,300	34,620	41,160	51,460	61,735	67,885

Coefficients

Average age at first calf	- $3\frac{1}{2}$ years
Calving interval	- 15 months
Calving rate	- 80 per cent
Cows in milk	- 70 per cent
Lactation length	- 300 days
Milk yield (excl. calf milk): Zebu	- 1 gal/day
Zebu x Friesian	- 2 gal/day

Mortality Rates:

Calves (unweaned)	10 per cent
Heifers	3 per cent
Cows	2 per cent
Cow culling rate	20 per cent

Livestock Unit (LSU) Conversion Factors

Cow	1
Bull	1.25
Heifers 2-3 years	0.5
1-2 years	0.5
Less than 1 year	0.25

(a) Could be reduced more rapidly if A. I. is introduced successfully.

TABLE A2. 16 Target Programme for Establishment of Atbara Crossbred Milking Herd (Zebu x Friesian)

Year:	1	2	3	4	5	6	7	8 (onwards)
Herd Composition								
Cows: Total	-	350	700	700	700	700	700	700
Zebu	-	350	700	700	585	360	139	-
Crossbred	-	-	-	-	115	340	561	700
Cows in Milk: Total	-	245	490	490	490	490	490	490
Zebu	-	245	490	490	410	252	97	-
Crossbred	-	-	-	-	80	238	393	490
Heifers: 2-3 years	364	385	42	118	235	235	235	235
1-2 years	-	-	122	244	244	244	244	244
Less than 1 year	-	126	252	252	252	252	252	252
Bulls[a]	14	14	14	14	7	7	7	7
Livestock Units	200	595	870	965	1,020	1,020	1,020	1,020
Purchases								
Zebu heifers (2-3 years)	364	378	42	-	-	-	-	-
Bulls	14	-	-	7	-	-	-	-
Sales								
Milk - Daily (gals)	-	245	490	490	570	728	883	980
Annual (th. gals): Total	-	89.5	178.9	178.9	208.0	265.7	322.4	357.7
Zebu	-	89.5	178.9	178.9	149.6	91.9	35.2	-
Crossbred	-	-	-	-	58.2	173.7	287.1	357.7
Male calves	-	126	266	266	266	266	266	266
Cull cows and heifers	-	14	28	99	214	214	207	214
Bulls	-	-	-	14	-	-	7	-
Revenue (LS)								
Milk (25 pt/gal)	-	22,375	44,725	44,725	52,000	66,425	80,600	89,425
Male calves (LS 5/head)	-	630	1,330	1,330	1,330	1,330	1,330	1,330
Cull cows and heifers (LS 20/head)	-	280	560	1,980	4,280	4,280	4,140	4,280
Bulls (LS 30/head)	-	-	-	420	-	-	210	-
Total:	-	23,285	46,615	48,455	57,610	72,035	86,280	95,035

Coefficients - as for Wad Medani herd projection.

(a) Could be reduced more rapidly if A. I. is successful.

7. RESEARCH

The following research should be conducted as soon as possible in the fields of beef and mutton production:

(i) Weight performance: A comparison should be made of weight performance of livestock travelling on the hoof or by rail from various points in the producing areas to central Sudan; also of livestock travelling from Khartoum to Port Sudan and Jeddah. Trials should be conducted at different times of the year to determine seasonal effects and note should be taken of age and initial conformation. These tests could most conveniently be carried out by the Marketing Agency.

(ii) Reproductive Performance of Cows: Groups of 50 to 80 yearling unmated Baggara heifers should be purchased (in addition to those required as base stock for the ranches) for the following treatments: (a) a control group, to run with Butana bulls on native pasture only, with no feed supplement; (b) a group to run with Butana bulls on native pasture and a protein-phosphate supplement as recommended in the proposal; and (c) later, once sufficient improved grass/legume pastures have been established, a repetition of the experiment on these improved pastures. This would be a long-term experiment, but would provide invaluable information for the future beef ranching potential of the Sudan.

(iii) Reproductive Performance of Ewes: Ewes and breeding rams of different ecotypes should be selected for detailed recording of reproductive performance under varying climatic and soil conditions and different planes of nutrition. A few years' records should reveal the most profitable ecotypes.

(iv) Feedlotting of sheep: A small pilot feedlot should be incorporated under the Gedaref feedlot management. Experimental work on finishing Sudanese desert sheep has so far been confined to short periods on small samples purchased direct from traditional producers (Volume I, Section 4.3.1). More information should be available from the livestock farm at El Masid and the new El Huda sheep research station before the project commences. Feedlotting would have to be in the form of a small scale trial at first to test whether an expensive high protein/energy or a cheaper low protein/energy ration would be more economic in terms of cost related to liveweight gain. The feed conversion ratio of desert sheep is not high and the ration constituents must be of low cost per lb. of protein. The ration must be compound and fed so that excessive fat is not deposited. Young animals are particularly suited to this system and the required immature stock should be available from assembly area purchases.

(v) Infertility diseases in cattle: This trial should be designed to establish the incidence of infertility diseases in base cows likely to be used in the stocking of development ranches, and can be conducted on the basis of routine testing. Diseases to be investigated will include: Brucellosis, caused by the bacteria Brucella abortis; Vibriosis, caused by a number of strains of the bacterium Vibrio; Leptospirosis, caused by strains of the bacterium Leptospira; and Trichomoniasis, caused by the protozoa Trichomonas.

The whole of the recommended production research can be integrated with the development programme outlined in the report. The only funds required in addition to those budgeted for the production sub-projects will be for the purchase of heifers in the reproduction experiment, since the class of stock required will not be the same as those likely to be purchased as base stock for the ranches. Provision has been made for this and for the necessary supervision of all experimental work in estimating the total research investment requirements (Volume II, Section 2.6).

APPENDIX IV

EXPORT MARKETS

1. SUDAN LIVESTOCK EXPORT STATISTICS

There are discrepancies between the figures given in the annual Foreign Trade Statistics and the records kept by the Ministry of Animal Production officials at Port Sudan and Wadi Halfa, the latter usually being higher. Because the MAP figures were available complete in monthly form from 1967 to 1971 inclusive, they were used in studies of seasonality patterns and for reasons of consistency were also employed in Volume I, Table 1.8 for live exports between those dates. The 1966 figures for live exports and all estimates of meat exports were, however, taken from the Foreign Trade Statistics[(a)]. For purposes of comparison and as a guide to the approximate values of past exports, the Foreign Trade Statistics figures for 1960 to 1970 inclusive are given in Tables A4. 1 and A4. 2. Figures for hides and skins exports over the same period are shown in Table A4. 3.

Monthly livestock export figures are given for Port Sudan (January 1967 - January 1972) in Table A4. 4 and Wadi Halfa (October 1969 - January 1972) in Table A4. 5. Since mid-1970 these valuable records have been collected and published in an annual report by the Head of the Quarantine Section of the MAP, together with figures of animals which have either died, been slaughtered or withdrawn while in quarantine. Losses are generally low at this stage, the major casualties occurring after animals leave the point of export. The 1970/71 pattern is shown in Table A4. 6.

(a) Alterations were made in the meat export figures where more accurate information seemed available from elsewhere.

TABLE A4. 1 Foreign Trade Statistics Estimates of Beef Exports, 1960-1970

	1960		1961		1962		1963		1964		1965		1966		1967		1968		1969		1970	
	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)		Value (LS. 000)		Value (LS. 000)		Value (LS. 000)		Value (LS. 000)
(1) Live Cattle																						
Egypt	38,788	944.1	32,978	800.4	5,433	121.7	21,278	512.4	11,744	282.3	5,535	151.0	14,949	445.9	7,174	214.6	781	23.8	1,519	49.6	15,155	554.3
Saudi Arabia	729	15.3	13	0.6	674	6.4	804	20.5	360	6.6	2,810	81.4	1,726	51.9	1,798	60.2	6,235	198.0	6,335	219 2	5,463	200.1
Gulf States (incl. Kuwait)	-	-	-	-	666	14.7	-	-	-	-	-	-	-	-	270	6.8	1,067	27.6	1,614	48.8	480	14 4
Libya	-	-	-	-	-	-	-	-	310	10.9	1,210	42.8	534	14.4	-	-	-	-	-	-	-	-
Other	475	7.3	249	5.9	950	18.1	-	-	-	-	40	1.3	225	6.7	-	-	-	-	5	0.1	-	-
Total Exports:	39,992	966.7	33,240	806.9	7,723	160.9	22,082	532.9	12,414	299.8	9,595	276.5	17,434	518.9	9,242	281.6	8,083	249.4	9,476	317.7	21,098	768.8
(2) Chilled Beef (metric tons)																						
Egypt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	706.6	277.1	-	-
Saudi Arabia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	0.9	7.4	2.0
Libya	-	-	-	-	-	-	-	-	38.7	6.9	89.3	15.8	65.3	9.8	40.0	6.5	7.2	0.9	53.7	12.3	13.5	2.7
Lebanon	-	-	-	-	-	-	-	-	-	-	2.5	0.4	2.5	0.4	-	-	1.7	0.2	30.9	4 8	0.2	0.1
Total Exports:	-	-	-	-	-	-	-	-	38.7	6.9	91.8	16.2	67.8	10.2	40.0	6.5	8.9	1.1	796.3	295.1	21.1	4.8

TABLE A4. 2 Foreign Trade Statistics Estimates of Mutton Exports, 1960-1970

	1960		1961		1962		1963		1964		1965		1966		1967		1968		1969		1970	
	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)
(1) Live Sheep																						
Saudi Arabia	69,268	466.9	99,545	665.2	90,729	619.8	72,565	506.1	70,362	495.6	220,668	1,648.9	161,951	1,257.8	216,343	1,740.7	201,956	1,722.8	221,507	1,956.9	145,948	1,273.3
Egypt	-	-	-	-	-	-	400	3.0	9,000	71.6	5,351	43.1	1,100	9.5	-	-	-	-	250	2.0	27,852	247.3
Gulf States (incl. Kuwait)	3,385	20.1	-	-	2,500	20.0	-	-	-	-	-	-	-	-	2,400	20.4	7,900	68.0	-	-	-	-
Libya	-	-	-	-	-	-	-	-	180	2.3	200	1.5	-	-	800	6.8	650	3.7	260	2.1	500	4.3
Other	2,680	17.1	-	-	1,750	13.4	-	-	700	4.9	1,000	7.6	-	-	-	-	-	-	2,720	24.0	-	-
Total Exports:	75,333	504.1	99,545	665.2	94,979	653.2	72,965	509.1	80,242	574.4	227,219	1,701.1	163,051	1,267.3	219,543	1,767.9	210,506	1,794.5	224,737	1,985.0	174,300	1,524.9
(2) Chilled Mutton (metric tons)																						
Libya	-	-	-	-	-	-	-	-	-	-	39.3	8.4	21.5	5.0	9.3	3.1	19.0	4.3	16.2	4.1	-	-
Lebanon	-	-	-	-	-	-	-	-	-	-	0.5	0.2	-	-	-	-	2.0	0.3	3.8	0.6	-	-
Egypt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.1	2.4	-	-
Saudi Arabia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	0.3	0.5	0.1
Gulf States (incl. Kuwait)	-	-	-	-	29.4	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Exports:	-	-	-	-	29.4	7.6	-	-	-	-	39.8	8.6	21.5	5.0	9.3	3.1	21.0	4.6	34.1	7.3	0.5	0.1

TABLE A4. 3 Hides and Skins Exports, 1960-1970

	Hides		Sheepskins		Goatskins		Other Hides and Skins		Leather (heavy and light)	
	Tons	Value (LS. 000)	Tons	Value (LS. 000)	Tons	Value (LS. 000)	Tons	Value (LS. 000)	Tons	Value (LS. 000)
1960	3,281	536. 7	1,059	348. 7	383	103. 0	95	36. 3	6	3. 4
1961	3,023	457. 5	1,261	419. 7	421	105. 1	41	57. 1	7	3. 6
1962	3,101	500. 4	1,023	315. 4	362	100. 6	34	57. 6	2	1. 0
1963	4,512	679. 7	1,045	396. 9	464	144. 9	38	58. 4	10	6. 6
1964	1,572	250. 8	1,457	522. 6	378	98. 8	58	108. 4	4	3. 0
1965	3,539	529. 4	1,416	487. 9	458	132. 0	55	99. 3	7	13. 4
1966	3,461	622. 8	1,616	570. 3	682	251. 0	128	159. 7	-	-
1967	2,162	451. 1	1,451	633. 0	567	239. 8	64	122. 6	-	-
1968	3,018	580. 4	1,468	681. 0	481	182. 4	33	63. 3	-	-
1969	3,250	617. 7	1,721	759. 3	601	270. 2	66	155. 5	31	18. 4
1970	3,944	693. 6	1,409	674. 1	472	186. 3	56	361. 6	-	-

Source: Department of Statistics.

TABLE A4. 4 Monthly Livestock Exports, Port Sudan, January 1967 - January 1972

	1967	1968	1969	1970	1971	1972
(1) Sheep						
January	23,556	37,710	44,921	30,200	24,045	12,670
February	23,903	42,697	18,800	26,575	12,247	
March	25,243	18,550	14,930	18,260	19,204	
April	30,248	14,100	15,977	12,750	13,200	
May	19,386	22,293	7,300	7,747	11,600	
June	11,777	17,350	5,230	6,200	2,700	
July	1,368	6,332	900	1,355	800	
August	6,145	12,900	2,398	-	565	
September	20,699	15,650	9,200	697	-	
October	18,434	31,642	22,266	11,120	9,104	
November	39,658	32,974	42,673	17,482	4,560	
December	48,094	27,126	35,555	13,813	6,896	
Annual Totals:	268,511	279,324	220,150	146,199	104,921	
(2) Cattle and Calves						
January	1,591	996	410	1,323	148	-
February	1,294	1,403	795	610	-	
March	507	997	622	779	104	
April	2,110	530	1,063	870	500	
May	2,514	456	700	430	902	
June	1,370	311	279	688	120	
July	1,274	160	-	-	124	
August	-	-	-	-	-	
September	-	324	50	-	2	
October	213	1,574	1,155	105	-	
November	398	1,822	1,084	812	-	
December	2,368	1,073	877	300	-	
Annual Totals	13,639	9,646	7,035	5,917	1,900	
(3) Goats						
Annual Totals:	4,450	3,220	2,415	3,500	846	
(4) Camels						
Annual Totals:	546	862	63	111	12	

Source: MAP Records, Port Sudan.

N. B. Until March 1968 the bulk of cattle exports were going to Egypt; thereafter all livestock was sent to Saudi Arabia and the Gulf States.

TABLE A4. 5 Monthly Livestock Exports, Wadi Halfa
October 1969 - January 1972

	1969	1970	1971	1972
(1) Cattle and Calves				
January	-	1,141	1,429	-
February	-	591	2,477	
March	-	1,813	3,004	
April	-	2,235	3,391	
May	-	724	1,762	
June	-	1,373	2,239	
July	-	913	1,532	
August	-	-	988	
September	-	-	632	
October	325[a]	570	1,015	
November	1,578	1,354	1,993	
December	1,561	2,218	-	
Annual Totals:	3,464	12,932	20,462	
(2) Sheep				
January	-	15,300	12,035	7,773[b]
February	-	2,700	-	
March	-	1,065	2,116	
April	-	-	-	
May	-	-	3,438	
June	-	-	1,454	
July	-	-	-	
August	-	-	-	
September	-	-	-	
October	-	-	-	
November	-	5,384	-	
December	-	2,441	-	
Annual Totals:	-	26,890	19,043	

(a) This was the first consignment after the creation of Lake Nuba.

(b) As at 21st January 1972.

Sources: MAP Quarantine Head Section, Khartoum and MAP Records, Wadi Halfa.

TABLE A4. 6 Quarantine Losses, July 1970 - June 1971

	Percentage of Animals Arriving at Quarantine								
	Adult Cattle			Calves			Sheep		
	Exported	Died	Withdrawn	Exported	Died	Withdrawn	Exported	Died	Withdrawn
Port Sudan	96. 7	0. 8	2. 5	54. 5	1. 8	43. 6	98. 9	0. 1	1. 0
Wadi Halfa	98. 5	1. 0	0. 5	99. 2	0. 5	0. 2	99. 0	0. 2	0. 8

Source: MAP Quarantine Head Section 1970/71 Report.

Records of meat exports are particularly confusing, the Foreign Trade Statistics and MAP figures rarely coming near to correspondence. This can be seen from comparing the figures in Tables A4. 1 and A4. 2 with those in Table A4. 7, which are taken from two sources: the MAP Animal Health Section and the Omdurman Slaughterhouse. These anomalies should be investigated as soon as possible, as well as those relating to live exports. The co-ordination of records should, in future, be a function of the Marketing Agency.

2. MARKETS FOR MEAT IN THE MIDDLE EAST

2. 1 Introduction

As part of this study, a member of the Consultants' team visited all the principal meat importing countries in the Middle East to investigate the market potential for Sudan. The characteristics of each market are discussed below under the following headings:

(a) current livestock and meat imports;
(b) estimated current meat consumption;
(c) quality preferences;
(d) prices;
(e) import duties;
(f) health requirements and
(g) religious factors.

TABLE A4.7 Estimates of Chilled Meat Exports, 1967-1971

		1967	1968	1969		1970		1971	
		Tons	Tons	Tons	Nos. of Animals	Tons	Nos. of Animals	Tons	Nos. of Animals
(1)	Beef								
	Libya	112.0	16.0	79.3	333[a]	107.6	686	291.5[b]	1,823
	Lebanon	-	5.0	44.6	-	0.2	100	-	-
	Kuwait	-	-	-	-	-	-	3.8[b]	22
	Egypt	-	-	305.0	2,606[a]	490.0	4,193	33.0[b]	-
	Saudi Arabia	-	-	5.6	-	9.3	-	14.0[b]	-
(2)	Mutton								
	Libya	31.2	24.0	4.0	200[a]	18.0	851	0.3[b]	7
	Lebanon	-	-	-	-	tr.	-	-	-
	Kuwait	-	-	-	-	-	-	12.2[b]	995
	Egypt	-	-	-	-	tr.	-	-	-

Note: Weight estimates from MAP Animal Health Section, animal numbers from Omdurman slaughterhouse.

(a) November and December 1969 only.

(b) Foreign Trade Statistics (January-August 1971 only) give the following estimates (in tons): Beef: Libya 307.9, Kuwait 0.9, Egypt 0.3, Saudi Arabia 4.5; Mutton: Libya 54.0, Lebanon 0.5, Kuwait 10.5, Saudi Arabia 3.1.

Finally, projections have been made of future demand and Sudan's prospects in each market are assessed. Contacts who were particularly helpful during the market survey are also mentioned.

2. 2 Saudi Arabia

(a) Imports

The most recent complete edition available of Saudi Arabia's Foreign Trade Statistics relates to 1968. Digests have been published for 1969 and 1970 but these do not contain breakdowns by country for each item imported. Unfortunately, little confidence can be placed in the 1968 figures, which quote imports from the Sudan which are higher than those in the Sudanese export records by 120 per cent in the case of cattle and 75 per cent in the case of sheep. It was assumed that the figures for all livestock imports in 1968 were distorted to a similar degree and the consequent adjustment produced figures which were of the same order as those for 1969 and 1970. The 1968 records indicated the following market shares (per cent):(a)

	Sheep	Cattle	Goats
Somalia	63	69	16
Sudan	29	24	37
Ethiopia	3	6	42
Australia	2	-	-
Other	3	-	5

More recent figures, collected from the records of the Department of Agriculture's veterinary inspector in Jeddah, indicate that the ratio of Sudanese to Somali imports dropped in 1970 to 13 : 87 for both sheep and cattle; the ratio for the first eight months of 1971 was the same in the case of sheep and fell to 11 : 89 in the case of cattle. Detailed figures are given in Table A4. 8, from which it can be seen that the Somali supplies, besides being much higher than the Sudanese, also maintain a much more even flow

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(a) In terms of numbers. The Somali sheep are in fact substantially smaller than the Sudanese (averaging about 15 kg carcaseweight against 22 kg) and fetch only a little over half their price per head. In value terms, therefore, the recent ratio has probably been about 20 : 80. But it will have fallen further in the second half of 1971.

TABLE A4. 8 Saudi Arabia - Monthly Livestock Imports from Somalia and Sudan, 1970-1971

		Cattle		Sheep	
		Somalia	Sudan	Somalia	Sudan
January	1970	1,502[a]	410[a]	45,434[a]	15,460[a]
February		1,314	1,420	101,786	30,029
March		1,456	1,159	57,772	21,360
April		1,565	462	21,010	7,556
May		830	798	22,742	9,050
June		3,910	-	42,971	3,200
July		4,608	150	87,747	2,555
August		4,043	-	77,541	-
September		2,248	-	78,540	697
October		1,990	170	96,334	9,420
November		4,356	105	94,609	15,312
December		4,327	315	113,154	13,386
January	1971	4,145	500	86,578	16,665
February		1,352	50	88,677	15,930
March		1,835	4	98,172	21,906
April		1,279	63	47,743	12,650
May		1,726	760	63,968	12,699
June		3,442	312	41,720	3,600
July		3,290	-	49,465	-
August		3,361	906	68,859	565
September		4,664[b]		51,340[b]	
October		2,249		59,796	
November		6,465		122,102	
December		3,366		110,109	

(a) Figures for January 1970 - August 1971 from Ministry of Agriculture, Riyadh.

(b) Figures for September - December 1971 from Jeddah Ministry of Commerce.

Note: Original data referred to Islamic months and conversion is only approximate.

throughout the year.

After the downward adjustment of the 1968 import figures, all import estimates were raised by 36 per cent on the basis of official urban slaughterhouse records[(a)]. It is very probable that import records would tend to be underestimated in view of the apparently substantial illegal movement of livestock into Saudi Arabia (there is some evidence of smuggling between north of Port Sudan and Yenbo). The revised import estimates are given in Table A4. 9 below. While it is realised that this treatment of official figures is unorthodox, it appeared the only way of obtaining some kind of internal consistency.

TABLE A4. 9 Saudi Arabia - Revised Livestock Import Estimates (000 head)

	1968	1969	1970
Cattle	41. 6	51. 7	62. 6
Sheep	1, 275. 8	1, 491. 7	1, 382. 8
Goats	31. 6	32. 7	32. 7
Camels	5. 4	13. 6	32. 7
Poultry	732. 2	644. 2	1, 562. 4

Imports of chilled and frozen meat are low (424 tons in 1968, plus 5, 122 tons of frozen chicken), partly because of the preference in Saudi Arabia for freshly slaughtered meat and partly because of the high duty applying until recently to imported meat. Canned meat imports are also small.

(a) Slaughter records for February - July 1969 gave a figure for imported animals of 10, 787 tons. After converting this to an annual total and allowing for 35 per cent of slaughtering being outside official premises, it appeared that imports were underestimated by 36 per cent.

(b) Consumption

The estimated livestock population of Saudi Arabia is: Sheep 2. 73 m, Goats 1. 39 m, Camels 1. 04 m and Cattle 0. 27 m[(a)]. According to senior representatives of the Ministry of Agriculture, 47 per cent of the country's mutton consumption is believed to be supplied from local sources and about 2 million locally produced sheep equivalents are slaughtered each year.

On the basis of these assumptions and the revised import estimates, the consumption figures in Table A4. 10 were reached.

Estimation of Saudi Arabia's per capita consumption is more than usually difficult owing to uncertainty about the size of the total population (estimates range between 4. 0 and 7. 7 million). It is assumed here to have been 4. 5 million in 1970.

TABLE A4. 10 Estimated Meat Consumption, Saudi Arabia, 1970

	Total (tons)	Kg/head
Beef	9, 900	2. 2
Mutton	44, 530	9. 9
Camel	21, 400	4. 8
Poultry	8, 590	1. 9
Total:	84, 420	18. 8

There appears to be no very strong seasonal variation in consumption patterns, but demand is reported to be higher during the winter and 2-3 times higher than average during the month of Ramadan.

(a) FAO, Rome/Cairo (1971), Regional Study on animal husbandry, etc. in the Near East (draft).

(c) Quality Preferences

As Table A4. 10 shows, the Saudis are predominantly mutton eaters. Freshly slaughtered meat is generally preferred to chilled or frozen. Especially large numbers of sheep and goats are sacrificed during the major Muslim festivals, most notably at the Eid el Bairam, when many pilgrims from abroad visit Mecca. Preference is for the "traditional" desert sheep (castrated males) and the Sudanese animals rate very highly. However, their large size makes them more suitable for special feasts than ordinary family occasions, for which the smaller Somali animals are more convenient. Butchers are also said to favour Somali animals because they have a smaller percentage of bone and are easier to cut[(a)].

Towns near the western coast and the capital, Riyadh, obtain most of their imported supplies live through Jeddah. In Eastern Province, however, most imports come through Dammam and contain a larger proportion of frozen meat, much of it from Australia. Some live sheep have also been sent from Australia (by the Homeidi-Klausen firm operating in Kuwait). Their meat has not been well received so far but the low prices at which the animals are being offered could lead to a change in attitudes.

Demand for beef is said to be increasing fairly rapidly in urban higher income groups and the population of expatriates (predominantly beef-eating) is expected to double or treble in the next five years (up to 15-20, 000 Europeans may be working in Eastern Province alone). Imported cattle are generally of poor quality but some "good average" quality beef air-freighted from Ethiopia is consumed by Europeans. Small amounts of "frozen" beef fillet (1-2 tons/month) have recently been sent by air from Sudan to Jeddah. Since the removal of the heavy duty on imported meat (see below), there could be an increased market for

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(a) There is also a substantial consumption of goat-meat in Saudi Arabia. There is reported to be little consumer differentiation between sheep and goat-meat of Somali origin. However, Sudanese goat-meat is said not to be popular and fetches a price 20 per cent below that of sheep.

chilled beef, especially in Eastern Province and possibly Riyadh, where fresh supplies are scarcer than in Jeddah.

(d) Prices

The retail price of mutton is fixed by Jeddah municipality at 50 pt/kg[(a)] and importers quote a maximum c. and f. price equivalent to 19 pt/kg liveweight. One reason why imports of Sudanese sheep have been declining is that Sudanese exporters have been asking too high prices (e. g. up to LS. 11. 25 for an animal of 45 kg liveweight, or 25 pt/kg). Australian exporters are recently reported to have offered trial consignments to Jeddah for as little as $7\frac{1}{2}$ pt/kg c. i. f. liveweight, or about 17 pt/kg carcaseweight. The cost of freighting sheep to Riyadh is about 4 Saudi Riyals per animal (or 2 pt per kg carcaseweight).

Urban retail prices for beef appear to be about 20-30 per cent lower than those for mutton. Importers in Jeddah quote $8\frac{1}{2}$ pt/kg c. and f. liveweight (about 16 pt/kg carcaseweight) for cattle and calves from Somalia, but exporters from Sudan report having received offers between 20 pt and 25 pt/kg carcaseweight, depending on quality. The beef fillets from Sudan were coming in at about 67 pt/kg before the removal of the $27\frac{1}{2}$ per cent duty but they were not properly deep-frozen or packed and were overpriced compared with better quality frozen beef from other sources.

Livestock import prices are reported to rise by about 10 per cent during the summer months as a result of a decline in supply.

(e) Duties

No import duty is charged on live animals. Until January 1972 imported meat was liable to a duty of $27\frac{1}{2}$ per cent, but this has now been entirely removed.

A subsidy for the import of live animals was removed in 1970.

(a) Fixed retail prices in Riyadh and Dammam are about 58 pt/kg and 67 pt/kg respectively.

(f) Health Requirements

Saudi Arabia has no special sanitary requirements, but Sudan applies the same measures as for Egypt and Libya.

(g) Religious Factors

The preference for locally slaughtered meat is strong in traditional circles, but as far as imported meat was concerned it did not generally seem considered that religion would greatly favour Sudan at the expense of non-Islamic exporters.

(h) Demand Projections and Conclusions

In projecting Saudi Arabia's future demand for meat, it was assumed that population would increase by 2. 8 per cent per annum and income per head by 2. 6 per cent per annum[(a)]; and that the income elasticity of demand for all meats was 0. 6 (comparable to other Middle East countries with similar conditions). It was also assumed that, with retail prices for different meats remaining in the same relation to each other as at present, expenditure on beef in 1982/3 would rise to 20 per cent of expenditure on all meats (compared with 11 per cent now), mutton fall to 50 per cent (against 59 per cent now), camel fall to 10 per cent from 22 per cent and poultry rise to 20 per cent from 8 per cent. The resulting values were then translated into quantity terms. Local livestock production (and offtake) was assumed to increase by 4. 6 per cent per annum, on the basis of information supplied by the Ministry of Agriculture (new livestock development schemes are planned south of Riyadh and near Hofuf). The estimate of locally-produced meat was deducted from total projected consumption to give total imports. Finally, the proportion of meat consumed in frozen or preserved form was assumed to have increased by 1982/3 to 20 per cent in the case of beef and 10 per cent in the case of mutton. When this was deducted, an estimate was obtained

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(a) Annual GNP growth rate is predicted at 5. 5 per cent in Moe, L. E. (1966), Supply and Demand Projections for Farm Products to 1975, USDA., ERS-Foreign 168.

of mutton and beef import requirements in live or chilled form. These results are shown in Table A4. 11.

TABLE A4. 11 Saudi Arabia - Projected Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	29. 7	4. 8	0. 7	29. 0	23. 0
Mutton	62. 8	10. 1	31. 7	31. 1	24. 9
Camel	16. 3	2. 6			
Poultry	36. 3	5. 8			
Total:	145. 1	23. 3			

Saudi Arabia is likely to remain the largest and easiest market (in terms of quality and accessibility) for exporters of Sudanese sheep in the foreseeable future. There are also attractive prospects for medium-quality beef, where competition will probably be less severe. Sudanese exports have been declining lately because of rising prices and costs in Sudan and inability to guarantee supplies on a regular basis. The 15 per cent export bonus and the proposals made for improving marketing in this Report should help to overcome these problems. Saudi importers have complained at times of not getting the type or size of animal agreed by contract, but this source of friction should also be removed if sales are made on a liveweight, graded basis. Importers are agreed that the quality of Sudanese mutton is superior to the Somali and they are generally well disposed to Sudanese products, but they are mostly acute businessmen and expect value for money and efficient marketing.

Among the most prominent of those who provided information for this survey were: Messrs. Abbar and Zainy, Jeddah; Awadh Etaiwi

and Sons, Jeddah; Sharbatly Food Corporation, Jeddah; Sheikh Mohammed Bad Kok of Kilo 10 Restaurant, Jeddah; Khalifa Algoseibi Cold Stores, Dammam and Jeddah; Spinney's Food Supplies, Riyadh; and the Ministry of Agriculture, Riyadh.

2.3 Kuwait

(a) Imports

The official Kuwait import figures for 1966-1970 are summarised in Table A4.12. It will be seen that Sudan has so far been insignificant as an exporter of livestock or meat to Kuwait. Over the five year period there was a marked shift towards importing chilled and frozen meat rather than livestock. The type of meat imported is unspecified in the statistics, but traders' estimates are that it is made up of 85 per cent mutton (equal parts chilled and frozen) and 15 per cent beef (all frozen). The principal suppliers of chilled mutton are East European countries and Turkey. As Table A4.12 shows, this trade has expanded very rapidly indeed in the last four years.

Examination of the slaughter records of Kuwait[(a)] indicate that the live import figures are, as often, underestimated, possibly on account of smuggling. After account was taken of local livestock production (very small), discrepancies were often still very large and it was decided that live imports should be adjusted upwards to be consistent with the slaughter figures. Thus in 1970, for example, the number of cattle and sheep actually imported was assumed to be as high as 9,960 and 490,000 respectively.

(b) Consumption

The livestock population of Kuwait is very small indeed and nearly all supplies are imported. There are estimated to be 100,000 sheep, 15,000 cattle, 50,000 goats and 7,000 camels. On the basis of these

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(a) Statistical Abstract (1971), Central Statistical Office, Kuwait.

TABLE A4. 12 Kuwait, Livestock and Meat Imports, 1966-1970

Country of Origin	1966	1967	1968	1969	1970
Cattle (Nos.)					
Iran	9,325	13,415	-	-	-
Syria	-	620	3,217	1,406	-
Somalia	307	-	409	1,093	1,893
Ethiopia	-	-	1,083	2,141	-
East Africa	375	195	563	510	2,345
Sudan	-	-	1,428	1,348	773
Others	251	482	1,440	925	176
Total:	10,258	14,712	8,140	7,063	5,187
Sheep and Goats (Nos.)					
Iran	329,854	93,133	2	89	786
Syria	15,768	43,035	68,229	45,698	20,229
Somalia	-	7,423	16,500	6,700	20
South America	-	8,500	64,666	37,313	18,857
Australia	137,803	152,323	158,369	129,744	223,726
Sudan	-	-	2,646	1,994	-
Others	15,921	44,790	43,426	757	10,519
Total:	499,346	349,204	353,874	222,295	274,137
Fresh, Chilled or Frozen Meat (Tons) (excluding poultry)					
China	114.7	282.3	2,625.7	1,326.3	2,445.6
Turkey	-	0.4	682.0	447.2	1,051.5
Eastern Europe	15.0	96.6	1,447.5	3,035.0	2,228.8
Australia	1,763.1	1,884.8	1,828.2	1,496.0	1,045.6
Denmark	267.3	181.0	327.6	431.2	434.7
East Africa	76.4	87.4	105.4	64.0	49.5
Sudan	-	-	-	-	0.2
Other	97.5	185.5	378.2	294.1	360.2
Total:	2,334.0	2,718.0	7,394.6	7,093.8	7,616.1
Canned Meat (Tons)					
Total:	546.1	547.8	572.6	655.1	474.7

Source: Kuwait Foreign Trade Statistics.

figures and the revised import estimates (and a human population of about 733, 200 in 1970), the consumption figures in Table A4. 13 were obtained.

TABLE A4. 13 Estimated Meat Consumption, Kuwait, 1970

	Total (tons)	Kg/head
Beef	2, 950	4. 0
Mutton	18, 240	24. 9
Camel	490	0. 7
Poultry	5, 510	7. 5
Total	27, 190	37. 1

Consumption per head is large but it does not seem improbable in view of the very high standard of living among nearly all classes in Kuwait (GDP per head in 1970 was equivalent to about LS. 1, 415). The emphasis on mutton is very marked.

There is a substantial fall in demand for meat in the summer months, when many Kuwaitis move out of their country to cooler areas such as Lebanon. Consumption is higher than average during Ramadan.

(c) Quality Preferences

With such a high income per head, Kuwait is a quality market for mutton, though less so for beef, which is relatively little eaten at present. The preference is for young lamb of 10-12 kg carcaseweight, with 20 kg the maximum. Chilled carcases sent from Eastern Europe and Turkey have been of this type. The Australian sheep imported by the firm of Homeidi-Clausen, which now dominates the live market, have tended to be 2-3 years old (26-27 kg carcaseweight) but realised good sales (mainly tenders to government departments) on account of their very low price. However,

it is reported that increasing competition from the suppliers of chilled meat has caused a movement towards younger lambs in the live market also.

There are considerable risks in dealing in chilled meat, especially in such a competitive market as Kuwait, since meat not sold quickly has to be frozen and fetches only about half the price. Several firms consider that the recent enthusiasm for competing in the chilled market will wane but others see few signs of this occurring. One or two consignments of Sudanese mutton were sent by air in 1970/71 but they were not successful; importers' complaints were that the carcases were "not fat enough" and that the meat was badly chilled and discoloured on arrival. However, purely in terms of meat quality, Sudanese mutton should enjoy an advantage over most major suppliers at present in that animals fed on dry grazing (and subsequently fattened) are preferred to those which are pasture-fed.

A movement in consumer preference towards beef is discernible, but good quality is required. The fact that the movement is only slow suggests that quality beef is in relatively short supply. Importers express a preference for live cattle. No chilled beef is imported at present, but if it were it would have to be of prime quality (not older than eight months). Whole carcases are not in demand.

A notable increase in demand is reported among lower and middle income groups for frozen meat and (especially) chicken. Since ownership of refrigerators is widespread in Kuwait, this demand will no doubt continue to grow rapidly, but prices for frozen meat are very low.

(d) Prices

Average import prices for chilled mutton range from 37-40 pt/kg carcaseweight. One of the reasons for the low mutton prices prevailing in Kuwait is that when the East European countries first entered the market they subsidised their costs and were offering prices as low as 31 pt/kg. Prices were then raised steadily after a share of the market had been captured; in late 1971 the import price for East Europeans'

meat was reported to be up to 41½ pt/kg and it seemed that they were being undercut by the Turks and running into various difficulties. The additional competition from the chilled mutton suppliers has also affected the price of live animals, and wholesale selling prices for Australian sheep are said to have declined from 45½ pt to 33 pt per kg carcaseweight in the last three years (the c. i. f. price in 1970 was about 24 pt/kg).

Live cattle were fetching import prices of only 22 pt/kg carcase-weight in 1970 but, as the countries of origin in Table A4. 12 show, quality was not outstanding. It is believed that properly finished animals could fetch prices up to 30 pt/kg and possibly above, but further market research is required to test this.

C. i. f. prices for frozen mutton legs range from about 26 pt/kg (Australia) to 19 pt/kg in the case of Chinese mutton, which is reported as of "decent quality". The margin between chilled and frozen meat prices is illustrated by the fact that if chilled mutton is not sold on the day of arrival, the retail price slips from 52 pt/kg to 47 pt/kg the next day and is thereafter classified as "frozen", selling at only 26 pt/kg.

(e) Duties

Live animals are imported duty free but all meat is subject to 4 per cent duty.

(f) Health Requirements

Cattle are required to be vaccinated against rinderpest, anthrax and H. S. ; they should also be tested against C. B. P. P. and vaccinated against this disease 20 days before departure from the exporting country; they should also be dipped against ectoparasites. Sanitary measures for other categories of livestock and meat are the same as in the case of Egypt and Libya (see below). The necessary health certificates are required, but some smuggling to evade these is reported from Iraq. Veterinary officials in Kuwait are not satisfied with the present health arrangements and attempts are being made to impose stricter measures on importers.

(g) Religious Factors

While there is still a substantial traditional element in Kuwait society, the recent large increases in meat imports from non-Islamic countries suggests that little importance is attached to the provenance of meat provided that evidence is given of slaughter according to Mohammedan law.

(h) Demand Projections and Conclusions

Kuwait's population increased at a rate of over 9 per cent per annum during the 1960's but it was assumed to drop to 5 per cent during the period of analysis. The annual increase in income per head was projected at 1.6 per cent, with a 0.8 income elasticity for meat. In view of the present price differentials between meats and the relatively low beef consumption, a movement was assumed away from mutton and towards beef and poultry, so that in 1982/3 expenditure on all meats would be in the proportion of 20 per cent on beef, 55 per cent on mutton and 25 per cent on chicken. Provision was made for an increase in the present very small indigenous livestock offtake and the proportion of meat consumed in frozen or canned form was assumed to rise by 1982/3 to 50 per cent in the case of beef and 35 per cent in the case of mutton. The results of these assumptions are shown in Table A4.14.

TABLE A4.14 Kuwait - Projected Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	14.1	10.3	0.2	13.9	6.8
Mutton	28.8	21.0	1.4	27.4	17.3
Poultry	21.8	15.9			
Total:	64.7	47.2			

The market for mutton in Kuwait at present appears to be almost saturated. Entry into the live market is particularly difficult. However, if competition in the chilled market eases, there might be an opening for Sudanese mutton in view of local preference for the desert type animal. Even so, it is only likely to become an attractive market if some kind of subsidy in air-freight rates were provided, which is a distinct possibility in view of the need for the new Sudan Airways planes to visit Kuwait at least once a week. The best market to aim for in the near future could well be that for live cattle of good average quality; Kuwaiti importers believed that movement by truck from Jeddah was the quickest and cheapest route, but this would have to be investigated carefully by the Marketing Agency before major commitments could be made.

Many Kuwaiti importers are anxious in principle to import Sudanese meat products and some have made fairly intensive studies of livestock production and marketing in the Sudan. Provided certain essential infrastructural improvements were carried out (e. g. with regard to railway transport) some businessmen in Kuwait would probably consider investing in large-scale livestock production in Sudan.

Among those who gave assistance to this survey in Kuwait were: Messrs. A. & M. Abughazaleh; Mr. Al-Barakat; Mr. Al-Wazzan; Mr. Yousuf Al-Saqer; Dr. Khalil Osman of Gulf Fisheries; and Dr. Abdal Rahman Salman, Director of Animal Husbandry.

2. 4 The Trucial States, Bahrain and Qatar

(a) Imports

Visits were made to Bahrain and Dubai. Statistics of livestock imports in both states were unreliable (in Bahrain 80 per cent of live imports are reckoned to go unrecorded) but figures for meat imports were accepted. Total live imports were estimated on the basis of experienced opinion in Bahrain and on slaughterhouse figures in Dubai. The figures are summarised briefly in Table A4. 15. Bahrain imports most of its cattle from South Iran; until recently the same was true in

the case of sheep, but now about 30,000 per year or almost half the estimated imports come from Australia (through the firm of Homeidi-Klausen in Kuwait). Dubai obtains the bulk of its livestock from South Iran (most of the importing is carried out by merchants with relatives on the Iran coast); half its total imports (or about 70,000 sheep and 5,000 cattle per year) are re-exported to other states such as Abu Dhabi, Qatar or Bahrain.

TABLE A4.15 Bahrain and Dubai - Estimated Livestock and Meat Imports, 1970

	Bahrain	Dubai
Cattle (Nos.)	8,000	10,000(a)
Sheep (Nos.)	60,000	140,000(a)
Chilled or Frozen Beef (Tons)	60	375(b)
Chilled or Frozen Mutton (Tons)	245	1,215(b)
Canned Meat (Tons)	222	472

(a) Of which half assumed to be consumed in Northern Trucial States and half re-exported.

(b) Assuming that all imported meat is made up of: Beef 20 per cent, Mutton 65 per cent, Poultry 15 per cent (importer's estimate).

Sources: Official statistics for meat imports.

(b) Consumption

Livestock production in the Gulf States is negligible (Bahrain is credited with 10,000 sheep and 5,000 cattle)(a). Estimated human populations in 1970 were: Bahrain 210,000; Qatar 112,000; Abu Dhabi 60,000; and Northern Trucial States 150,000 (of which Dubai had 60,000). On the uncertain information available, meat consumption in Bahrain and the North Trucial States was estimated to be on the lines indicated in Table A4.16.

(a) FAO, Rome/Cairo (1971), Regional Study on Animal Husbandry, etc., in the Near East (draft).

TABLE A4.16 Estimated Meat Consumption, Bahrain and North Trucial States, 1970

	Bahrain		North Trucial States	
	Total (tons)	Kg/head	Total (tons)	Kg/head
Beef	1,220	5.8	1,450	9.7
Mutton	2,210	10.5	2,860	19.1
Camel	310	1.5	220	1.5
Poultry	1,015	4.9	340	2.2
Total:	4,755	22.7	4,870	32.5

In subsequent calculations it has been assumed that the per capita consumption pattern in Dubai and the North Trucial States is also representative of Abu Dhabi and Qatar.

Monthly slaughter figures from Dubai indicate a marked increase in Ramadan and, as in Kuwait, demand is reported to decline substantially in summer. Otherwise, the principal causes for fluctuations in consumption levels appear to be on the supply side; small ships are used to transport livestock from south Iran and their movement is greatly handicapped by rough seas between December and February.

(c) Quality Preferences

Average income per head in Bahrain is lower than in the surrounding states and there is a greater emphasis on beef than in Kuwait as well as on imports of cheap frozen and canned meats (partly a consequence of the substantial Indian and Pakistani element in the population). A similar pattern prevails in the Trucial States and Qatar which, despite their high standards of living, are too small and isolated to attract regular supplies of high quality meat. Australia air-freights 4-5 tons of chilled meat every month to Bahrain, mainly for European consumption, and just over 1 ton per month to Dubai. Abu Dhabi, through lack of alternative air connections,

air-freights meat at high cost from the U. K. All meat imports to Qatar are frozen.

Sudanese sheep are highly thought of in the Gulf States and the quality of their meat is much preferred to that of the Australian animals.

(d) Prices

Because of their relative inaccessibility, prices in the Gulf States tend to be high. Officials in Bahrain quoted up to 60 pt/kg carcaseweight c. and f. for Iranian or Somali sheep and 41 pt/kg for Australian sheep. Frozen mutton legs from Australia sell at almost half this price.

For the special consignment of Sudanese sheep to Abu Dhabi in Ramadan 1971, a price was agreed equivalent to 58 pt/kg carcaseweight f. o. b. Port Sudan or 68 pt/kg c. and f. Abu Dhabi. A similar price is reported to have been offered for a second consignment, together with an offer of 46 pt/kg carcaseweight c. and f. for calves under three years.

Import prices in Dubai are lower owing to its greater accessibility to Iran; Iranian sheep and goats have been priced at 33 pt/kg, but the quality was poor and Sudanese animals could be expected to obtain a substantial premium.

(e) Duties

Bahrain charges 3 per cent customs duty on live animals, 5 per cent on meat. Dubai has no charge for live animals but 4. 625 per cent on meat.

(f) Health Requirements

Measures are not very stringent, especially in Dubai, but efforts are being made there to apply quarantine regulations in order to control the import and re-export of livestock.

(g) Religious Factors

As far as could be seen, attitudes were similar to those in Kuwait.

(h) Demand Projections and Conclusions

Bahrain's population was assumed to increase at a rate of 2. 8 per cent per annum, that of the Trucial States and Qatar at 4 per cent per annum. Per capita expenditure on meat was projected to increase at the same rate as Kuwait in all states except Bahrain, where the rate chosen (1 per cent per annum) was somewhat lower. A movement was assumed from mutton to beef and chicken, so that proportions of all meat consumed in 1982/3 were (in the case of Bahrain) beef 30 per cent, mutton 45 per cent, chicken 25 per cent, and (in the other states) beef 35 per cent, mutton 50 per cent, chicken 15 per cent. The proportions of beef assumed to be in frozen or canned form were 30 per cent for Bahrain and 47 per cent for the other states; respective proportions for mutton were 45 per cent and 52 per cent. The resulting patterns are shown in Table A4. 17.

TABLE A4. 17 Gulf States - Project Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons)	Consumption/ Head (Kg)	Local Production (Tons)	Imports (Tons)	Imports (live and chilled only) (Tons)
Bahrain					
Beef	2, 390	8. 2	90	2, 300	1, 580
Mutton	2, 860	9. 8	60	2, 800	1, 510
Poultry	2, 396	8. 2			
Total:	7, 640	26. 2			
Trucial States & Qatar					
Beef	7, 860	14. 9	-	7, 860	4, 170
Mutton	8, 980	17. 0	-	8, 960	4, 300
Poultry	4, 040	7. 7			
Total:	20, 880	39. 6			

The Gulf States markets are potentially very lucrative and there is little price or quality competition, though there might be some difficulty in breaking the Iranian monopoly in Dubai. The main problem from Sudan's (and other exporters') point of view is the States' relative inaccessibility and small size. If flights were available, air-freighting would be the cheapest means of supplying Bahrain, Abu Dhabi and Dubai, but in the case of the latter two this seems unlikely to occur. The possibility of providing return loads for fertiliser ships from Kuwait therefore deserves serious attention (see Appendix V, Section 3).

Among those who assisted this survey were: The Meat Control Committee, Manama Municipality, Bahrain; Sayed Kamal Hamza, Director, Dubai Municipality and Dr. Hassan Othman, Dubai Municipality.

2.5 Egypt

(a) Imports

Egyptian import statistics appear to be, at best, incomplete, certainly with regard to live animals. However, since Sudan is the main supplier of livestock to Egypt (alternative sources have become difficult since the closure of Suez to shipping)[(a)], this deficiency can to some extent be made up by using Sudanese data. Thus total imports of cattle at present could be assumed to be about 35,000 (with Sudan's share 20-25,000); of sheep about 30,000 (nearly all from Sudan); and of camels perhaps 85,000 (again, nearly all from Sudan). Egyptian trade statistics for 1969/70 specified about 2,500 tons of imported frozen meat, divided mainly between Argentine (beef) and China (mutton); and 3,600 tons of canned meat, almost two-thirds of it from China. On the assumption that imported frozen meat is half beef and half mutton and imported canned meat half beef and one-third mutton, total imports (in terms of meat equivalent) would be in the region of 10,000 tons of beef, 3,000 tons of mutton and 21,000 tons of camel-meat.

(a) Some Somali supplies come through the Red Sea port of Safaja but the route is not an easy or convenient one.

(b) Consumption

Official 1968 figures for Egypt's livestock population were: Cattle 2. 06 million, Buffaloes 1. 94 million, Sheep 1. 94 million and Goats 1. 13 million[(a)]. 1970 figures for indigenous animals officially slaughtered were: Cattle 343, 100, Buffaloes 312, 100 and Sheep and Goats combined 424, 600. It was considered that these figures should be multiplied by factors of at least 1. 75 for cattle and buffaloes and 2. 75 for sheep to obtain a reasonable estimate of total indigenous slaughter. This implied off-takes of 29 per cent for cattle, 28 per cent for buffaloes and 38 per cent for sheep and goats, which suggests that Egypt's livestock population is considerably underestimated.

Having increased the slaughter figures by the stated factors and added estimated imports, the consumption picture shown in Table A4. 18 was reached (the total human population of Egypt in 1970 was taken to be 33. 3 million).

TABLE A4. 18 Estimated Meat Consumption, Egypt, 1970

	Total (tons)	Kg/head
Beef	176, 500	5. 3
Mutton	24, 980	0. 75
Camel	23, 980	0. 7
Poultry	96, 570	2. 9
Total:	322, 030	9. 65

Egypt is clearly in a very different category from the other countries in this survey with its much larger population, lower income and lower meat consumption per head. Estimates may possibly be low, since a budget survey in 1958/59 found an average per capita consumption of

(a) U. A. R. Statistical Handbook (1970).

13 kg of meat in urban areas and 10 kg in rural areas[a], but it is not improbable that the figure should have fallen since then. The Egyptian pattern is also different because of the emphasis on beef and camel, both cheaper meats, rather than mutton.

(c) Quality Preferences

Egypt is essentially a quantity rather than a quality market and has always been recognised as such by Sudanese exporters. Since Egypt does not operate a market economy, individual preferences have little impact on the total pattern of demand, which is determined to a large extent by the government. However, the Egyptian negotiators for the annual agreement on trade with the Sudan are anxious to improve quality as much as possible and are prepared to give a premium for younger beef. A Sudanese exporter noted that the Egyptians were now pressing for 30 per cent of total cattle exports to be 2-3 year old calves, 20 per cent under 5 years and 50 per cent adults, whereas previously there were no quality requirements.

The Egyptian authorities are willing and equipped to receive imports from the Sudan in the form of chilled meat and recently a Sudanese businessman concluded a contract to supply Egypt with 3,000 tons. The attempt to send chilled meat by air in 1969/70 failed not so much because of Sudan's inability to supply meat of the agreed quality as because of disagreement over what the appropriate price should be.

(d) Prices

Import prices, c. and f. Cairo, agreed for 1970/71 were $12\frac{1}{2}$ pt per kg liveweight for cattle, $13\frac{1}{2}$ pt for calves and 21-22 pt for sheep. Exporters, however, would not accept this price in the following year and at the time of writing no agreement had been reached. So long as the present high costs and risks of transporting livestock via Wadi Halfa and Shellal persist, their requests for higher prices appear justified.

(a) See Amin, G. (1966), Food Supply and Economic Development, Cairo University.

Under present conditions, air-freighting should be distinctly cheaper (see Section 3 below).

In 1971 beef retail prices in Cairo, fixed by government and not indicative of market forces, were as follows (pt per kg):

	With Bone	Boneless
Imported (4-5 years)	0.31½	0.45
Local, 2 years (including buffalo)	0.40½	0.58½
Local beefling (1 year)	0.47	0.65

(e) Duties

None were noted.

(f) Health Requirements

Requirements for live animals are not particularly stringent; cattle are merely required to have been in quarantine for 21 days and sheep must be accompanied by evidence of vaccination against anthrax. Nevertheless, it was reported from Wadi Halfa that the Egyptian veterinary representatives at Aswan had been known to re-quarantine Sudanese animals for a further 21 days after entering Egypt. In the case of animals exported as beef, vaccinations are required ten days before slaughter against rinderpest, anthrax and H. S. Ante- and post-mortems are also specified.

(g) Religious Factors

These do not appear to be significant in the context of meat imports.

(h) Demand Projections and Conclusions

If Egypt's meat consumption were determined by supply and demand, it would almost certainly increase rapidly, as would imports, since substantial expansion in local supply is restricted by shortage of land, competition from cash crops and scarcity of animal feed. However, it is assumed that demand will be controlled at a level of a 1 per cent annual increase in the quantity of all meat consumed per head. Total population is assumed to increase at 2.5 per cent per year and local

slaughter numbers by 2. 4 per cent per year for beef and 3. 9 per cent per year for mutton. The resulting pattern is summarised in Table A4. 19.

TABLE A4. 19 Egypt - Projected Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	266. 9	5. 97	221. 3	45. 6	22. 8
Mutton	37. 8	0. 85	34. 7	3. 1	0. 4
Camel	24. 0	0. 54			
Poultry	157. 8	3. 53			
Total:	486. 5	10. 89			

Egypt will always be useful to Sudan as a mass market for "traditional" quality beef animals, but in economic terms it has the great disadvantage of bringing no foreign exchange returns to the Sudan. Nevertheless, it is in both countries' interests to reduce the present high costs of exporting livestock.

Among those who assisted in this survey were: Dr. Tawfiq Ragab of the General Organisation for Meat; Dr. M. Hadi Maghrabi, Deputy Chairman, U. A. R. General Authority for Supply Commodities; and senior members of the Animal Production Department, Ain Shams University, Cairo.

2. 6 Libya

(a) Imports

Libya's livestock and meat imports between 1966 and 1969 (the last complete year available in official statistics) are shown in Table A4. 20. These demonstrate that imports, especially of live sheep, beef and

TABLE A4. 20 Libya, Livestock and Meat Imports, 1966-1969

Country of Origin	1966	1967	1968	1969
Cattle (Nos.)				
Lebanon	915	1,200	661	100
Tunisia	434	32	-	-
Turkey	336	1,845	50	-
Eastern Europe	814	10,596	16,693	1,748
Others	667	2,308	1,187	1,401
Total:	3,166	15,981	18,591	3,249
Sheep (Nos.)				
Lebanon	49,127	18,125	23,880	13,455
Syria	22,159	11,537	4,689	8,336
Tunisia	4,042	42,996	56,560	30,338
Eastern Europe	107,385	240,206	308,269	406,048
Others	10,910	33,256	49,391	46,871
Total:	193,623	346,120	442,789	505,048
Beef, Chilled or Frozen (Tons)				
Tunisia	323.6	482.3	251.5	505.5
Chad	176.9	37.7	-	-
Sudan	87.9	48.5	5.9	39.6
East Africa	45.0	11.1	12.1	331.3
Eastern Europe	70.1	348.4	298.3	981.3
Others	184.9	268.7	248.9	478.3
Total:	888.4	1,196.7	816.7	2,336.0
Mutton, Chilled or Frozen (Tons)				
Tunisia	489.5	621.3	616.6	558.6
Turkey	-	-	123.2	138.2
China	-	1.5	213.2	-
Australia	10.5	-	10.2	65.2
East Africa	-	-	44.6	53.8
Eastern Europe	60.3	128.5	506.5	846.3
Sudan	15.8	13.5	11.6	9.5
Others	104.8	116.6	55.8	91.5
Total:	680.9	881.4	1,581.7	1,763.1
Canned Meat - Total (Tons)	333.6	392.9	N.A.	709.3

Source: Libya Foreign Trade Statistics.

mutton have been rising very rapidly indeed - a consequence of the rapid rise in income per head in Libya in recent years and the very limited scope for increasing Libyan livestock production. It will be noted that East European countries have, in a very short space of time, taken a dominant position in all four categories of product shown. Sudanese exports of meat, never very significant, declined during this period of overall expansion.

(b) Consumption

Libya's internal statistics were the best encountered during the market survey. Household budget surveys carried out in Tripoli and Benghazi in 1969 indicated an urban income elasticity of demand for meat of about 0. 8, which served as a basis for estimates in other Middle Eastern countries. Average urban expenditure on meat per head was LL. 26. 1 which at prevailing retail prices indicated an urban meat consumption of 33. 8 kg per head per year.

Official slaughter estimates, after some upward adjustment for outside slaughter, fitted fairly well with imports and probable offtake from local livestock (in 1968 population estimates were: sheep 1. 7 million, goats 1. 4 million, cattle 122, 000 and camels 235, 000)[(a)]. With the human population in 1968 estimated at 1. 8 million, it was possible to calculate a national average meat consumption of 21. 8 kg per year. This, in combination with the urban result obtained separately, indicated an average consumption outside the main cities of 17. 7 kg per head. The national pattern of consumption is summarised in Table A4. 21.

TABLE A4. 21 Estimated Meat Consumption, Libya, 1968

	Total (Tons)	Kg/head
Beef	7, 110	3. 9
Mutton	19, 910	11. 0
Camel	11, 215	6. 2
Poultry	1, 200	0. 6
Total:	39, 435	21. 8

(a) Statistical Abstract (1968), Ministry of Planning, Libyan Arab Republic.

Beef consumption is confined mainly to the cities while the high consumption of camel-meat is principally in the desert areas. But the main emphasis, as everywhere else in the Middle East except Egypt, is on mutton.

(c) Quality Preferences

The quality of the desert sheep is preferred but the demand is for young tender animals (10-15 kg carcases), which the East European countries are supplying. Taste in beef is also sophisticated compared with other countries in the region, possibly as a result of Mediterranean influence. Young lean beef and even real veal are in demand among most urban income-groups. Sudanese beef has a poor reputation among private Libyan traders. Imports of live Sudanese cattle (while the Suez canal route was open) were prohibited in 1965 on the grounds that they had led to an outbreak of foot and mouth disease. The discontinuation of the 1970/71 contract for chilled beef between the Libyan Agricultural Bank and the Sudanese Government, apparently owing to a decline in quality, has been a further setback. Nevertheless, if a regular supply of good quality lamb and beef can be provided at a reasonable price and old policies and attitudes can be seen to have been changed, Libyan importers can be expected to be very responsive.

(d) Prices

The market for mutton is probably more competitive than that for beef. The Sudanese Government was offered c. and f. prices of 48½ pt/kg carcaseweight for mutton and 39 pt/kg for beef. East European lamb is imported at a similar price and some undercutting could no doubt occur if Sudanese mutton imports increased substantially. However, the market is not so competitive as Kuwait. The problem of having to freeze chilled meat because of failure to sell it in time seems to arise only infrequently; in any case, the loss is not so great since frozen prices average only 20-25 per cent less than chilled. The Sudanese beef was being imported at a price distinctly lower than that paid for the best "veal" carcases

(45 pt/kg carcaseweight) and marginally less than that for the average older beef carcase ($40\frac{1}{2}$ pt/kg).

(e) Duties

Live animals are not charged duty. Meat imported in pieces weighing less than 10 kg is subject to 30 per cent duty; larger pieces (i. e. carcases) are free of duty.

(f) Health Requirements

Apart from the Lebanon, Libya is probably the country most concerned about health regulations in the Middle East. Cattle whose meat is destined to Libya should be vaccinated with tissue culture vaccine 40 days before slaughter in addition to anthrax and H. S. vaccines. Sheep should be vaccinated against anthrax before slaughter. All carcases are required to be chilled for 24 hours at 20-25°F before despatch.

(g) Religious Factors

There was a campaign last year by Libyan religious teachers against importing meat from non-Muslim countries and this could help to place Sudan in an advantageous position in relation to some of her competitors.

(h) Demand Projections and Conclusions

Assumptions were made with regard to an annual 3. 5 per cent population growth rate, a 1. 4 per cent increase in income per head and an income elasticity of demand for meat of 0. 8. Taste was assumed to move, similarly to elsewhere, away from mutton and towards beef and poultry and local production was allowed, somewhat generously, to increase at 4. 6 per cent per year on the grounds that substantial livestock development might take place in Kufrah oasis. The resulting picture is indicated in Table A4. 22.

TABLE A4. 22 Libya - Projected Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	22. 4	7. 63	4. 7	17. 7	12. 1
Mutton	33. 7	11. 44	12. 0	21. 7	15. 8
Camel	5. 4	1. 83			
Poultry	24. 0	8. 14			
Total:	85. 5	29. 04			

Libya is distinctly the most attractive Middle East market for Sudan in terms of price and every effort should be made to secure a place in this market. The quality required is high, but the project proposals should ensure that these can be met. It is important that the next major attempt to enter this market be carefully prepared and that there are no faults in the chilling techniques or transport arrangements.

Among those who gave assistance to this survey were Sayed Achmed Saad Mansur; Achmed Gendy; and the Census and Statistical Department, Ministry of Planning.

2. 7 Lebanon

The market in Lebanon (1970 population: c. 2. 7 million) was not studied in the same detail as others in the Middle East and is therefore described more briefly. The official import statistics for 1970 are summarised in Table A4. 23. Large numbers of live animals are imported from nearby Syria and Turkey, and consequently meat imports are low compared with other countries in the Middle East; most of the meat imported is frozen. Both live animals and meat are imported duty-free. Some livestock and meat products are re-exported to other Middle Eastern countries.

TABLE A4. 23 Lebanon - Livestock and Meat Imports, 1970

Country of Origin		Country of Origin	
Cattle (Nos.)		Chilled and Frozen Beef (Tons)	
Syria	61,716	South America	401.4
Turkey	21,015	Eastern Europe	293.0
Others	115	China	75.0
Total:	82,846	Others	339.2
		Total:	1,108.6
Sheep and Goats (Nos.)		Chilled and Frozen Mutton (Tons)	
Syria	308,476	Argentina	2,470.4
Turkey	235,429	China	362.3
Eastern Europe	51,960	Australia	131.4
Others	1,414	Others	154.2
Total:	597.279	Total:	3,118.3
		Canned Meat (Tons)	
		Total:	2,360.4

Source: Lebanon External Trade Statistics.

The local livestock population is estimated at about 106,000 Cattle, 220,000 Sheep and 450,000 Goats. On the basis of the import statistics and estimated local off-take (with an upward adjustment similar to that applied to the Kuwait statistics), 1970 consumption was reckoned to be of the order indicated in Table A4. 24. The poultry element is probably underestimated.

TABLE A4.24 Estimated Meat Consumption, Lebanon, 1970

	Total (Tons)	Per Head (Kg)
Beef	26,140	9.6
Mutton	41,660	15.3
Poultry	1,080	0.4
Total:	68,880	25.3

Lebanese import prices are low, especially for mutton; the 1970 trade statistics indicate an average c. and f. price of about 35 pt/kg carcase-weight. The relative unattractiveness of Lebanese mutton prices is reflected in the much lower degree of East European competition than in Kuwait or Libya. Average import prices for beef were shown to be about $31\frac{1}{2}$ pt/kg, but Sudanese exporters with connections in the Lebanon estimated that the price for good average quality beef could now be up to $34\frac{1}{2}$ pt/kg. Beef therefore looks a better long-term prospect than mutton, but of the "quality" markets in the Middle East, Lebanon appears the least favourable for substantial penetration, unless very cheap air-freight terms can be obtained.

Health regulations are the most stringent in the Middle East. A large quarantine station was built at the port of Tripoli specifically for the reception and isolation of imported livestock from Africa but the closure of the Suez Canal precluded its use for this purpose and African imports now have to be in the form of meat, which is treated with considerable suspicion. There is a particular fear of foot and mouth disease being introduced by African meat and several consignments of Sudanese meat in the 1960's were destroyed on arrival at Beirut airport. All cattle intended for slaughter and export to Lebanon are required to be vaccinated against this disease with OAC as well as against rinderpest and anthrax. They are also supposed to be kept isolated in special quarantine away from other export animals. It is further specified that all beef (but not mutton) should

be de-boned before export, but this provision is now understood to be under discussion and is expected to be removed. In the 1960's a Sudanese exporter attempted to send boneless beef to Lebanon (at a c. and f. price of about LS. 1. 00 per kg), but the boning equipment and the butchers to operate it had to be imported at heavy cost and the process proved uneconomic.

The projected pattern of demand, based on similar assumptions to those used for other importing countries, is given in Table A4. 25.

TABLE A4. 25 Lebanon - Projected Meat Consumption and Beef and Mutton Imports, 1982/3

	Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	43. 2	11. 4	5. 9	37. 3	26. 5
Mutton	45. 7	12. 1	9. 5	36. 2	27. 0
Poultry	29. 2	7. 7			
Total:	118. 1	31. 2			

3. THE CHOICE BETWEEN EXPORTING LIVE AND CHILLED

Certain Middle East countries (Libya and Lebanon) can at present only be supplied with meat by air. Choosing the form in which to export meat to the other countries in the region will depend on:

(a) Consumer preference (e. g. preference for local slaughter in Saudi Arabia).

(b) Availability of alternative forms of transport (e. g. return loads by air are unlikely to be obtained to the Trucial States).

(c) Comparative incidental costs.

(d) The technical efficiency likely to be achieved by Sudan in meat chilling and freighting in the near future.

(e) The requirement of the Sudanese tanning industry for additional hides and skins.

The question of comparative costs is discussed briefly below. Much will depend on the freight rates obtainable from Sudan Airways or air charter companies, but if an average rate is assumed of 6.75 pt per ton/mile (50 per cent higher than the unusually low rate charged by Tradewinds to Libya), and facilities for transporting livestock are improved as recommended in the proposal, the cost differences are often marginal. Sheep entail higher incidental costs per kg when transported live than cattle, so that in most cases, such as the Kuwait example below (where three possible routes exist), it would probably be cheapest to send mutton chilled and beef live, especially when the relatively high value of slaughtered sheep's hides and offals are taken into account. The alternative cost schedules are set out in Table A4. 26, though the effect of duty on meat imports has not been included.

The situation with regard to exports to Egypt is particularly interesting. Incidental costs of exporting cattle via Wadi Halfa under present conditions are reckoned to be about 11 pt/kg carcaseweight. Under improved conditions it is expected that these could be reduced to about $7\frac{1}{2}$ pt/kg, while the incidental costs of air-freighting would (on the same basis of reckoning as above) also be $7\frac{1}{2}$ pt/kg (excluding returns from hides and offals). In the case of mutton, air-freighting should be much the cheapest method.

4. CENTRAL AFRICAN MARKETS

A brief market survey was carried out in 1970 by MAP representatives in Zaire and the Central African Republic, which are both importers of meat, predominantly beef. There is already an uncontrolled movement of poor quality beef animals from South West Darfur into the Central

TABLE A4. 26 Costs of Transporting Meat to Kuwait by Different Means

	Cattle		Sheep	
	LS/head	Pt/kg Carcaseweight (@ 200 kg/hd)	Ls/head	Pt/kg Carcaseweight (@ 20 kg/hd)
(a) Rail to Port Sudan and ship direct to Kuwait				
Khartoum - Port Sudan[a]	4.18	2.09	0.80	4.00
Freight, etc. Port Sudan - Kuwait[b]	9.00	4.50	2.06	10.30
Feed (8 days)	1.60	0.80	0.40	2.00
Losses	1.00	0.50	0.10	0.50
Total:	LS. 15.78	Pt. 7.89	LS. 3.36	Pt. 16.80
(b) Rail to Port Sudan, ship to Jeddah and truck Jeddah - Kuwait				
Khartoum - Port Sudan[a]	4.18	2.09	0.80	4.00
Freight, etc. and losses Port Sudan-Jeddah	2.60	1.30	0.59	2.95
Feed, Jeddah (1 day)	0.20	0.10	0.05	0.25
Freight, Jeddah - Kuwait[c]	3.44	1.72	0.78	3.89
Losses	0.66	0.33	0.06	0.33
Total:	LS. 11.08	Pt. 5.54	LS. 2.28	Pt. 11.42
(c) Slaughtered in Khartoum and air-freighted				
Quarantine fees, vaccines, feeding in quarantine, etc.	1.80	0.90	0.42	2.13
Slaughter fees	0.60	0.30	0.17	0.85
Chilling[d]		0.12		0.12
Incidental costs to airport		0.25		0.25
Freight, Khartoum - Kuwait		8.37		8.37
Total		9.94		11.72
Credit value of hides and offals[a]	-2.46	-1.23	-1.50	-7.50
Total (crediting hides and offals)		Pt. 8.71		Pt. 4.22

(a) See Appendix III.

(b) Assuming return load.

(c) At 1,100 Saudi Riyals per truckload of 27 cattle; or

(d) At LS. 48 per 40 tons (capacity of chilling room) per day.

African Republic and there appear to be possibilities of placing the trade on a more regular basis, with half the payment for Sudan's exports coming in foreign exchange form and half in kind. It is thought that a market exists for 10-12,000 cattle per year. During the survey the sale was observed of about 50 scrub animals (about 200 kg liveweight) for the equivalent of LS. 9.50 per head. Their purchase price in Darfur was probably below LS. 7.50.

Zaire is at present importing substantial quantities of air-freighted beef from Chad, but while retail prices in the capital, Kinshasa, are reported to be high (70 pt/kg for bone-in Chad beef), the c. and f. price quoted was 27 pt/kg and air-freight costs were high - 15 pt/kg. Unless much cheaper freight rates can be found or changes are made in the monopolistic buying structure, Zaire cannot be regarded as an attractive market at present.

Any expansion of trade with Central or West Africa would clearly be directed from Nyala or Wau rather than Khartoum.

APPENDIX IV

EXPORT MARKETS

1. SUDAN LIVESTOCK EXPORT STATISTICS

There are discrepancies between the figures given in the annual Foreign Trade Statistics and the records kept by the Ministry of Animal Production officials at Port Sudan and Wadi Halfa, the latter usually being higher. Because the MAP figures were available complete in monthly form from 1967 to 1971 inclusive, they were used in studies of seasonality patterns and for reasons of consistency were also employed in Volume I, Table 1. 8 for live exports between those dates. The 1966 figures for live exports and all estimates of meat exports were, however, taken from the Foreign Trade Statistics[(a)]. For purposes of comparison and as a guide to the approximate values of past exports, the Foreign Trade Statistics figures for 1960 to 1970 inclusive are given in Tables A4. 1 and A4. 2. Figures for hides and skins exports over the same period are shown in Table A4. 3.

Monthly livestock export figures are given for Port Sudan (January 1967 - January 1972) in Table A4. 4 and Wadi Halfa (October 1969 - January 1972) in Table A4. 5. Since mid-1970 these valuable records have been collected and published in an annual report by the Head of the Quarantine Section of the MAP, together with figures of animals which have either died, been slaughtered or withdrawn while in quarantine. Losses are generally low at this stage, the major casualties occurring after animals leave the point of export. The 1970/71 pattern is shown in Table A4. 6.

(a) Alterations were made in the meat export figures where more accurate information seemed available from elsewhere.

TABLE A4. 1 Foreign Trade Statistics Estimates of Beef Exports, 1960-1970

	1960		1961		1962		1963		1964		1965		1966		1967		1968		1969		1970	
	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)		Value (LS. 000)		Value (LS. 000)		Value (LS. 000)		Value (LS. 000)
(1) Live Cattle																						
Egypt	38,788	944.1	32,978	800.4	5,433	121.7	21,278	512.4	11,744	282.3	5,535	151.0	14,949	445.9	7,174	214.6	781	23.8	1,519	49.6	15,155	554.3
Saudi Arabia	729	15.3	13	0.6	674	6.4	804	20.5	360	6.6	2,810	81.4	1,726	51.9	1,798	60.2	6,235	198.0	6,335	219 2	5,463	200.1
Gulf States (incl. Kuwait)	-	-	-	-	666	14.7	-	-	-	-	-	-	-	-	270	6.8	1,067	27.6	1,614	48.8	480	14 4
Libya	-	-	-	-	-	-	-	-	310	10.9	1,210	42.8	534	14.4	-	-	-	-	-	-	-	-
Other	475	7.3	249	5.9	950	18.1	-	-	-	-	40	1.3	225	6.7	-	-	-	-	5	0.1	-	-
Total Exports:	39,992	966.7	33,240	806.9	7,723	160.9	22,082	532.9	12,414	299.8	9,595	276.5	17,434	518.9	9,242	281.6	8,083	249.4	9,476	317.7	21,098	768.8
(2) Chilled Beef (metric tons)																						
Egypt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	706.6	277.1	-	-
Saudi Arabia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	0.9	7.4	2.0
Libya	-	-	-	-	-	-	-	-	38.7	6.9	89.3	15.8	65.3	9.8	40.0	6.5	7.2	0.9	53.7	12.3	13.5	2.7
Lebanon	-	-	-	-	-	-	-	-	-	-	2.5	0.4	2.5	0.4	-	-	1.7	0.2	30.9	4 8	0.2	0.1
Total Exports:	-	-	-	-	-	-	-	-	38.7	6.9	91.8	16.2	67.8	10.2	40.0	6.5	8.9	1.1	796.3	295.1	21.1	4.8

TABLE A4. 2 Foreign Trade Statistics Estimates of Mutton Exports, 1960-1970

	1960		1961		1962		1963		1964		1965		1966		1967		1968		1969		1970	
	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)
(1) Live Sheep																						
Saudi Arabia	69,268	466.9	99,545	665.2	90,729	619.8	72,565	506.1	70,362	495.6	220,668	1,648.9	161,951	1,257.8	216,343	1,740.7	201,956	1,722.8	221,507	1,956.9	145,948	1,273.3
Egypt	-	-	-	-	-	-	400	3.0	9,000	71.6	5,351	43.1	1,100	9.5	-	-	-	-	250	2.0	27,852	247.3
Gulf States (incl. Kuwait)	3,385	20.1	-	-	2,500	20.0	-	-	-	-	-	-	-	-	2,400	20.4	7,900	68.0	-	-	-	-
Libya	-	-	-	-	-	-	-	-	180	2.3	200	1.5	-	-	800	6.8	650	3.7	260	2.1	500	4.3
Other	2,680	17.1	-	-	1,750	13.4	-	-	700	4.9	1,000	7.6	-	-	-	-	-	-	2,720	24.0	-	-
Total Exports:	75,333	504.1	99,545	665.2	94,979	653.2	72,965	509.1	80,242	574.4	227,219	1,701.1	163,051	1,267.3	219,543	1,767.9	210,506	1,794.5	224,737	1,985.0	174,300	1,524.9
(2) Chilled Mutton (metric tons)																						
Libya	-	-	-	-	-	-	-	-	-	-	39.3	8.4	21.5	5.0	9.3	3.1	19.0	4.3	16.2	4.1	-	-
Lebanon	-	-	-	-	-	-	-	-	-	-	0.5	0.2	-	-	-	-	2.0	0.3	3.8	0.6	-	-
Egypt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.1	2.4	-	-
Saudi Arabia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	0.3	0.5	0.1
Gulf States (incl. Kuwait)	-	-	-	-	29.4	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Exports:	-	-	-	-	29.4	7.6	-	-	-	-	39.8	8.6	21.5	5.0	9.3	3.1	21.0	4.6	34.1	7.3	0.5	0.1

TABLE A4.3 Hides and Skins Exports, 1960-1970

	Hides		Sheepskins		Goatskins		Other Hides and Skins		Leather (heavy and light)	
	Tons	Value (LS. 000)	Tons	Value (LS. 000)	Tons	Value (LS. 000)	Tons	Value (LS. 000)	Tons	Value (LS. 000)
1960	3,281	536.7	1,059	348.7	383	103.0	95	36.3	6	3.4
1961	3,023	457.5	1,261	419.7	421	105.1	41	57.1	7	3.6
1962	3,101	500.4	1,023	315.4	362	100.6	34	57.6	2	1.0
1963	4,512	679.7	1,045	396.9	464	144.9	38	58.4	10	6.6
1964	1,572	250.8	1,457	522.6	378	98.8	58	108.4	4	3.0
1965	3,539	529.4	1,416	487.9	458	132.0	55	99.3	7	13.4
1966	3,461	622.8	1,616	570.3	682	251.0	128	159.7	-	-
1967	2,162	451.1	1,451	633.0	567	239.8	64	122.6	-	-
1968	3,018	580.4	1,468	681.0	481	182.4	33	63.3	-	-
1969	3,250	617.7	1,721	759.3	601	270.2	66	155.5	31	18.4
1970	3,944	693.6	1,409	674.1	472	186.3	56	361.6	-	-

Source: Department of Statistics.

TABLE A4. 4 Monthly Livestock Exports, Port Sudan, January 1967 - January 1972

	1967	1968	1969	1970	1971	1972
(1) Sheep						
January	23, 556	37, 710	44, 921	30, 200	24, 045	12, 670
February	23, 903	42, 697	18, 800	26, 575	12, 247	
March	25, 243	18, 550	14, 930	18, 260	19, 204	
April	30, 248	14, 100	15, 977	12, 750	13, 200	
May	19, 386	22, 293	7, 300	7, 747	11, 600	
June	11, 777	17, 350	5, 230	6, 200	2, 700	
July	1, 368	6, 332	900	1, 355	800	
August	6, 145	12, 900	2, 398	-	565	
September	20, 699	15, 650	9, 200	697	-	
October	18, 434	31, 642	22, 266	11, 120	9, 104	
November	39, 658	32, 974	42, 673	17, 482	4, 560	
December	48, 094	27, 126	35, 555	13, 813	6, 896	
Annual Totals:	268, 511	279, 324	220, 150	146, 199	104, 921	
(2) Cattle and Calves						
January	1, 591	996	410	1, 323	148	-
February	1, 294	1, 403	795	610	-	
March	507	997	622	779	104	
April	2, 110	530	1, 063	870	500	
May	2, 514	456	700	430	902	
June	1, 370	311	279	688	120	
July	1, 274	160	-	-	124	
August	-	-	-	-	-	
September	-	324	50	-	2	
October	213	1, 574	1, 155	105	-	
November	398	1, 822	1, 084	812	-	
December	2, 368	1, 073	877	300	-	
Annual Totals	13, 639	9, 646	7, 035	5, 917	1, 900	
(3) Goats						
Annual Totals:	4, 450	3, 220	2, 415	3, 500	846	
(4) Camels						
Annual Totals:	546	862	63	111	12	

Source: MAP Records, Port Sudan.

N. B. Until March 1968 the bulk of cattle exports were going to Egypt; thereafter all livestock was sent to Saudi Arabia and the Gulf States.

TABLE A4. 5 Monthly Livestock Exports, Wadi Halfa
October 1969 - January 1972

	1969	1970	1971	1972
(1) Cattle and Calves				
January	-	1,141	1,429	-
February	-	591	2,477	
March	-	1,813	3,004	
April	-	2,235	3,391	
May	-	724	1,762	
June	-	1,373	2,239	
July	-	913	1,532	
August	-	-	988	
September	-	-	632	
October	325[a]	570	1,015	
November	1,578	1,354	1,993	
December	1,561	2,218	-	
Annual Totals:	3,464	12,932	20,462	
(2) Sheep				
January	-	15,300	12,035	7,773[b]
February	-	2,700	-	
March	-	1,065	2,116	
April	-	-	-	
May	-	-	3,438	
June	-	-	1,454	
July	-	-	-	
August	-	-	-	
September	-	-	-	
October	-	-	-	
November	-	5,384	-	
December	-	2,441	-	
Annual Totals:	-	26,890	19,043	

(a) This was the first consignment after the creation of Lake Nuba.

(b) As at 21st January 1972.

Sources: MAP Quarantine Head Section, Khartoum and MAP Records, Wadi Halfa.

TABLE A4. 6 Quarantine Losses, July 1970 - June 1971

	Percentage of Animals Arriving at Quarantine								
	Adult Cattle			Calves			Sheep		
	Exported	Died	Withdrawn	Exported	Died	Withdrawn	Exported	Died	Withdrawn
Port Sudan	96. 7	0. 8	2. 5	54. 5	1. 8	43. 6	98. 9	0. 1	1. 0
Wadi Halfa	98. 5	1. 0	0. 5	99. 2	0. 5	0. 2	99. 0	0. 2	0. 8

Source: MAP Quarantine Head Section 1970/71 Report.

Records of meat exports are particularly confusing, the Foreign Trade Statistics and MAP figures rarely coming near to correspondence. This can be seen from comparing the figures in Tables A4. 1 and A4. 2 with those in Table A4. 7, which are taken from two sources: the MAP Animal Health Section and the Omdurman Slaughterhouse. These anomalies should be investigated as soon as possible, as well as those relating to live exports. The co-ordination of records should, in future, be a function of the Marketing Agency.

2. MARKETS FOR MEAT IN THE MIDDLE EAST

2. 1 Introduction

As part of this study, a member of the Consultants' team visited all the principal meat importing countries in the Middle East to investigate the market potential for Sudan. The characteristics of each market are discussed below under the following headings:

(a) current livestock and meat imports;
(b) estimated current meat consumption;
(c) quality preferences;
(d) prices;
(e) import duties;
(f) health requirements and
(g) religious factors.

TABLE A4.7 Estimates of Chilled Meat Exports, 1967-1971

		1967	1968	1969		1970		1971	
		Tons	Tons	Tons	Nos. of Animals	Tons	Nos. of Animals	Tons	Nos. of Animals
(1)	Beef								
	Libya	112.0	16.0	79.3	333[a]	107.6	686	291.5[b]	1,823
	Lebanon	-	5.0	44.6	-	0.2	100	-	-
	Kuwait	-	-	-	-	-	-	3.8[b]	22
	Egypt	-	-	305.0	2,606[a]	490.0	4,193	33.0[b]	-
	Saudi Arabia	-	-	5.6	-	9.3	-	14.0[b]	-
(2)	Mutton								
	Libya	31.2	24.0	4.0	200[a]	18.0	851	0.3[b]	7
	Lebanon	-	-	-	-	tr.	-	-	-
	Kuwait	-	-	-	-	-	-	12.2[b]	995
	Egypt	-	-	-	-	tr.	-	-	-

Note: Weight estimates from MAP Animal Health Section, animal numbers from Omdurman slaughterhouse.

(a) November and December 1969 only.

(b) Foreign Trade Statistics (January-August 1971 only) give the following estimates (in tons): Beef: Libya 307.9, Kuwait 0.9, Egypt 0.3, Saudi Arabia 4.5; Mutton: Libya 54.0, Lebanon 0.5, Kuwait 10.5, Saudi Arabia 3.1.

Finally, projections have been made of future demand and Sudan's prospects in each market are assessed. Contacts who were particularly helpful during the market survey are also mentioned.

2. 2 Saudi Arabia

(a) Imports

The most recent complete edition available of Saudi Arabia's Foreign Trade Statistics relates to 1968. Digests have been published for 1969 and 1970 but these do not contain breakdowns by country for each item imported. Unfortunately, little confidence can be placed in the 1968 figures, which quote imports from the Sudan which are higher than those in the Sudanese export records by 120 per cent in the case of cattle and 75 per cent in the case of sheep. It was assumed that the figures for all livestock imports in 1968 were distorted to a similar degree and the consequent adjustment produced figures which were of the same order as those for 1969 and 1970. The 1968 records indicated the following market shares (per cent):(a)

	Sheep	Cattle	Goats
Somalia	63	69	16
Sudan	29	24	37
Ethiopia	3	6	42
Australia	2	-	-
Other	3	-	5

More recent figures, collected from the records of the Department of Agriculture's veterinary inspector in Jeddah, indicate that the ratio of Sudanese to Somali imports dropped in 1970 to 13 : 87 for both sheep and cattle; the ratio for the first eight months of 1971 was the same in the case of sheep and fell to 11 : 89 in the case of cattle. Detailed figures are given in Table A4. 8, from which it can be seen that the Somali supplies, besides being much higher than the Sudanese, also maintain a much more even flow

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(a) In terms of numbers. The Somali sheep are in fact substantially smaller than the Sudanese (averaging about 15 kg carcaseweight against 22 kg) and fetch only a little over half their price per head. In value terms, therefore, the recent ratio has probably been about 20 : 80. But it will have fallen further in the second half of 1971.

TABLE A4. 8 Saudi Arabia - Monthly Livestock Imports from Somalia and Sudan, 1970-1971

	Cattle		Sheep	
	Somalia	Sudan	Somalia	Sudan
January 1970	1,502[a]	410[a]	45,434[a]	15,460[a]
February	1,314	1,420	101,786	30,029
March	1,456	1,159	57,772	21,360
April	1,565	462	21,010	7,556
May	830	798	22,742	9,050
June	3,910	-	42,971	3,200
July	4,608	150	87,747	2,555
August	4,043	-	77,541	-
September	2,248	-	78,540	697
October	1,990	170	96,334	9,420
November	4,356	105	94,609	15,312
December	4,327	315	113,154	13,386
January 1971	4,145	500	86,578	16,665
February	1,352	50	88,677	15,930
March	1,835	4	98,172	21,906
April	1,279	63	47,743	12,650
May	1,726	760	63,968	12,699
June	3,442	312	41,720	3,600
July	3,290	-	49,465	-
August	3,361	906	68,859	565
September	4,664[b]		51,340[b]	
October	2,249		59,796	
November	6,465		122,102	
December	3,366		110,109	

(a) Figures for January 1970 - August 1971 from Ministry of Agriculture, Riyadh.

(b) Figures for September - December 1971 from Jeddah Ministry of Commerce.

Note: Original data referred to Islamic months and conversion is only approximate.

throughout the year.

After the downward adjustment of the 1968 import figures, all import estimates were raised by 36 per cent on the basis of official urban slaughterhouse records[(a)]. It is very probable that import records would tend to be underestimated in view of the apparently substantial illegal movement of livestock into Saudi Arabia (there is some evidence of smuggling between north of Port Sudan and Yenbo). The revised import estimates are given in Table A4. 9 below. While it is realised that this treatment of official figures is unorthodox, it appeared the only way of obtaining some kind of internal consistency.

TABLE A4. 9 Saudi Arabia - Revised Livestock Import Estimates (000 head)

	1968	1969	1970
Cattle	41. 6	51. 7	62. 6
Sheep	1, 275. 8	1, 491. 7	1, 382. 8
Goats	31. 6	32. 7	32. 7
Camels	5. 4	13. 6	32. 7
Poultry	732. 2	644. 2	1, 562. 4

Imports of chilled and frozen meat are low (424 tons in 1968, plus 5, 122 tons of frozen chicken), partly because of the preference in Saudi Arabia for freshly slaughtered meat and partly because of the high duty applying until recently to imported meat. Canned meat imports are also small.

(a) Slaughter records for February - July 1969 gave a figure for imported animals of 10, 787 tons. After converting this to an annual total and allowing for 35 per cent of slaughtering being outside official premises, it appeared that imports were underestimated by 36 per cent.

(b) Consumption

The estimated livestock population of Saudi Arabia is: Sheep 2. 73 m, Goats 1. 39 m, Camels 1. 04 m and Cattle 0. 27 m[(a)]. According to senior representatives of the Ministry of Agriculture, 47 per cent of the country's mutton consumption is believed to be supplied from local sources and about 2 million locally produced sheep equivalents are slaughtered each year.

On the basis of these assumptions and the revised import estimates, the consumption figures in Table A4. 10 were reached.

Estimation of Saudi Arabia's per capita consumption is more than usually difficult owing to uncertainty about the size of the total population (estimates range between 4. 0 and 7. 7 million). It is assumed here to have been 4. 5 million in 1970.

TABLE A4. 10 Estimated Meat Consumption, Saudi Arabia, 1970

	Total (tons)	Kg/head
Beef	9, 900	2. 2
Mutton	44, 530	9. 9
Camel	21, 400	4. 8
Poultry	8, 590	1. 9
Total:	84, 420	18. 8

There appears to be no very strong seasonal variation in consumption patterns, but demand is reported to be higher during the winter and 2-3 times higher than average during the month of Ramadan.

(a) FAO, Rome/Cairo (1971), Regional Study on animal husbandry, etc. in the Near East (draft).

(c) Quality Preferences

As Table A4. 10 shows, the Saudis are predominantly mutton eaters. Freshly slaughtered meat is generally preferred to chilled or frozen. Especially large numbers of sheep and goats are sacrificed during the major Muslim festivals, most notably at the Eid el Bairam, when many pilgrims from abroad visit Mecca. Preference is for the "traditional" desert sheep (castrated males) and the Sudanese animals rate very highly. However, their large size makes them more suitable for special feasts than ordinary family occasions, for which the smaller Somali animals are more convenient. Butchers are also said to favour Somali animals because they have a smaller percentage of bone and are easier to cut[(a)].

Towns near the western coast and the capital, Riyadh, obtain most of their imported supplies live through Jeddah. In Eastern Province, however, most imports come through Dammam and contain a larger proportion of frozen meat, much of it from Australia. Some live sheep have also been sent from Australia (by the Homeidi-Klausen firm operating in Kuwait). Their meat has not been well received so far but the low prices at which the animals are being offered could lead to a change in attitudes.

Demand for beef is said to be increasing fairly rapidly in urban higher income groups and the population of expatriates (predominantly beef-eating) is expected to double or treble in the next five years (up to 15-20, 000 Europeans may be working in Eastern Province alone). Imported cattle are generally of poor quality but some "good average" quality beef air-freighted from Ethiopia is consumed by Europeans. Small amounts of "frozen" beef fillet (1-2 tons/month) have recently been sent by air from Sudan to Jeddah. Since the removal of the heavy duty on imported meat (see below), there could be an increased market for

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(a) There is also a substantial consumption of goat-meat in Saudi Arabia. There is reported to be little consumer differentiation between sheep and goat-meat of Somali origin. However, Sudanese goat-meat is said not to be popular and fetches a price 20 per cent below that of sheep.

chilled beef, especially in Eastern Province and possibly Riyadh, where fresh supplies are scarcer than in Jeddah.

(d) Prices

The retail price of mutton is fixed by Jeddah municipality at 50 pt/kg[(a)] and importers quote a maximum c. and f. price equivalent to 19 pt/kg liveweight. One reason why imports of Sudanese sheep have been declining is that Sudanese exporters have been asking too high prices (e.g. up to LS. 11.25 for an animal of 45 kg liveweight, or 25 pt/kg). Australian exporters are recently reported to have offered trial consignments to Jeddah for as little as $7\frac{1}{2}$ pt/kg c. i. f. liveweight, or about 17 pt/kg carcaseweight. The cost of freighting sheep to Riyadh is about 4 Saudi Riyals per animal (or 2 pt per kg carcaseweight).

Urban retail prices for beef appear to be about 20-30 per cent lower than those for mutton. Importers in Jeddah quote $8\frac{1}{2}$ pt/kg c. and f. liveweight (about 16 pt/kg carcaseweight) for cattle and calves from Somalia, but exporters from Sudan report having received offers between 20 pt and 25 pt/kg carcaseweight, depending on quality. The beef fillets from Sudan were coming in at about 67 pt/kg before the removal of the $27\frac{1}{2}$ per cent duty but they were not properly deep-frozen or packed and were overpriced compared with better quality frozen beef from other sources.

Livestock import prices are reported to rise by about 10 per cent during the summer months as a result of a decline in supply.

(e) Duties

No import duty is charged on live animals. Until January 1972 imported meat was liable to a duty of $27\frac{1}{2}$ per cent, but this has now been entirely removed.

A subsidy for the import of live animals was removed in 1970.

(a) Fixed retail prices in Riyadh and Dammam are about 58 pt/kg and 67 pt/kg respectively.

(f) Health Requirements

Saudi Arabia has no special sanitary requirements, but Sudan applies the same measures as for Egypt and Libya.

(g) Religious Factors

The preference for locally slaughtered meat is strong in traditional circles, but as far as imported meat was concerned it did not generally seem considered that religion would greatly favour Sudan at the expense of non-Islamic exporters.

(h) Demand Projections and Conclusions

In projecting Saudi Arabia's future demand for meat, it was assumed that population would increase by 2. 8 per cent per annum and income per head by 2. 6 per cent per annum[(a)]; and that the income elasticity of demand for all meats was 0. 6 (comparable to other Middle East countries with similar conditions). It was also assumed that, with retail prices for different meats remaining in the same relation to each other as at present, expenditure on beef in 1982/3 would rise to 20 per cent of expenditure on all meats (compared with 11 per cent now), mutton fall to 50 per cent (against 59 per cent now), camel fall to 10 per cent from 22 per cent and poultry rise to 20 per cent from 8 per cent. The resulting values were then translated into quantity terms. Local livestock production (and offtake) was assumed to increase by 4. 6 per cent per annum, on the basis of information supplied by the Ministry of Agriculture (new livestock development schemes are planned south of Riyadh and near Hofuf). The estimate of locally-produced meat was deducted from total projected consumption to give total imports. Finally, the proportion of meat consumed in frozen or preserved form was assumed to have increased by 1982/3 to 20 per cent in the case of beef and 10 per cent in the case of mutton. When this was deducted, an estimate was obtained

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(a) Annual GNP growth rate is predicted at 5. 5 per cent in Moe, L. E. (1966), Supply and Demand Projections for Farm Products to 1975, USDA., ERS-Foreign 168.

of mutton and beef import requirements in live or chilled form. These results are shown in Table A4. 11.

TABLE A4. 11 Saudi Arabia - Projected Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	29. 7	4. 8	0. 7	29. 0	23. 0
Mutton	62. 8	10. 1	31. 7	31. 1	24. 9
Camel	16. 3	2. 6			
Poultry	36. 3	5. 8			
Total:	145. 1	23. 3			

Saudi Arabia is likely to remain the largest and easiest market (in terms of quality and accessibility) for exporters of Sudanese sheep in the foreseeable future. There are also attractive prospects for medium-quality beef, where competition will probably be less severe. Sudanese exports have been declining lately because of rising prices and costs in Sudan and inability to guarantee supplies on a regular basis. The 15 per cent export bonus and the proposals made for improving marketing in this Report should help to overcome these problems. Saudi importers have complained at times of not getting the type or size of animal agreed by contract, but this source of friction should also be removed if sales are made on a liveweight, graded basis. Importers are agreed that the quality of Sudanese mutton is superior to the Somali and they are generally well disposed to Sudanese products, but they are mostly acute businessmen and expect value for money and efficient marketing.

Among the most prominent of those who provided information for this survey were: Messrs. Abbar and Zainy, Jeddah; Awadh Etaiwi

and Sons, Jeddah; Sharbatly Food Corporation, Jeddah; Sheikh Mohammed Bad Kok of Kilo 10 Restaurant, Jeddah; Khalifa Algoseibi Cold Stores, Dammam and Jeddah; Spinney's Food Supplies, Riyadh; and the Ministry of Agriculture, Riyadh.

2.3 Kuwait

(a) Imports

The official Kuwait import figures for 1966-1970 are summarised in Table A4.12. It will be seen that Sudan has so far been insignificant as an exporter of livestock or meat to Kuwait. Over the five year period there was a marked shift towards importing chilled and frozen meat rather than livestock. The type of meat imported is unspecified in the statistics, but traders' estimates are that it is made up of 85 per cent mutton (equal parts chilled and frozen) and 15 per cent beef (all frozen). The principal suppliers of chilled mutton are East European countries and Turkey. As Table A4.12 shows, this trade has expanded very rapidly indeed in the last four years.

Examination of the slaughter records of Kuwait[(a)] indicate that the live import figures are, as often, underestimated, possibly on account of smuggling. After account was taken of local livestock production (very small), discrepancies were often still very large and it was decided that live imports should be adjusted upwards to be consistent with the slaughter figures. Thus in 1970, for example, the number of cattle and sheep actually imported was assumed to be as high as 9,960 and 490,000 respectively.

(b) Consumption

The livestock population of Kuwait is very small indeed and nearly all supplies are imported. There are estimated to be 100,000 sheep, 15,000 cattle, 50,000 goats and 7,000 camels. On the basis of these

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(a) Statistical Abstract (1971), Central Statistical Office, Kuwait.

TABLE A4. 12 Kuwait, Livestock and Meat Imports, 1966-1970

Country of Origin	1966	1967	1968	1969	1970
Cattle (Nos.)					
Iran	9,325	13,415	-	-	-
Syria	-	620	3,217	1,406	-
Somalia	307	-	409	1,093	1,893
Ethiopia	-	-	1,083	2,141	-
East Africa	375	195	563	510	2,345
Sudan	-	-	1,428	1,348	773
Others	251	482	1,440	925	176
Total:	10,258	14,712	8,140	7,063	5,187
Sheep and Goats (Nos.)					
Iran	329,854	93,133	2	89	786
Syria	15,768	43,035	68,229	45,698	20,229
Somalia	-	7,423	16,500	6,700	20
South America	-	8,500	64,666	37,313	18,857
Australia	137,803	152,323	158,369	129,744	223,726
Sudan	-	-	2,646	1,994	-
Others	15,921	44,790	43,426	757	10,519
Total:	499,346	349,204	353,874	222,295	274,137
Fresh, Chilled or Frozen Meat (Tons) (excluding poultry)					
China	114.7	282.3	2,625.7	1,326.3	2,445.6
Turkey	-	0.4	682.0	447.2	1,051.5
Eastern Europe	15.0	96.6	1,447.5	3,035.0	2,228.8
Australia	1,763.1	1,884.8	1,828.2	1,496.0	1,045.6
Denmark	267.3	181.0	327.6	431.2	434.7
East Africa	76.4	87.4	105.4	64.0	49.5
Sudan	-	-	-	-	0.2
Other	97.5	185.5	378.2	294.1	360.2
Total:	2,334.0	2,718.0	7,394.6	7,093.8	7,616.1
Canned Meat (Tons)					
Total:	546.1	547.8	572.6	655.1	474.7

Source: Kuwait Foreign Trade Statistics.

figures and the revised import estimates (and a human population of about 733, 200 in 1970), the consumption figures in Table A4. 13 were obtained.

TABLE A4. 13 Estimated Meat Consumption, Kuwait, 1970

	Total (tons)	Kg/head
Beef	2, 950	4. 0
Mutton	18, 240	24. 9
Camel	490	0. 7
Poultry	5, 510	7. 5
Total	27, 190	37. 1

Consumption per head is large but it does not seem improbable in view of the very high standard of living among nearly all classes in Kuwait (GDP per head in 1970 was equivalent to about LS. 1, 415). The emphasis on mutton is very marked.

There is a substantial fall in demand for meat in the summer months, when many Kuwaitis move out of their country to cooler areas such as Lebanon. Consumption is higher than average during Ramadan.

(c) Quality Preferences

With such a high income per head, Kuwait is a quality market for mutton, though less so for beef, which is relatively little eaten at present. The preference is for young lamb of 10-12 kg carcaseweight, with 20 kg the maximum. Chilled carcases sent from Eastern Europe and Turkey have been of this type. The Australian sheep imported by the firm of Homeidi-Clausen, which now dominates the live market, have tended to be 2-3 years old (26-27 kg carcaseweight) but realised good sales (mainly tenders to government departments) on account of their very low price. However,

it is reported that increasing competition from the suppliers of chilled meat has caused a movement towards younger lambs in the live market also.

There are considerable risks in dealing in chilled meat, especially in such a competitive market as Kuwait, since meat not sold quickly has to be frozen and fetches only about half the price. Several firms consider that the recent enthusiasm for competing in the chilled market will wane but others see few signs of this occurring. One or two consignments of Sudanese mutton were sent by air in 1970/71 but they were not successful; importers' complaints were that the carcases were "not fat enough" and that the meat was badly chilled and discoloured on arrival. However, purely in terms of meat quality, Sudanese mutton should enjoy an advantage over most major suppliers at present in that animals fed on dry grazing (and subsequently fattened) are preferred to those which are pasture-fed.

A movement in consumer preference towards beef is discernible, but good quality is required. The fact that the movement is only slow suggests that quality beef is in relatively short supply. Importers express a preference for live cattle. No chilled beef is imported at present, but if it were it would have to be of prime quality (not older than eight months). Whole carcases are not in demand.

A notable increase in demand is reported among lower and middle income groups for frozen meat and (especially) chicken. Since ownership of refrigerators is widespread in Kuwait, this demand will no doubt continue to grow rapidly, but prices for frozen meat are very low.

(d) Prices

Average import prices for chilled mutton range from 37-40 pt/kg carcaseweight. One of the reasons for the low mutton prices prevailing in Kuwait is that when the East European countries first entered the market they subsidised their costs and were offering prices as low as 31 pt/kg. Prices were then raised steadily after a share of the market had been captured; in late 1971 the import price for East Europeans'

meat was reported to be up to 41½ pt/kg and it seemed that they were being undercut by the Turks and running into various difficulties. The additional competition from the chilled mutton suppliers has also affected the price of live animals, and wholesale selling prices for Australian sheep are said to have declined from 45½ pt to 33 pt per kg carcaseweight in the last three years (the c. i. f. price in 1970 was about 24 pt/kg).

Live cattle were fetching import prices of only 22 pt/kg carcase-weight in 1970 but, as the countries of origin in Table A4. 12 show, quality was not outstanding. It is believed that properly finished animals could fetch prices up to 30 pt/kg and possibly above, but further market research is required to test this.

C. i. f. prices for frozen mutton legs range from about 26 pt/kg (Australia) to 19 pt/kg in the case of Chinese mutton, which is reported as of "decent quality". The margin between chilled and frozen meat prices is illustrated by the fact that if chilled mutton is not sold on the day of arrival, the retail price slips from 52 pt/kg to 47 pt/kg the next day and is thereafter classified as "frozen", selling at only 26 pt/kg.

(e) Duties

Live animals are imported duty free but all meat is subject to 4 per cent duty.

(f) Health Requirements

Cattle are required to be vaccinated against rinderpest, anthrax and H. S. ; they should also be tested against C. B. P. P. and vaccinated against this disease 20 days before departure from the exporting country; they should also be dipped against ectoparasites. Sanitary measures for other categories of livestock and meat are the same as in the case of Egypt and Libya (see below). The necessary health certificates are required, but some smuggling to evade these is reported from Iraq. Veterinary officials in Kuwait are not satisfied with the present health arrangements and attempts are being made to impose stricter measures on importers.

(g) Religious Factors

While there is still a substantial traditional element in Kuwait society, the recent large increases in meat imports from non-Islamic countries suggests that little importance is attached to the provenance of meat provided that evidence is given of slaughter according to Mohammedan law.

(h) Demand Projections and Conclusions

Kuwait's population increased at a rate of over 9 per cent per annum during the 1960's but it was assumed to drop to 5 per cent during the period of analysis. The annual increase in income per head was projected at 1.6 per cent, with a 0.8 income elasticity for meat. In view of the present price differentials between meats and the relatively low beef consumption, a movement was assumed away from mutton and towards beef and poultry, so that in 1982/3 expenditure on all meats would be in the proportion of 20 per cent on beef, 55 per cent on mutton and 25 per cent on chicken. Provision was made for an increase in the present very small indigenous livestock offtake and the proportion of meat consumed in frozen or canned form was assumed to rise by 1982/3 to 50 per cent in the case of beef and 35 per cent in the case of mutton. The results of these assumptions are shown in Table A4.14.

TABLE A4.14 Kuwait - Projected Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	14.1	10.3	0.2	13.9	6.8
Mutton	28.8	21.0	1.4	27.4	17.3
Poultry	21.8	15.9			
Total:	64.7	47.2			

The market for mutton in Kuwait at present appears to be almost saturated. Entry into the live market is particularly difficult. However, if competition in the chilled market eases, there might be an opening for Sudanese mutton in view of local preference for the desert type animal. Even so, it is only likely to become an attractive market if some kind of subsidy in air-freight rates were provided, which is a distinct possibility in view of the need for the new Sudan Airways planes to visit Kuwait at least once a week. The best market to aim for in the near future could well be that for live cattle of good average quality; Kuwaiti importers believed that movement by truck from Jeddah was the quickest and cheapest route, but this would have to be investigated carefully by the Marketing Agency before major commitments could be made.

Many Kuwaiti importers are anxious in principle to import Sudanese meat products and some have made fairly intensive studies of livestock production and marketing in the Sudan. Provided certain essential infrastructural improvements were carried out (e. g. with regard to railway transport) some businessmen in Kuwait would probably consider investing in large-scale livestock production in Sudan.

Among those who gave assistance to this survey in Kuwait were: Messrs. A. & M. Abughazaleh; Mr. Al-Barakat; Mr. Al-Wazzan; Mr. Yousuf Al-Saqer; Dr. Khalil Osman of Gulf Fisheries; and Dr. Abdal Rahman Salman, Director of Animal Husbandry.

2.4 The Trucial States, Bahrain and Qatar

(a) Imports

Visits were made to Bahrain and Dubai. Statistics of livestock imports in both states were unreliable (in Bahrain 80 per cent of live imports are reckoned to go unrecorded) but figures for meat imports were accepted. Total live imports were estimated on the basis of experienced opinion in Bahrain and on slaughterhouse figures in Dubai. The figures are summarised briefly in Table A4. 15. Bahrain imports most of its cattle from South Iran; until recently the same was true in

the case of sheep, but now about 30,000 per year or almost half the estimated imports come from Australia (through the firm of Homeidi-Klausen in Kuwait). Dubai obtains the bulk of its livestock from South Iran (most of the importing is carried out by merchants with relatives on the Iran coast); half its total imports (or about 70,000 sheep and 5,000 cattle per year) are re-exported to other states such as Abu Dhabi, Qatar or Bahrain.

TABLE A4.15 Bahrain and Dubai - Estimated Livestock and Meat Imports, 1970

	Bahrain	Dubai
Cattle (Nos.)	8,000	10,000[a]
Sheep (Nos.)	60,000	140,000[a]
Chilled or Frozen Beef (Tons)	60	375[b]
Chilled or Frozen Mutton (Tons)	245	1,215[b]
Canned Meat (Tons)	222	472

(a) Of which half assumed to be consumed in Northern Trucial States and half re-exported.

(b) Assuming that all imported meat is made up of: Beef 20 per cent, Mutton 65 per cent, Poultry 15 per cent (importer's estimate).

Sources: Official statistics for meat imports.

(b) Consumption

Livestock production in the Gulf States is negligible (Bahrain is credited with 10,000 sheep and 5,000 cattle)[a]. Estimated human populations in 1970 were: Bahrain 210,000; Qatar 112,000; Abu Dhabi 60,000; and Northern Trucial States 150,000 (of which Dubai had 60,000). On the uncertain information available, meat consumption in Bahrain and the North Trucial States was estimated to be on the lines indicated in Table A4.16.

(a) FAO, Rome/Cairo (1971), Regional Study on Animal Husbandry, etc., in the Near East (draft).

TABLE A4. 16 Estimated Meat Consumption, Bahrain and North Trucial States, 1970

	Bahrain		North Trucial States	
	Total (tons)	Kg/head	Total (tons)	Kg/head
Beef	1,220	5.8	1,450	9.7
Mutton	2,210	10.5	2,860	19.1
Camel	310	1.5	220	1.5
Poultry	1,015	4.9	340	2.2
Total:	4,755	22.7	4,870	32.5

In subsequent calculations it has been assumed that the per capita consumption pattern in Dubai and the North Trucial States is also representative of Abu Dhabi and Qatar.

Monthly slaughter figures from Dubai indicate a marked increase in Ramadan and, as in Kuwait, demand is reported to decline substantially in summer. Otherwise, the principal causes for fluctuations in consumption levels appear to be on the supply side; small ships are used to transport livestock from south Iran and their movement is greatly handicapped by rough seas between December and February.

(c) Quality Preferences

Average income per head in Bahrain is lower than in the surrounding states and there is a greater emphasis on beef than in Kuwait as well as on imports of cheap frozen and canned meats (partly a consequence of the substantial Indian and Pakistani element in the population). A similar pattern prevails in the Trucial States and Qatar which, despite their high standards of living, are too small and isolated to attract regular supplies of high quality meat. Australia air-freights 4-5 tons of chilled meat every month to Bahrain, mainly for European consumption, and just over 1 ton per month to Dubai. Abu Dhabi, through lack of alternative air connections,

air-freights meat at high cost from the U. K. All meat imports to Qatar are frozen.

Sudanese sheep are highly thought of in the Gulf States and the quality of their meat is much preferred to that of the Australian animals.

(d) Prices

Because of their relative inaccessibility, prices in the Gulf States tend to be high. Officials in Bahrain quoted up to 60 pt/kg carcaseweight c. and f. for Iranian or Somali sheep and 41 pt/kg for Australian sheep. Frozen mutton legs from Australia sell at almost half this price.

For the special consignment of Sudanese sheep to Abu Dhabi in Ramadan 1971, a price was agreed equivalent to 58 pt/kg carcaseweight f. o. b. Port Sudan or 68 pt/kg c. and f. Abu Dhabi. A similar price is reported to have been offered for a second consignment, together with an offer of 46 pt/kg carcaseweight c. and f. for calves under three years.

Import prices in Dubai are lower owing to its greater accessibility to Iran; Iranian sheep and goats have been priced at 33 pt/kg, but the quality was poor and Sudanese animals could be expected to obtain a substantial premium.

(e) Duties

Bahrain charges 3 per cent customs duty on live animals, 5 per cent on meat. Dubai has no charge for live animals but 4. 625 per cent on meat.

(f) Health Requirements

Measures are not very stringent, especially in Dubai, but efforts are being made there to apply quarantine regulations in order to control the import and re-export of livestock.

(g) Religious Factors

As far as could be seen, attitudes were similar to those in Kuwait.

(h) Demand Projections and Conclusions

Bahrain's population was assumed to increase at a rate of 2. 8 per cent per annum, that of the Trucial States and Qatar at 4 per cent per annum. Per capita expenditure on meat was projected to increase at the same rate as Kuwait in all states except Bahrain, where the rate chosen (1 per cent per annum) was somewhat lower. A movement was assumed from mutton to beef and chicken, so that proportions of all meat consumed in 1982/3 were (in the case of Bahrain) beef 30 per cent, mutton 45 per cent, chicken 25 per cent, and (in the other states) beef 35 per cent, mutton 50 per cent, chicken 15 per cent. The proportions of beef assumed to be in frozen or canned form were 30 per cent for Bahrain and 47 per cent for the other states; respective proportions for mutton were 45 per cent and 52 per cent. The resulting patterns are shown in Table A4. 17.

TABLE A4. 17 Gulf States - Project Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons)	Consumption/ Head (Kg)	Local Production (Tons)	Imports (Tons)	Imports (live and chilled only) (Tons)
Bahrain					
Beef	2, 390	8. 2	90	2, 300	1, 580
Mutton	2, 860	9. 8	60	2, 800	1, 510
Poultry	2, 396	8. 2			
Total:	7, 640	26. 2			
Trucial States & Qatar					
Beef	7, 860	14. 9	-	7, 860	4, 170
Mutton	8, 980	17. 0	-	8, 960	4, 300
Poultry	4, 040	7. 7			
Total:	20, 880	39. 6			

The Gulf States markets are potentially very lucrative and there is little price or quality competition, though there might be some difficulty in breaking the Iranian monopoly in Dubai. The main problem from Sudan's (and other exporters') point of view is the States' relative inaccessibility and small size. If flights were available, air-freighting would be the cheapest means of supplying Bahrain, Abu Dhabi and Dubai, but in the case of the latter two this seems unlikely to occur. The possibility of providing return loads for fertiliser ships from Kuwait therefore deserves serious attention (see Appendix V, Section 3).

Among those who assisted this survey were: The Meat Control Committee, Manama Municipality, Bahrain; Sayed Kamal Hamza, Director, Dubai Municipality and Dr. Hassan Othman, Dubai Municipality.

2.5 Egypt

(a) Imports

Egyptian import statistics appear to be, at best, incomplete, certainly with regard to live animals. However, since Sudan is the main supplier of livestock to Egypt (alternative sources have become difficult since the closure of Suez to shipping)[(a)], this deficiency can to some extent be made up by using Sudanese data. Thus total imports of cattle at present could be assumed to be about 35,000 (with Sudan's share 20-25,000); of sheep about 30,000 (nearly all from Sudan); and of camels perhaps 85,000 (again, nearly all from Sudan). Egyptian trade statistics for 1969/70 specified about 2,500 tons of imported frozen meat, divided mainly between Argentine (beef) and China (mutton); and 3,600 tons of canned meat, almost two-thirds of it from China. On the assumption that imported frozen meat is half beef and half mutton and imported canned meat half beef and one-third mutton, total imports (in terms of meat equivalent) would be in the region of 10,000 tons of beef, 3,000 tons of mutton and 21,000 tons of camel-meat.

(a) Some Somali supplies come through the Red Sea port of Safaja but the route is not an easy or convenient one.

(b) Consumption

Official 1968 figures for Egypt's livestock population were: Cattle 2. 06 million, Buffaloes 1. 94 million, Sheep 1. 94 million and Goats 1. 13 million[(a)]. 1970 figures for indigenous animals officially slaughtered were: Cattle 343, 100, Buffaloes 312, 100 and Sheep and Goats combined 424, 600. It was considered that these figures should be multiplied by factors of at least 1. 75 for cattle and buffaloes and 2. 75 for sheep to obtain a reasonable estimate of total indigenous slaughter. This implied off-takes of 29 per cent for cattle, 28 per cent for buffaloes and 38 per cent for sheep and goats, which suggests that Egypt's livestock population is considerably underestimated.

Having increased the slaughter figures by the stated factors and added estimated imports, the consumption picture shown in Table A4. 18 was reached (the total human population of Egypt in 1970 was taken to be 33. 3 million).

TABLE A4. 18 Estimated Meat Consumption, Egypt, 1970

	Total (tons)	Kg/head
Beef	176, 500	5. 3
Mutton	24, 980	0. 75
Camel	23, 980	0. 7
Poultry	96, 570	2. 9
Total:	322, 030	9. 65

Egypt is clearly in a very different category from the other countries in this survey with its much larger population, lower income and lower meat consumption per head. Estimates may possibly be low, since a budget survey in 1958/59 found an average per capita consumption of

(a) U. A. R. Statistical Handbook (1970).

13 kg of meat in urban areas and 10 kg in rural areas[(a)], but it is not improbable that the figure should have fallen since then. The Egyptian pattern is also different because of the emphasis on beef and camel, both cheaper meats, rather than mutton.

(c) Quality Preferences

Egypt is essentially a quantity rather than a quality market and has always been recognised as such by Sudanese exporters. Since Egypt does not operate a market economy, individual preferences have little impact on the total pattern of demand, which is determined to a large extent by the government. However, the Egyptian negotiators for the annual agreement on trade with the Sudan are anxious to improve quality as much as possible and are prepared to give a premium for younger beef. A Sudanese exporter noted that the Egyptians were now pressing for 30 per cent of total cattle exports to be 2-3 year old calves, 20 per cent under 5 years and 50 per cent adults, whereas previously there were no quality requirements.

The Egyptian authorities are willing and equipped to receive imports from the Sudan in the form of chilled meat and recently a Sudanese businessman concluded a contract to supply Egypt with 3,000 tons. The attempt to send chilled meat by air in 1969/70 failed not so much because of Sudan's inability to supply meat of the agreed quality as because of disagreement over what the appropriate price should be.

(d) Prices

Import prices, c. and f. Cairo, agreed for 1970/71 were $12\frac{1}{2}$ pt per kg liveweight for cattle, $13\frac{1}{2}$ pt for calves and 21-22 pt for sheep. Exporters, however, would not accept this price in the following year and at the time of writing no agreement had been reached. So long as the present high costs and risks of transporting livestock via Wadi Halfa and Shellal persist, their requests for higher prices appear justified.

(a) See Amin, G. (1966), Food Supply and Economic Development, Cairo University.

Under present conditions, air-freighting should be distinctly cheaper (see Section 3 below).

In 1971 beef retail prices in Cairo, fixed by government and not indicative of market forces, were as follows (pt per kg):

	With Bone	Boneless
Imported (4-5 years)	0.31½	0.45
Local, 2 years (including buffalo)	0.40½	0.58½
Local beefling (1 year)	0.47	0.65

(e) Duties

None were noted.

(f) Health Requirements

Requirements for live animals are not particularly stringent; cattle are merely required to have been in quarantine for 21 days and sheep must be accompanied by evidence of vaccination against anthrax. Nevertheless, it was reported from Wadi Halfa that the Egyptian veterinary representatives at Aswan had been known to re-quarantine Sudanese animals for a further 21 days after entering Egypt. In the case of animals exported as beef, vaccinations are required ten days before slaughter against rinderpest, anthrax and H.S. Ante- and post-mortems are also specified.

(g) Religious Factors

These do not appear to be significant in the context of meat imports.

(h) Demand Projections and Conclusions

If Egypt's meat consumption were determined by supply and demand, it would almost certainly increase rapidly, as would imports, since substantial expansion in local supply is restricted by shortage of land, competition from cash crops and scarcity of animal feed. However, it is assumed that demand will be controlled at a level of a 1 per cent annual increase in the quantity of all meat consumed per head. Total population is assumed to increase at 2.5 per cent per year and local

slaughter numbers by 2. 4 per cent per year for beef and 3. 9 per cent per year for mutton. The resulting pattern is summarised in Table A4. 19.

TABLE A4. 19 Egypt - Projected Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	266. 9	5. 97	221. 3	45. 6	22. 8
Mutton	37. 8	0. 85	34. 7	3. 1	0. 4
Camel	24. 0	0. 54			
Poultry	157. 8	3. 53			
Total:	486. 5	10. 89			

Egypt will always be useful to Sudan as a mass market for "traditional" quality beef animals, but in economic terms it has the great disadvantage of bringing no foreign exchange returns to the Sudan. Nevertheless, it is in both countries' interests to reduce the present high costs of exporting livestock.

Among those who assisted in this survey were: Dr. Tawfiq Ragab of the General Organisation for Meat; Dr. M. Hadi Maghrabi, Deputy Chairman, U. A. R. General Authority for Supply Commodities; and senior members of the Animal Production Department, Ain Shams University, Cairo.

2. 6 Libya

(a) Imports

Libya's livestock and meat imports between 1966 and 1969 (the last complete year available in official statistics) are shown in Table A4. 20. These demonstrate that imports, especially of live sheep, beef and

TABLE A4. 20 Libya, Livestock and Meat Imports, 1966-1969

Country of Origin	1966	1967	1968	1969
Cattle (Nos.)				
Lebanon	915	1, 200	661	100
Tunisia	434	32	-	-
Turkey	336	1, 845	50	-
Eastern Europe	814	10, 596	16, 693	1, 748
Others	667	2, 308	1, 187	1, 401
Total:	3, 166	15, 981	18, 591	3, 249
Sheep (Nos.)				
Lebanon	49, 127	18, 125	23, 880	13, 455
Syria	22, 159	11, 537	4, 689	8, 336
Tunisia	4, 042	42, 996	56, 560	30, 338
Eastern Europe	107, 385	240, 206	308, 269	406, 048
Others	10, 910	33, 256	49, 391	46, 871
Total:	193, 623	346, 120	442, 789	505, 048
Beef, Chilled or Frozen (Tons)				
Tunisia	323. 6	482. 3	251. 5	505. 5
Chad	176. 9	37. 7	-	-
Sudan	87. 9	48. 5	5. 9	39. 6
East Africa	45. 0	11. 1	12. 1	331. 3
Eastern Europe	70. 1	348. 4	298. 3	981. 3
Others	184. 9	268. 7	248. 9	478. 3
Total:	888. 4	1, 196. 7	816. 7	2, 336. 0
Mutton, Chilled or Frozen (Tons)				
Tunisia	489. 5	621. 3	616. 6	558. 6
Turkey	-	-	123. 2	138. 2
China	-	1. 5	213. 2	-
Australia	10. 5	-	10. 2	65. 2
East Africa	-	-	44. 6	53. 8
Eastern Europe	60. 3	128. 5	506. 5	846. 3
Sudan	15. 8	13. 5	11. 6	9. 5
Others	104. 8	116. 6	55. 8	91. 5
Total:	680. 9	881. 4	1, 581. 7	1, 763. 1
Canned Meat - Total (Tons)	333. 6	392. 9	N. A.	709. 3

Source: Libya Foreign Trade Statistics.

mutton have been rising very rapidly indeed - a consequence of the rapid rise in income per head in Libya in recent years and the very limited scope for increasing Libyan livestock production. It will be noted that East European countries have, in a very short space of time, taken a dominant position in all four categories of product shown. Sudanese exports of meat, never very significant, declined during this period of overall expansion.

(b) Consumption

Libya's internal statistics were the best encountered during the market survey. Household budget surveys carried out in Tripoli and Benghazi in 1969 indicated an urban income elasticity of demand for meat of about 0. 8, which served as a basis for estimates in other Middle Eastern countries. Average urban expenditure on meat per head was LL. 26. 1 which at prevailing retail prices indicated an urban meat consumption of 33. 8 kg per head per year.

Official slaughter estimates, after some upward adjustment for outside slaughter, fitted fairly well with imports and probable offtake from local livestock (in 1968 population estimates were: sheep 1. 7 million, goats 1. 4 million, cattle 122, 000 and camels 235, 000)(a). With the human population in 1968 estimated at 1. 8 million, it was possible to calculate a national average meat consumption of 21. 8 kg per year. This, in combination with the urban result obtained separately, indicated an average consumption outside the main cities of 17. 7 kg per head. The national pattern of consumption is summarised in Table A4. 21.

TABLE A4. 21 Estimated Meat Consumption, Libya, 1968

	Total (Tons)	Kg/head
Beef	7, 110	3. 9
Mutton	19, 910	11. 0
Camel	11, 215	6. 2
Poultry	1, 200	0. 6
Total:	39, 435	21. 8

(a) Statistical Abstract (1968), Ministry of Planning, Libyan Arab Republic.

Beef consumption is confined mainly to the cities while the high consumption of camel-meat is principally in the desert areas. But the main emphasis, as everywhere else in the Middle East except Egypt, is on mutton.

(c) Quality Preferences

The quality of the desert sheep is preferred but the demand is for young tender animals (10-15 kg carcases), which the East European countries are supplying. Taste in beef is also sophisticated compared with other countries in the region, possibly as a result of Mediterranean influence. Young lean beef and even real veal are in demand among most urban income-groups. Sudanese beef has a poor reputation among private Libyan traders. Imports of live Sudanese cattle (while the Suez canal route was open) were prohibited in 1965 on the grounds that they had led to an outbreak of foot and mouth disease. The discontinuation of the 1970/71 contract for chilled beef between the Libyan Agricultural Bank and the Sudanese Government, apparently owing to a decline in quality, has been a further setback. Nevertheless, if a regular supply of good quality lamb and beef can be provided at a reasonable price and old policies and attitudes can be seen to have been changed, Libyan importers can be expected to be very responsive.

(d) Prices

The market for mutton is probably more competitive than that for beef. The Sudanese Government was offered c. and f. prices of $48\frac{1}{2}$ pt/kg carcaseweight for mutton and 39 pt/kg for beef. East European lamb is imported at a similar price and some undercutting could no doubt occur if Sudanese mutton imports increased substantially. However, the market is not so competitive as Kuwait. The problem of having to freeze chilled meat because of failure to sell it in time seems to arise only infrequently; in any case, the loss is not so great since frozen prices average only 20-25 per cent less than chilled. The Sudanese beef was being imported at a price distinctly lower than that paid for the best "veal" carcases

(45 pt/kg carcaseweight) and marginally less than that for the average older beef carcase (40½ pt/kg).

(e) Duties

Live animals are not charged duty. Meat imported in pieces weighing less than 10 kg is subject to 30 per cent duty; larger pieces (i. e. carcases) are free of duty.

(f) Health Requirements

Apart from the Lebanon, Libya is probably the country most concerned about health regulations in the Middle East. Cattle whose meat is destined to Libya should be vaccinated with tissue culture vaccine 40 days before slaughter in addition to anthrax and H. S. vaccines. Sheep should be vaccinated against anthrax before slaughter. All carcases are required to be chilled for 24 hours at 20-25°F before despatch.

(g) Religious Factors

There was a campaign last year by Libyan religious teachers against importing meat from non-Muslim countries and this could help to place Sudan in an advantageous position in relation to some of her competitors.

(h) Demand Projections and Conclusions

Assumptions were made with regard to an annual 3. 5 per cent population growth rate, a 1. 4 per cent increase in income per head and an income elasticity of demand for meat of 0. 8. Taste was assumed to move, similarly to elsewhere, away from mutton and towards beef and poultry and local production was allowed, somewhat generously, to increase at 4. 6 per cent per year on the grounds that substantial livestock development might take place in Kufrah oasis. The resulting picture is indicated in Table A4. 22.

TABLE A4. 22 Libya - Projected Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	22. 4	7. 63	4. 7	17. 7	12. 1
Mutton	33. 7	11. 44	12. 0	21. 7	15. 8
Camel	5. 4	1. 83			
Poultry	24. 0	8. 14			
Total:	85. 5	29. 04			

Libya is distinctly the most attractive Middle East market for Sudan in terms of price and every effort should be made to secure a place in this market. The quality required is high, but the project proposals should ensure that these can be met. It is important that the next major attempt to enter this market be carefully prepared and that there are no faults in the chilling techniques or transport arrangements.

Among those who gave assistance to this survey were Sayed Achmed Saad Mansur; Achmed Gendy; and the Census and Statistical Department, Ministry of Planning.

2. 7 Lebanon

The market in Lebanon (1970 population: c. 2. 7 million) was not studied in the same detail as others in the Middle East and is therefore described more briefly. The official import statistics for 1970 are summarised in Table A4. 23. Large numbers of live animals are imported from nearby Syria and Turkey, and consequently meat imports are low compared with other countries in the Middle East; most of the meat imported is frozen. Both live animals and meat are imported duty-free. Some livestock and meat products are re-exported to other Middle Eastern countries.

TABLE A4. 23 Lebanon - Livestock and Meat Imports, 1970

Country of Origin		Country of Origin	
Cattle (Nos.)		Chilled and Frozen Beef (Tons)	
Syria	61,716	South America	401. 4
Turkey	21,015	Eastern Europe	293. 0
Others	115	China	75. 0
Total:	82,846	Others	339. 2
		Total:	1,108. 6
Sheep and Goats (Nos.)		Chilled and Frozen Mutton (Tons)	
Syria	308,476	Argentina	2,470. 4
Turkey	235,429	China	362. 3
Eastern Europe	51,960	Australia	131. 4
Others	1,414	Others	154. 2
Total:	597. 279	Total:	3,118. 3
		Canned Meat (Tons)	
		Total:	2,360. 4

Source: Lebanon External Trade Statistics.

The local livestock population is estimated at about 106, 000 Cattle, 220, 000 Sheep and 450, 000 Goats. On the basis of the import statistics and estimated local off-take (with an upward adjustment similar to that applied to the Kuwait statistics), 1970 consumption was reckoned to be of the order indicated in Table A4. 24. The poultry element is probably underestimated.

TABLE A4. 24 Estimated Meat Consumption, Lebanon, 1970

	Total (Tons)	Per Head (Kg)
Beef	26, 140	9. 6
Mutton	41, 660	15. 3
Poultry	1, 080	0. 4
Total:	68, 880	25. 3

Lebanese import prices are low, especially for mutton; the 1970 trade statistics indicate an average c. and f. price of about 35 pt/kg carcase-weight. The relative unattractiveness of Lebanese mutton prices is reflected in the much lower degree of East European competition than in Kuwait or Libya. Average import prices for beef were shown to be about $31\frac{1}{2}$ pt/kg, but Sudanese exporters with connections in the Lebanon estimated that the price for good average quality beef could now be up to $34\frac{1}{2}$ pt/kg. Beef therefore looks a better long-term prospect than mutton, but of the "quality" markets in the Middle East, Lebanon appears the least favourable for substantial penetration, unless very cheap air-freight terms can be obtained.

Health regulations are the most stringent in the Middle East. A large quarantine station was built at the port of Tripoli specifically for the reception and isolation of imported livestock from Africa but the closure of the Suez Canal precluded its use for this purpose and African imports now have to be in the form of meat, which is treated with considerable suspicion. There is a particular fear of foot and mouth disease being introduced by African meat and several consignments of Sudanese meat in the 1960's were destroyed on arrival at Beirut airport. All cattle intended for slaughter and export to Lebanon are required to be vaccinated against this disease with OAC as well as against rinderpest and anthrax. They are also supposed to be kept isolated in special quarantine away from other export animals. It is further specified that all beef (but not mutton) should

be de-boned before export, but this provision is now understood to be under discussion and is expected to be removed. In the 1960's a Sudanese exporter attempted to send boneless beef to Lebanon (at a c. and f. price of about LS. 1. 00 per kg), but the boning equipment and the butchers to operate it had to be imported at heavy cost and the process proved uneconomic.

The projected pattern of demand, based on similar assumptions to those used for other importing countries, is given in Table A4. 25.

TABLE A4. 25 Lebanon - Projected Meat Consumption and Beef and Mutton Imports, 1982/3

	Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	43. 2	11. 4	5. 9	37. 3	26. 5
Mutton	45. 7	12. 1	9. 5	36. 2	27. 0
Poultry	29. 2	7. 7			
Total:	118. 1	31. 2			

3. THE CHOICE BETWEEN EXPORTING LIVE AND CHILLED

Certain Middle East countries (Libya and Lebanon) can at present only be supplied with meat by air. Choosing the form in which to export meat to the other countries in the region will depend on:

(a) Consumer preference (e. g. preference for local slaughter in Saudi Arabia).

(b) Availability of alternative forms of transport (e. g. return loads by air are unlikely to be obtained to the Trucial States).

(c) Comparative incidental costs.

(d) The technical efficiency likely to be achieved by Sudan in meat chilling and freighting in the near future.

(e) The requirement of the Sudanese tanning industry for additional hides and skins.

The question of comparative costs is discussed briefly below. Much will depend on the freight rates obtainable from Sudan Airways or air charter companies, but if an average rate is assumed of 6.75 pt per ton/mile (50 per cent higher than the unusually low rate charged by Tradewinds to Libya), and facilities for transporting livestock are improved as recommended in the proposal, the cost differences are often marginal. Sheep entail higher incidental costs per kg when transported live than cattle, so that in most cases, such as the Kuwait example below (where three possible routes exist), it would probably be cheapest to send mutton chilled and beef live, especially when the relatively high value of slaughtered sheep's hides and offals are taken into account. The alternative cost schedules are set out in Table A4.26, though the effect of duty on meat imports has not been included.

The situation with regard to exports to Egypt is particularly interesting. Incidental costs of exporting cattle via Wadi Halfa under present conditions are reckoned to be about 11 pt/kg carcaseweight. Under improved conditions it is expected that these could be reduced to about $7\frac{1}{2}$ pt/kg, while the incidental costs of air-freighting would (on the same basis of reckoning as above) also be $7\frac{1}{2}$ pt/kg (excluding returns from hides and offals). In the case of mutton, air-freighting should be much the cheapest method.

4. CENTRAL AFRICAN MARKETS

A brief market survey was carried out in 1970 by MAP representatives in Zaire and the Central African Republic, which are both importers of meat, predominantly beef. There is already an uncontrolled movement of poor quality beef animals from South West Darfur into the Central

TABLE A4. 26 Costs of Transporting Meat to Kuwait by Different Means

	Cattle		Sheep	
	LS/head	Pt/kg Carcaseweight (@ 200 kg/hd)	Ls/head	Pt/kg Carcaseweight (@ 20 kg/hd)
(a) Rail to Port Sudan and ship direct to Kuwait				
Khartoum - Port Sudan[a]	4. 18	2. 09	0. 80	4. 00
Freight, etc. Port Sudan - Kuwait[b]	9. 00	4. 50	2. 06	10. 30
Feed (8 days)	1. 60	0. 80	0. 40	2. 00
Losses	1. 00	0. 50	0. 10	0. 50
Total:	LS. 15. 78	Pt. 7. 89	LS. 3. 36	Pt. 16. 80
(b) Rail to Port Sudan, ship to Jeddah and truck Jeddah - Kuwait				
Khartoum - Port Sudan[a]	4. 18	2. 09	0. 80	4. 00
Freight, etc. and losses Port Sudan-Jeddah	2. 60	1. 30	0. 59	2. 95
Feed, Jeddah (1 day)	0. 20	0. 10	0. 05	0. 25
Freight, Jeddah - Kuwait[c]	3. 44	1. 72	0. 78	3. 89
Losses	0. 66	0. 33	0. 06	0. 33
Total:	LS. 11. 08	Pt. 5. 54	LS. 2. 28	Pt. 11. 42
(c) Slaughtered in Khartoum and air-freighted				
Quarantine fees, vaccines, feeding in quarantine, etc.	1. 80	0. 90	0. 42	2. 13
Slaughter fees	0. 60	0. 30	0. 17	0. 85
Chilling[d]		0. 12		0. 12
Incidental costs to airport		0. 25		0. 25
Freight, Khartoum - Kuwait		8. 37		8. 37
Total		9. 94		11. 72
Credit value of hides and offals[a]	-2. 46	-1. 23	-1. 50	-7. 50
Total (crediting hides and offals)		Pt. 8. 71		Pt. 4. 22

(a) See Appendix III.

(b) Assuming return load.

(c) At 1, 100 Saudi Riyals per truckload of 27 cattle; or

(d) At LS. 48 per 40 tons (capacity of chilling room) per day.

African Republic and there appear to be possibilities of placing the trade on a more regular basis, with half the payment for Sudan's exports coming in foreign exchange form and half in kind. It is thought that a market exists for 10-12,000 cattle per year. During the survey the sale was observed of about 50 scrub animals (about 200 kg liveweight) for the equivalent of LS. 9.50 per head. Their purchase price in Darfur was probably below LS. 7.50.

Zaire is at present importing substantial quantities of air-freighted beef from Chad, but while retail prices in the capital, Kinshasa, are reported to be high (70 pt/kg for bone-in Chad beef), the c. and f. price quoted was 27 pt/kg and air-freight costs were high - 15 pt/kg. Unless much cheaper freight rates can be found or changes are made in the monopolistic buying structure, Zaire cannot be regarded as an attractive market at present.

Any expansion of trade with Central or West Africa would clearly be directed from Nyala or Wau rather than Khartoum.

APPENDIX IV

EXPORT MARKETS

1. SUDAN LIVESTOCK EXPORT STATISTICS

There are discrepancies between the figures given in the annual Foreign Trade Statistics and the records kept by the Ministry of Animal Production officials at Port Sudan and Wadi Halfa, the latter usually being higher. Because the MAP figures were available complete in monthly form from 1967 to 1971 inclusive, they were used in studies of seasonality patterns and for reasons of consistency were also employed in Volume I, Table 1.8 for live exports between those dates. The 1966 figures for live exports and all estimates of meat exports were, however, taken from the Foreign Trade Statistics[(a)]. For purposes of comparison and as a guide to the approximate values of past exports, the Foreign Trade Statistics figures for 1960 to 1970 inclusive are given in Tables A4.1 and A4.2. Figures for hides and skins exports over the same period are shown in Table A4.3.

Monthly livestock export figures are given for Port Sudan (January 1967 - January 1972) in Table A4.4 and Wadi Halfa (October 1969 - January 1972) in Table A4.5. Since mid-1970 these valuable records have been collected and published in an annual report by the Head of the Quarantine Section of the MAP, together with figures of animals which have either died, been slaughtered or withdrawn while in quarantine. Losses are generally low at this stage, the major casualties occurring after animals leave the point of export. The 1970/71 pattern is shown in Table A4.6.

(a) Alterations were made in the meat export figures where more accurate information seemed available from elsewhere.

TABLE A4. 1 Foreign Trade Statistics Estimates of Beef Exports, 1960-1970

	1960		1961		1962		1963		1964		1965		1966		1967		1968		1969		1970	
	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)		Value (LS. 000)		Value (LS. 000)		Value (LS. 000)		Value (LS. 000)
(1) Live Cattle																						
Egypt	38,788	944.1	32,978	800.4	5,433	121.7	21,278	512.4	11,744	282.3	5,535	151.0	14,949	445.9	7,174	214.6	781	23.8	1,519	49.6	15,155	554.3
Saudi Arabia	729	15.3	13	0.6	674	6.4	804	20.5	360	6.6	2,810	81.4	1,726	51.9	1,798	60.2	6,235	198.0	6,335	219 2	5,463	200.1
Gulf States (incl. Kuwait)	-	-	-	-	666	14.7	-	-	-	-	-	-	-	-	270	6.8	1,067	27.6	1,614	48.8	480	14 4
Libya	-	-	-	-	-	-	-	-	310	10.9	1,210	42.8	534	14.4	-	-	-	-	-	-	-	-
Other	475	7.3	249	5.9	950	18.1	-	-	-	-	40	1.3	225	6.7	-	-	-	-	5	0.1	-	-
Total Exports:	39,992	966.7	33,240	806.9	7,723	160.9	22,082	532.9	12,414	299.8	9,595	276.5	17,434	518.9	9,242	281.6	8,083	249.4	9,476	317.7	21,098	768.8
(2) Chilled Beef (metric tons)																			706.6	277.1	-	-
Egypt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	0.9	7.4	2.0
Saudi Arabia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	53.7	12.3	13.5	2.7
Libya	-	-	-	-	-	-	-	-	38.7	6.9	89.3	15.8	65.3	9.8	40.0	6.5	7.2	0.9	30.9	4 8	0.2	0.1
Lebanon	-	-	-	-	-	-	-	-	-	-	2.5	0.4	2.5	0.4	-	-	1.7	0.2	796.3	295.1	21.1	4.8
Total Exports:	-	-	-	-	-	-	-	-	38.7	6.9	91.8	16.2	67.8	10.2	40.0	6.5	8.9	1.1				

TABLE A4. 2 Foreign Trade Statistics Estimates of Mutton Exports, 1960-1970

	1960		1961		1962		1963		1964		1965		1966		1967		1968		1969		1970	
	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)
(1) Live Sheep																						
Saudi Arabia	69,268	466.9	99,545	665.2	90,729	619.8	72,565	506.1	70,362	495.6	220,668	1,648.9	161,951	1,257.8	216,343	1,740.7	201,956	1,722.8	221,507	1,956.9	145,948	1,273.3
Egypt	-	-	-	-	-	-	400	3.0	9,000	71.6	5,351	43.1	1,100	9.5	-	-	-	-	250	2.0	27,852	247.3
Gulf States (incl. Kuwait)	3,385	20.1	-	-	2,500	20.0	-	-	-	-	-	-	-	-	2,400	20.4	7,900	68.0	-	-	-	-
Libya	-	-	-	-	-	-	-	-	180	2.3	200	1.5	-	-	800	6.8	650	3.7	260	2.1	500	4.3
Other	2,680	17.1	-	-	1,750	13.4	-	-	700	4.9	1,000	7.6	-	-	-	-	-	-	2,720	24.0	-	-
Total Exports:	75,333	504.1	99,545	665.2	94,979	653.2	72,965	509.1	80,242	574.4	227,219	1,701.1	163,051	1,267.3	219,543	1,767.9	210,506	1,794.5	224,737	1,985.0	174,300	1,524.9
(2) Chilled Mutton (metric tons)											39.3	8.4	21.5	5.0	9.3	3.1	19.0	4.3	16.2	4.1	-	-
Libya	-	-	-	-	-	-	-	-	-	-	0.5	0.2	-	-	-	-	2.0	0.3	3.8	0.6	-	-
Lebanon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.1	2.4	-	-
Egypt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	0.3	0.5	0.1
Saudi Arabia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gulf States (incl. Kuwait)	-	-	-	-	29.4	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Exports:	-	-	-	-	29.4	7.6	-	-	-	-	39.8	8.6	21.5	5.0	9.3	3.1	21.0	4.6	34.1	7.3	0.5	0.1

TABLE A4.3 Hides and Skins Exports, 1960-1970

	Hides		Sheepskins		Goatskins		Other Hides and Skins		Leather (heavy and light)	
	Tons	Value (LS. 000)	Tons	Value (LS. 000)	Tons	Value (LS. 000)	Tons	Value (LS. 000)	Tons	Value (LS. 000)
1960	3,281	536.7	1,059	348.7	383	103.0	95	36.3	6	3.4
1961	3,023	457.5	1,261	419.7	421	105.1	41	57.1	7	3.6
1962	3,101	500.4	1,023	315.4	362	100.6	34	57.6	2	1.0
1963	4,512	679.7	1,045	396.9	464	144.9	38	58.4	10	6.6
1964	1,572	250.8	1,457	522.6	378	98.8	58	108.4	4	3.0
1965	3,539	529.4	1,416	487.9	458	132.0	55	99.3	7	13.4
1966	3,461	622.8	1,616	570.3	682	251.0	128	159.7	-	-
1967	2,162	451.1	1,451	633.0	567	239.8	64	122.6	-	-
1968	3,018	580.4	1,468	681.0	481	182.4	33	63.3	-	-
1969	3,250	617.7	1,721	759.3	601	270.2	66	155.5	31	18.4
1970	3,944	693.6	1,409	674.1	472	186.3	56	361.6	-	-

Source: Department of Statistics.

TABLE A4. 4 Monthly Livestock Exports, Port Sudan, January 1967 - January 1972

	1967	1968	1969	1970	1971	1972
(1) Sheep						
January	23,556	37,710	44,921	30,200	24,045	12,670
February	23,903	42,697	18,800	26,575	12,247	
March	25,243	18,550	14,930	18,260	19,204	
April	30,248	14,100	15,977	12,750	13,200	
May	19,386	22,293	7,300	7,747	11,600	
June	11,777	17,350	5,230	6,200	2,700	
July	1,368	6,332	900	1,355	800	
August	6,145	12,900	2,398	-	565	
September	20,699	15,650	9,200	697	-	
October	18,434	31,642	22,266	11,120	9,104	
November	39,658	32,974	42,673	17,482	4,560	
December	48,094	27,126	35,555	13,813	6,896	
Annual Totals:	268,511	279,324	220,150	146,199	104,921	
(2) Cattle and Calves						
January	1,591	996	410	1,323	148	-
February	1,294	1,403	795	610	-	
March	507	997	622	779	104	
April	2,110	530	1,063	870	500	
May	2,514	456	700	430	902	
June	1,370	311	279	688	120	
July	1,274	160	-	-	124	
August	-	-	-	-	-	
September	-	324	50	-	2	
October	213	1,574	1,155	105	-	
November	398	1,822	1,084	812	-	
December	2,368	1,073	877	300	-	
Annual Totals	13,639	9,646	7,035	5,917	1,900	
(3) Goats						
Annual Totals:	4,450	3,220	2,415	3,500	846	
(4) Camels						
Annual Totals:	546	862	63	111	12	

Source: MAP Records, Port Sudan.

N. B. Until March 1968 the bulk of cattle exports were going to Egypt; thereafter all livestock was sent to Saudi Arabia and the Gulf States.

TABLE A4. 5 Monthly Livestock Exports, Wadi Halfa
October 1969 - January 1972

	1969	1970	1971	1972
(1) Cattle and Calves				
January	-	1,141	1,429	-
February	-	591	2,477	
March	-	1,813	3,004	
April	-	2,235	3,391	
May	-	724	1,762	
June	-	1,373	2,239	
July	-	913	1,532	
August	-	-	988	
September	-	-	632	
October	325[a]	570	1,015	
November	1,578	1,354	1,993	
December	1,561	2,218	-	
Annual Totals:	3,464	12,932	20,462	
(2) Sheep				
January	-	15,300	12,035	7,773[b]
February	-	2,700	-	
March	-	1,065	2,116	
April	-	-	-	
May	-	-	3,438	
June	-	-	1,454	
July	-	-	-	
August	-	-	-	
September	-	-	-	
October	-	-	-	
November	-	5,384	-	
December	-	2,441	-	
Annual Totals:	-	26,890	19,043	

(a) This was the first consignment after the creation of Lake Nuba.

(b) As at 21st January 1972.

Sources: MAP Quarantine Head Section, Khartoum and MAP Records, Wadi Halfa.

TABLE A4. 6 Quarantine Losses, July 1970 - June 1971

	Percentage of Animals Arriving at Quarantine								
	Adult Cattle			Calves			Sheep		
	Exported	Died	Withdrawn	Exported	Died	Withdrawn	Exported	Died	Withdrawn
Port Sudan	96. 7	0. 8	2. 5	54. 5	1. 8	43. 6	98. 9	0. 1	1. 0
Wadi Halfa	98. 5	1. 0	0. 5	99. 2	0. 5	0. 2	99. 0	0. 2	0. 8

Source: MAP Quarantine Head Section 1970/71 Report.

Records of meat exports are particularly confusing, the Foreign Trade Statistics and MAP figures rarely coming near to correspondence. This can be seen from comparing the figures in Tables A4. 1 and A4. 2 with those in Table A4. 7, which are taken from two sources: the MAP Animal Health Section and the Omdurman Slaughterhouse. These anomalies should be investigated as soon as possible, as well as those relating to live exports. The co-ordination of records should, in future, be a function of the Marketing Agency.

2. MARKETS FOR MEAT IN THE MIDDLE EAST

2. 1 Introduction

As part of this study, a member of the Consultants' team visited all the principal meat importing countries in the Middle East to investigate the market potential for Sudan. The characteristics of each market are discussed below under the following headings:

(a) current livestock and meat imports;
(b) estimated current meat consumption;
(c) quality preferences;
(d) prices;
(e) import duties;
(f) health requirements and
(g) religious factors.

TABLE A4.7 Estimates of Chilled Meat Exports, 1967-1971

		1967	1968	1969		1970		1971	
		Tons	Tons	Tons	Nos. of Animals	Tons	Nos. of Animals	Tons	Nos. of Animals
(1)	Beef								
	Libya	112.0	16.0	79.3	333[a]	107.6	686	291.5[b]	1,823
	Lebanon	-	5.0	44.6	-	0.2	100	-	-
	Kuwait	-	-	-	-	-	-	3.8[b]	22
	Egypt	-	-	305.0	2,606[a]	490.0	4,193	33.0[b]	-
	Saudi Arabia	-	-	5.6	-	9.3	-	14.0[b]	-
(2)	Mutton								
	Libya	31.2	24.0	4.0	200[a]	18.0	851	0.3[b]	7
	Lebanon	-	-	-	-	tr.	-	-	-
	Kuwait	-	-	-	-	-	-	12.2[b]	995
	Egypt	-	-	-	-	tr.	-	-	-

Note: Weight estimates from MAP Animal Health Section, animal numbers from Omdurman slaughterhouse.

(a) November and December 1969 only.

(b) Foreign Trade Statistics (January-August 1971 only) give the following estimates (in tons): Beef: Libya 307.9, Kuwait 0.9, Egypt 0.3, Saudi Arabia 4.5; Mutton: Libya 54.0, Lebanon 0.5, Kuwait 10.5, Saudi Arabia 3.1.

Finally, projections have been made of future demand and Sudan's prospects in each market are assessed. Contacts who were particularly helpful during the market survey are also mentioned.

2. 2 Saudi Arabia

(a) Imports

The most recent complete edition available of Saudi Arabia's Foreign Trade Statistics relates to 1968. Digests have been published for 1969 and 1970 but these do not contain breakdowns by country for each item imported. Unfortunately, little confidence can be placed in the 1968 figures, which quote imports from the Sudan which are higher than those in the Sudanese export records by 120 per cent in the case of cattle and 75 per cent in the case of sheep. It was assumed that the figures for all livestock imports in 1968 were distorted to a similar degree and the consequent adjustment produced figures which were of the same order as those for 1969 and 1970. The 1968 records indicated the following market shares (per cent):(a)

	Sheep	Cattle	Goats
Somalia	63	69	16
Sudan	29	24	37
Ethiopia	3	6	42
Australia	2	-	-
Other	3	-	5

More recent figures, collected from the records of the Department of Agriculture's veterinary inspector in Jeddah, indicate that the ratio of Sudanese to Somali imports dropped in 1970 to 13 : 87 for both sheep and cattle; the ratio for the first eight months of 1971 was the same in the case of sheep and fell to 11 : 89 in the case of cattle. Detailed figures are given in Table A4. 8, from which it can be seen that the Somali supplies, besides being much higher than the Sudanese, also maintain a much more even flow

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(a) In terms of numbers. The Somali sheep are in fact substantially smaller than the Sudanese (averaging about 15 kg carcaseweight against 22 kg) and fetch only a little over half their price per head. In value terms, therefore, the recent ratio has probably been about 20 : 80. But it will have fallen further in the second half of 1971.

TABLE A4. 8 Saudi Arabia - Monthly Livestock Imports from Somalia and Sudan, 1970-1971

		Cattle		Sheep	
		Somalia	Sudan	Somalia	Sudan
January	1970	1, 502[a]	410[a]	45, 434[a]	15, 460[a]
February		1, 314	1, 420	101, 786	30, 029
March		1, 456	1, 159	57, 772	21, 360
April		1, 565	462	21, 010	7, 556
May		830	798	22, 742	9, 050
June		3, 910	-	42, 971	3, 200
July		4, 608	150	87, 747	2, 555
August		4, 043	-	77, 541	-
September		2, 248	-	78, 540	697
October		1, 990	170	96, 334	9, 420
November		4, 356	105	94, 609	15, 312
December		4, 327	315	113, 154	13, 386
January	1971	4, 145	500	86, 578	16, 665
February		1, 352	50	88, 677	15, 930
March		1, 835	4	98, 172	21, 906
April		1, 279	63	47, 743	12, 650
May		1, 726	760	63, 968	12, 699
June		3, 442	312	41, 720	3, 600
July		3, 290	-	49, 465	-
August		3, 361	906	68, 859	565
September		4, 664[b]		51, 340[b]	
October		2, 249		59, 796	
November		6, 465		122, 102	
December		3, 366		110, 109	

(a) Figures for January 1970 - August 1971 from Ministry of Agriculture, Riyadh.

(b) Figures for September - December 1971 from Jeddah Ministry of Commerce.

Note: Original data referred to Islamic months and conversion is only approximate.

throughout the year.

After the downward adjustment of the 1968 import figures, all import estimates were raised by 36 per cent on the basis of official urban slaughterhouse records[(a)]. It is very probable that import records would tend to be underestimated in view of the apparently substantial illegal movement of livestock into Saudi Arabia (there is some evidence of smuggling between north of Port Sudan and Yenbo). The revised import estimates are given in Table A4. 9 below. While it is realised that this treatment of official figures is unorthodox, it appeared the only way of obtaining some kind of internal consistency.

TABLE A4. 9 Saudi Arabia - Revised Livestock Import Estimates (000 head)

	1968	1969	1970
Cattle	41. 6	51. 7	62. 6
Sheep	1, 275. 8	1, 491. 7	1, 382. 8
Goats	31. 6	32. 7	32. 7
Camels	5. 4	13. 6	32. 7
Poultry	732. 2	644. 2	1, 562. 4

Imports of chilled and frozen meat are low (424 tons in 1968, plus 5, 122 tons of frozen chicken), partly because of the preference in Saudi Arabia for freshly slaughtered meat and partly because of the high duty applying until recently to imported meat. Canned meat imports are also small.

(a) Slaughter records for February - July 1969 gave a figure for imported animals of 10, 787 tons. After converting this to an annual total and allowing for 35 per cent of slaughtering being outside official premises, it appeared that imports were underestimated by 36 per cent.

(b) Consumption

The estimated livestock population of Saudi Arabia is: Sheep 2. 73 m, Goats 1. 39 m, Camels 1. 04 m and Cattle 0. 27 m[(a)]. According to senior representatives of the Ministry of Agriculture, 47 per cent of the country's mutton consumption is believed to be supplied from local sources and about 2 million locally produced sheep equivalents are slaughtered each year.

On the basis of these assumptions and the revised import estimates, the consumption figures in Table A4. 10 were reached.

Estimation of Saudi Arabia's per capita consumption is more than usually difficult owing to uncertainty about the size of the total population (estimates range between 4. 0 and 7. 7 million). It is assumed here to have been 4. 5 million in 1970.

TABLE A4. 10 Estimated Meat Consumption, Saudi Arabia, 1970

	Total (tons)	Kg/head
Beef	9, 900	2. 2
Mutton	44, 530	9. 9
Camel	21, 400	4. 8
Poultry	8, 590	1. 9
Total:	84, 420	18. 8

There appears to be no very strong seasonal variation in consumption patterns, but demand is reported to be higher during the winter and 2-3 times higher than average during the month of Ramadan.

(a) FAO, Rome/Cairo (1971), Regional Study on animal husbandry, etc. in the Near East (draft).

(c) Quality Preferences

As Table A4. 10 shows, the Saudis are predominantly mutton eaters. Freshly slaughtered meat is generally preferred to chilled or frozen. Especially large numbers of sheep and goats are sacrificed during the major Muslim festivals, most notably at the Eid el Bairam, when many pilgrims from abroad visit Mecca. Preference is for the "traditional" desert sheep (castrated males) and the Sudanese animals rate very highly. However, their large size makes them more suitable for special feasts than ordinary family occasions, for which the smaller Somali animals are more convenient. Butchers are also said to favour Somali animals because they have a smaller percentage of bone and are easier to cut[(a)].

Towns near the western coast and the capital, Riyadh, obtain most of their imported supplies live through Jeddah. In Eastern Province, however, most imports come through Dammam and contain a larger proportion of frozen meat, much of it from Australia. Some live sheep have also been sent from Australia (by the Homeidi-Klausen firm operating in Kuwait). Their meat has not been well received so far but the low prices at which the animals are being offered could lead to a change in attitudes.

Demand for beef is said to be increasing fairly rapidly in urban higher income groups and the population of expatriates (predominantly beef-eating) is expected to double or treble in the next five years (up to 15-20, 000 Europeans may be working in Eastern Province alone). Imported cattle are generally of poor quality but some "good average" quality beef air-freighted from Ethiopia is consumed by Europeans. Small amounts of "frozen" beef fillet (1-2 tons/month) have recently been sent by air from Sudan to Jeddah. Since the removal of the heavy duty on imported meat (see below), there could be an increased market for

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(a) There is also a substantial consumption of goat-meat in Saudi Arabia. There is reported to be little consumer differentiation between sheep and goat-meat of Somali origin. However, Sudanese goat-meat is said not to be popular and fetches a price 20 per cent below that of sheep.

chilled beef, especially in Eastern Province and possibly Riyadh, where fresh supplies are scarcer than in Jeddah.

(d) Prices

The retail price of mutton is fixed by Jeddah municipality at 50 pt/kg[(a)] and importers quote a maximum c. and f. price equivalent to 19 pt/kg liveweight. One reason why imports of Sudanese sheep have been declining is that Sudanese exporters have been asking too high prices (e. g. up to LS. 11. 25 for an animal of 45 kg liveweight, or 25 pt/kg). Australian exporters are recently reported to have offered trial consignments to Jeddah for as little as $7\frac{1}{2}$ pt/kg c. i. f. liveweight, or about 17 pt/kg carcaseweight. The cost of freighting sheep to Riyadh is about 4 Saudi Riyals per animal (or 2 pt per kg carcaseweight).

Urban retail prices for beef appear to be about 20-30 per cent lower than those for mutton. Importers in Jeddah quote $8\frac{1}{2}$ pt/kg c. and f. liveweight (about 16 pt/kg carcaseweight) for cattle and calves from Somalia, but exporters from Sudan report having received offers between 20 pt and 25 pt/kg carcaseweight, depending on quality. The beef fillets from Sudan were coming in at about 67 pt/kg before the removal of the $27\frac{1}{2}$ per cent duty but they were not properly deep-frozen or packed and were overpriced compared with better quality frozen beef from other sources.

Livestock import prices are reported to rise by about 10 per cent during the summer months as a result of a decline in supply.

(e) Duties

No import duty is charged on live animals. Until January 1972 imported meat was liable to a duty of $27\frac{1}{2}$ per cent, but this has now been entirely removed.

A subsidy for the import of live animals was removed in 1970.

(a) Fixed retail prices in Riyadh and Dammam are about 58 pt/kg and 67 pt/kg respectively.

(f) Health Requirements

Saudi Arabia has no special sanitary requirements, but Sudan applies the same measures as for Egypt and Libya.

(g) Religious Factors

The preference for locally slaughtered meat is strong in traditional circles, but as far as imported meat was concerned it did not generally seem considered that religion would greatly favour Sudan at the expense of non-Islamic exporters.

(h) Demand Projections and Conclusions

In projecting Saudi Arabia's future demand for meat, it was assumed that population would increase by 2. 8 per cent per annum and income per head by 2. 6 per cent per annum[(a)]; and that the income elasticity of demand for all meats was 0. 6 (comparable to other Middle East countries with similar conditions). It was also assumed that, with retail prices for different meats remaining in the same relation to each other as at present, expenditure on beef in 1982/3 would rise to 20 per cent of expenditure on all meats (compared with 11 per cent now), mutton fall to 50 per cent (against 59 per cent now), camel fall to 10 per cent from 22 per cent and poultry rise to 20 per cent from 8 per cent. The resulting values were then translated into quantity terms. Local livestock production (and offtake) was assumed to increase by 4. 6 per cent per annum, on the basis of information supplied by the Ministry of Agriculture (new livestock development schemes are planned south of Riyadh and near Hofuf). The estimate of locally-produced meat was deducted from total projected consumption to give total imports. Finally, the proportion of meat consumed in frozen or preserved form was assumed to have increased by 1982/3 to 20 per cent in the case of beef and 10 per cent in the case of mutton. When this was deducted, an estimate was obtained

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(a) Annual GNP growth rate is predicted at 5. 5 per cent in Moe, L. E. (1966), Supply and Demand Projections for Farm Products to 1975, USDA., ERS-Foreign 168.

of mutton and beef import requirements in live or chilled form. These results are shown in Table A4. 11.

TABLE A4. 11 Saudi Arabia - Projected Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	29. 7	4. 8	0. 7	29. 0	23. 0
Mutton	62. 8	10. 1	31. 7	31. 1	24. 9
Camel	16. 3	2. 6			
Poultry	36. 3	5. 8			
Total:	145. 1	23. 3			

Saudi Arabia is likely to remain the largest and easiest market (in terms of quality and accessibility) for exporters of Sudanese sheep in the foreseeable future. There are also attractive prospects for medium-quality beef, where competition will probably be less severe. Sudanese exports have been declining lately because of rising prices and costs in Sudan and inability to guarantee supplies on a regular basis. The 15 per cent export bonus and the proposals made for improving marketing in this Report should help to overcome these problems. Saudi importers have complained at times of not getting the type or size of animal agreed by contract, but this source of friction should also be removed if sales are made on a liveweight, graded basis. Importers are agreed that the quality of Sudanese mutton is superior to the Somali and they are generally well disposed to Sudanese products, but they are mostly acute businessmen and expect value for money and efficient marketing.

Among the most prominent of those who provided information for this survey were: Messrs. Abbar and Zainy, Jeddah; Awadh Etaiwi

and Sons, Jeddah; Sharbatly Food Corporation, Jeddah; Sheikh Mohammed Bad Kok of Kilo 10 Restaurant, Jeddah; Khalifa Algoseibi Cold Stores, Dammam and Jeddah; Spinney's Food Supplies, Riyadh; and the Ministry of Agriculture, Riyadh.

2.3 Kuwait

(a) Imports

The official Kuwait import figures for 1966-1970 are summarised in Table A4.12. It will be seen that Sudan has so far been insignificant as an exporter of livestock or meat to Kuwait. Over the five year period there was a marked shift towards importing chilled and frozen meat rather than livestock. The type of meat imported is unspecified in the statistics, but traders' estimates are that it is made up of 85 per cent mutton (equal parts chilled and frozen) and 15 per cent beef (all frozen). The principal suppliers of chilled mutton are East European countries and Turkey. As Table A4.12 shows, this trade has expanded very rapidly indeed in the last four years.

Examination of the slaughter records of Kuwait[(a)] indicate that the live import figures are, as often, underestimated, possibly on account of smuggling. After account was taken of local livestock production (very small), discrepancies were often still very large and it was decided that live imports should be adjusted upwards to be consistent with the slaughter figures. Thus in 1970, for example, the number of cattle and sheep actually imported was assumed to be as high as 9,960 and 490,000 respectively.

(b) Consumption

The livestock population of Kuwait is very small indeed and nearly all supplies are imported. There are estimated to be 100,000 sheep, 15,000 cattle, 50,000 goats and 7,000 camels. On the basis of these

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(a) Statistical Abstract (1971), Central Statistical Office, Kuwait.

TABLE A4. 12 Kuwait, Livestock and Meat Imports, 1966-1970

Country of Origin	1966	1967	1968	1969	1970
Cattle (Nos.)					
Iran	9,325	13,415	-	-	-
Syria	-	620	3,217	1,406	-
Somalia	307	-	409	1,093	1,893
Ethiopia	-	-	1,083	2,141	-
East Africa	375	195	563	510	2,345
Sudan	-	-	1,428	1,348	773
Others	251	482	1,440	925	176
Total:	10,258	14,712	8,140	7,063	5,187
Sheep and Goats (Nos.)					
Iran	329,854	93,133	2	89	786
Syria	15,768	43,035	68,229	45,698	20,229
Somalia	-	7,423	16,500	6,700	20
South America	-	8,500	64,666	37,313	18,857
Australia	137,803	152,323	158,369	129,744	223,726
Sudan	-	-	2,646	1,994	-
Others	15,921	44,790	43,426	757	10,519
Total:	499,346	349,204	353,874	222,295	274,137
Fresh, Chilled or Frozen Meat (Tons) (excluding poultry)					
China	114.7	282.3	2,625.7	1,326.3	2,445.6
Turkey	-	0.4	682.0	447.2	1,051.5
Eastern Europe	15.0	96.6	1,447.5	3,035.0	2,228.8
Australia	1,763.1	1,884.8	1,828.2	1,496.0	1,045.6
Denmark	267.3	181.0	327.6	431.2	434.7
East Africa	76.4	87.4	105.4	64.0	49.5
Sudan	-	-	-	-	0.2
Other	97.5	185.5	378.2	294.1	360.2
Total:	2,334.0	2,718.0	7,394.6	7,093.8	7,616.1
Canned Meat (Tons)					
Total:	546.1	547.8	572.6	655.1	474.7

Source: Kuwait Foreign Trade Statistics.

figures and the revised import estimates (and a human population of about 733, 200 in 1970), the consumption figures in Table A4. 13 were obtained.

TABLE A4. 13 Estimated Meat Consumption, Kuwait, 1970

	Total (tons)	Kg/head
Beef	2, 950	4. 0
Mutton	18, 240	24. 9
Camel	490	0. 7
Poultry	5, 510	7. 5
Total	27, 190	37. 1

Consumption per head is large but it does not seem improbable in view of the very high standard of living among nearly all classes in Kuwait (GDP per head in 1970 was equivalent to about LS. 1, 415). The emphasis on mutton is very marked.

There is a substantial fall in demand for meat in the summer months, when many Kuwaitis move out of their country to cooler areas such as Lebanon. Consumption is higher than average during Ramadan.

(c) Quality Preferences

With such a high income per head, Kuwait is a quality market for mutton, though less so for beef, which is relatively little eaten at present. The preference is for young lamb of 10-12 kg carcaseweight, with 20 kg the maximum. Chilled carcases sent from Eastern Europe and Turkey have been of this type. The Australian sheep imported by the firm of Homeidi-Clausen, which now dominates the live market, have tended to be 2-3 years old (26-27 kg carcaseweight) but realised good sales (mainly tenders to government departments) on account of their very low price. However,

it is reported that increasing competition from the suppliers of chilled meat has caused a movement towards younger lambs in the live market also.

There are considerable risks in dealing in chilled meat, especially in such a competitive market as Kuwait, since meat not sold quickly has to be frozen and fetches only about half the price. Several firms consider that the recent enthusiasm for competing in the chilled market will wane but others see few signs of this occurring. One or two consignments of Sudanese mutton were sent by air in 1970/71 but they were not successful; importers' complaints were that the carcases were "not fat enough" and that the meat was badly chilled and discoloured on arrival. However, purely in terms of meat quality, Sudanese mutton should enjoy an advantage over most major suppliers at present in that animals fed on dry grazing (and subsequently fattened) are preferred to those which are pasture-fed.

A movement in consumer preference towards beef is discernible, but good quality is required. The fact that the movement is only slow suggests that quality beef is in relatively short supply. Importers express a preference for live cattle. No chilled beef is imported at present, but if it were it would have to be of prime quality (not older than eight months). Whole carcases are not in demand.

A notable increase in demand is reported among lower and middle income groups for frozen meat and (especially) chicken. Since ownership of refrigerators is widespread in Kuwait, this demand will no doubt continue to grow rapidly, but prices for frozen meat are very low.

(d) Prices

Average import prices for chilled mutton range from 37-40 pt/kg carcaseweight. One of the reasons for the low mutton prices prevailing in Kuwait is that when the East European countries first entered the market they subsidised their costs and were offering prices as low as 31 pt/kg. Prices were then raised steadily after a share of the market had been captured; in late 1971 the import price for East Europeans'

meat was reported to be up to 41½ pt/kg and it seemed that they were being undercut by the Turks and running into various difficulties. The additional competition from the chilled mutton suppliers has also affected the price of live animals, and wholesale selling prices for Australian sheep are said to have declined from 45½ pt to 33 pt per kg carcaseweight in the last three years (the c. i. f. price in 1970 was about 24 pt/kg).

Live cattle were fetching import prices of only 22 pt/kg carcase-weight in 1970 but, as the countries of origin in Table A4. 12 show, quality was not outstanding. It is believed that properly finished animals could fetch prices up to 30 pt/kg and possibly above, but further market research is required to test this.

C. i. f. prices for frozen mutton legs range from about 26 pt/kg (Australia) to 19 pt/kg in the case of Chinese mutton, which is reported as of "decent quality". The margin between chilled and frozen meat prices is illustrated by the fact that if chilled mutton is not sold on the day of arrival, the retail price slips from 52 pt/kg to 47 pt/kg the next day and is thereafter classified as "frozen", selling at only 26 pt/kg.

(e) Duties

Live animals are imported duty free but all meat is subject to 4 per cent duty.

(f) Health Requirements

Cattle are required to be vaccinated against rinderpest, anthrax and H. S. ; they should also be tested against C. B. P. P. and vaccinated against this disease 20 days before departure from the exporting country; they should also be dipped against ectoparasites. Sanitary measures for other categories of livestock and meat are the same as in the case of Egypt and Libya (see below). The necessary health certificates are required, but some smuggling to evade these is reported from Iraq. Veterinary officials in Kuwait are not satisfied with the present health arrangements and attempts are being made to impose stricter measures on importers.

(g) Religious Factors

While there is still a substantial traditional element in Kuwait society, the recent large increases in meat imports from non-Islamic countries suggests that little importance is attached to the provenance of meat provided that evidence is given of slaughter according to Mohammedan law.

(h) Demand Projections and Conclusions

Kuwait's population increased at a rate of over 9 per cent per annum during the 1960's but it was assumed to drop to 5 per cent during the period of analysis. The annual increase in income per head was projected at 1.6 per cent, with a 0.8 income elasticity for meat. In view of the present price differentials between meats and the relatively low beef consumption, a movement was assumed away from mutton and towards beef and poultry, so that in 1982/3 expenditure on all meats would be in the proportion of 20 per cent on beef, 55 per cent on mutton and 25 per cent on chicken. Provision was made for an increase in the present very small indigenous livestock offtake and the proportion of meat consumed in frozen or canned form was assumed to rise by 1982/3 to 50 per cent in the case of beef and 35 per cent in the case of mutton. The results of these assumptions are shown in Table A4.14.

TABLE A4.14 Kuwait - Projected Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	14.1	10.3	0.2	13.9	6.8
Mutton	28.8	21.0	1.4	27.4	17.3
Poultry	21.8	15.9			
Total:	64.7	47.2			

The market for mutton in Kuwait at present appears to be almost saturated. Entry into the live market is particularly difficult. However, if competition in the chilled market eases, there might be an opening for Sudanese mutton in view of local preference for the desert type animal. Even so, it is only likely to become an attractive market if some kind of subsidy in air-freight rates were provided, which is a distinct possibility in view of the need for the new Sudan Airways planes to visit Kuwait at least once a week. The best market to aim for in the near future could well be that for live cattle of good average quality; Kuwaiti importers believed that movement by truck from Jeddah was the quickest and cheapest route, but this would have to be investigated carefully by the Marketing Agency before major commitments could be made.

Many Kuwaiti importers are anxious in principle to import Sudanese meat products and some have made fairly intensive studies of livestock production and marketing in the Sudan. Provided certain essential infrastructural improvements were carried out (e. g. with regard to railway transport) some businessmen in Kuwait would probably consider investing in large-scale livestock production in Sudan.

Among those who gave assistance to this survey in Kuwait were: Messrs. A. & M. Abughazaleh; Mr. Al-Barakat; Mr. Al-Wazzan; Mr. Yousuf Al-Saqer; Dr. Khalil Osman of Gulf Fisheries; and Dr. Abdal Rahman Salman, Director of Animal Husbandry.

2.4 The Trucial States, Bahrain and Qatar

(a) Imports

Visits were made to Bahrain and Dubai. Statistics of livestock imports in both states were unreliable (in Bahrain 80 per cent of live imports are reckoned to go unrecorded) but figures for meat imports were accepted. Total live imports were estimated on the basis of experienced opinion in Bahrain and on slaughterhouse figures in Dubai. The figures are summarised briefly in Table A4. 15. Bahrain imports most of its cattle from South Iran; until recently the same was true in

the case of sheep, but now about 30,000 per year or almost half the estimated imports come from Australia (through the firm of Homeidi-Klausen in Kuwait). Dubai obtains the bulk of its livestock from South Iran (most of the importing is carried out by merchants with relatives on the Iran coast); half its total imports (or about 70,000 sheep and 5,000 cattle per year) are re-exported to other states such as Abu Dhabi, Qatar or Bahrain.

TABLE A4.15 Bahrain and Dubai - Estimated Livestock and Meat Imports, 1970

	Bahrain	Dubai
Cattle (Nos.)	8,000	10,000[a]
Sheep (Nos.)	60,000	140,000[a]
Chilled or Frozen Beef (Tons)	60	375[b]
Chilled or Frozen Mutton (Tons)	245	1,215[b]
Canned Meat (Tons)	222	472

(a) Of which half assumed to be consumed in Northern Trucial States and half re-exported.

(b) Assuming that all imported meat is made up of: Beef 20 per cent, Mutton 65 per cent, Poultry 15 per cent (importer's estimate).

Sources: Official statistics for meat imports.

(b) Consumption

Livestock production in the Gulf States is negligible (Bahrain is credited with 10,000 sheep and 5,000 cattle)[a]. Estimated human populations in 1970 were: Bahrain 210,000; Qatar 112,000; Abu Dhabi 60,000; and Northern Trucial States 150,000 (of which Dubai had 60,000). On the uncertain information available, meat consumption in Bahrain and the North Trucial States was estimated to be on the lines indicated in Table A4.16.

(a) FAO, Rome/Cairo (1971), Regional Study on Animal Husbandry, etc., in the Near East (draft).

TABLE A4. 16 Estimated Meat Consumption, Bahrain and North Trucial States, 1970

	Bahrain		North Trucial States	
	Total (tons)	Kg/head	Total (tons)	Kg/head
Beef	1,220	5.8	1,450	9.7
Mutton	2,210	10.5	2,860	19.1
Camel	310	1.5	220	1.5
Poultry	1,015	4.9	340	2.2
Total:	4,755	22.7	4,870	32.5

In subsequent calculations it has been assumed that the per capita consumption pattern in Dubai and the North Trucial States is also representative of Abu Dhabi and Qatar.

Monthly slaughter figures from Dubai indicate a marked increase in Ramadan and, as in Kuwait, demand is reported to decline substantially in summer. Otherwise, the principal causes for fluctuations in consumption levels appear to be on the supply side; small ships are used to transport livestock from south Iran and their movement is greatly handicapped by rough seas between December and February.

(c) Quality Preferences

Average income per head in Bahrain is lower than in the surrounding states and there is a greater emphasis on beef than in Kuwait as well as on imports of cheap frozen and canned meats (partly a consequence of the substantial Indian and Pakistani element in the population). A similar pattern prevails in the Trucial States and Qatar which, despite their high standards of living, are too small and isolated to attract regular supplies of high quality meat. Australia air-freights 4-5 tons of chilled meat every month to Bahrain, mainly for European consumption, and just over 1 ton per month to Dubai. Abu Dhabi, through lack of alternative air connections,

air-freights meat at high cost from the U. K. All meat imports to Qatar are frozen.

Sudanese sheep are highly thought of in the Gulf States and the quality of their meat is much preferred to that of the Australian animals.

(d) Prices

Because of their relative inaccessibility, prices in the Gulf States tend to be high. Officials in Bahrain quoted up to 60 pt/kg carcaseweight c. and f. for Iranian or Somali sheep and 41 pt/kg for Australian sheep. Frozen mutton legs from Australia sell at almost half this price.

For the special consignment of Sudanese sheep to Abu Dhabi in Ramadan 1971, a price was agreed equivalent to 58 pt/kg carcaseweight f. o. b. Port Sudan or 68 pt/kg c. and f. Abu Dhabi. A similar price is reported to have been offered for a second consignment, together with an offer of 46 pt/kg carcaseweight c. and f. for calves under three years.

Import prices in Dubai are lower owing to its greater accessibility to Iran; Iranian sheep and goats have been priced at 33 pt/kg, but the quality was poor and Sudanese animals could be expected to obtain a substantial premium.

(e) Duties

Bahrain charges 3 per cent customs duty on live animals, 5 per cent on meat. Dubai has no charge for live animals but 4. 625 per cent on meat.

(f) Health Requirements

Measures are not very stringent, especially in Dubai, but efforts are being made there to apply quarantine regulations in order to control the import and re-export of livestock.

(g) Religious Factors

As far as could be seen, attitudes were similar to those in Kuwait.

(h) Demand Projections and Conclusions

Bahrain's population was assumed to increase at a rate of 2. 8 per cent per annum, that of the Trucial States and Qatar at 4 per cent per annum. Per capita expenditure on meat was projected to increase at the same rate as Kuwait in all states except Bahrain, where the rate chosen (1 per cent per annum) was somewhat lower. A movement was assumed from mutton to beef and chicken, so that proportions of all meat consumed in 1982/3 were (in the case of Bahrain) beef 30 per cent, mutton 45 per cent, chicken 25 per cent, and (in the other states) beef 35 per cent, mutton 50 per cent, chicken 15 per cent. The proportions of beef assumed to be in frozen or canned form were 30 per cent for Bahrain and 47 per cent for the other states; respective proportions for mutton were 45 per cent and 52 per cent. The resulting patterns are shown in Table A4. 17.

TABLE A4. 17 Gulf States - Project Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons)	Consumption/ Head (Kg)	Local Production (Tons)	Imports (Tons)	Imports (live and chilled only) (Tons)
Bahrain					
Beef	2, 390	8. 2	90	2, 300	1, 580
Mutton	2, 860	9. 8	60	2, 800	1, 510
Poultry	2, 396	8. 2			
Total:	7, 640	26. 2			
Trucial States & Qatar					
Beef	7, 860	14. 9	-	7, 860	4, 170
Mutton	8, 980	17. 0	-	8, 960	4, 300
Poultry	4, 040	7. 7			
Total:	20, 880	39. 6			

The Gulf States markets are potentially very lucrative and there is little price or quality competition, though there might be some difficulty in breaking the Iranian monopoly in Dubai. The main problem from Sudan's (and other exporters') point of view is the States' relative inaccessibility and small size. If flights were available, air-freighting would be the cheapest means of supplying Bahrain, Abu Dhabi and Dubai, but in the case of the latter two this seems unlikely to occur. The possibility of providing return loads for fertiliser ships from Kuwait therefore deserves serious attention (see Appendix V, Section 3).

Among those who assisted this survey were: The Meat Control Committee, Manama Municipality, Bahrain; Sayed Kamal Hamza, Director, Dubai Municipality and Dr. Hassan Othman, Dubai Municipality.

2.5 Egypt

(a) Imports

Egyptian import statistics appear to be, at best, incomplete, certainly with regard to live animals. However, since Sudan is the main supplier of livestock to Egypt (alternative sources have become difficult since the closure of Suez to shipping)[(a)], this deficiency can to some extent be made up by using Sudanese data. Thus total imports of cattle at present could be assumed to be about 35,000 (with Sudan's share 20-25,000); of sheep about 30,000 (nearly all from Sudan); and of camels perhaps 85,000 (again, nearly all from Sudan). Egyptian trade statistics for 1969/70 specified about 2,500 tons of imported frozen meat, divided mainly between Argentine (beef) and China (mutton); and 3,600 tons of canned meat, almost two-thirds of it from China. On the assumption that imported frozen meat is half beef and half mutton and imported canned meat half beef and one-third mutton, total imports (in terms of meat equivalent) would be in the region of 10,000 tons of beef, 3,000 tons of mutton and 21,000 tons of camel-meat.

(a) Some Somali supplies come through the Red Sea port of Safaja but the route is not an easy or convenient one.

(b) Consumption

Official 1968 figures for Egypt's livestock population were: Cattle 2. 06 million, Buffaloes 1. 94 million, Sheep 1. 94 million and Goats 1. 13 million[a]. 1970 figures for indigenous animals officially slaughtered were: Cattle 343, 100, Buffaloes 312, 100 and Sheep and Goats combined 424, 600. It was considered that these figures should be multiplied by factors of at least 1. 75 for cattle and buffaloes and 2. 75 for sheep to obtain a reasonable estimate of total indigenous slaughter. This implied off-takes of 29 per cent for cattle, 28 per cent for buffaloes and 38 per cent for sheep and goats, which suggests that Egypt's livestock population is considerably underestimated.

Having increased the slaughter figures by the stated factors and added estimated imports, the consumption picture shown in Table A4. 18 was reached (the total human population of Egypt in 1970 was taken to be 33. 3 million).

TABLE A4. 18 Estimated Meat Consumption, Egypt, 1970

	Total (tons)	Kg/head
Beef	176, 500	5. 3
Mutton	24, 980	0. 75
Camel	23, 980	0. 7
Poultry	96, 570	2. 9
Total:	322, 030	9. 65

Egypt is clearly in a very different category from the other countries in this survey with its much larger population, lower income and lower meat consumption per head. Estimates may possibly be low, since a budget survey in 1958/59 found an average per capita consumption of

(a) U. A. R. Statistical Handbook (1970).

13 kg of meat in urban areas and 10 kg in rural areas[a], but it is not improbable that the figure should have fallen since then. The Egyptian pattern is also different because of the emphasis on beef and camel, both cheaper meats, rather than mutton.

(c) Quality Preferences

Egypt is essentially a quantity rather than a quality market and has always been recognised as such by Sudanese exporters. Since Egypt does not operate a market economy, individual preferences have little impact on the total pattern of demand, which is determined to a large extent by the government. However, the Egyptian negotiators for the annual agreement on trade with the Sudan are anxious to improve quality as much as possible and are prepared to give a premium for younger beef. A Sudanese exporter noted that the Egyptians were now pressing for 30 per cent of total cattle exports to be 2-3 year old calves, 20 per cent under 5 years and 50 per cent adults, whereas previously there were no quality requirements.

The Egyptian authorities are willing and equipped to receive imports from the Sudan in the form of chilled meat and recently a Sudanese businessman concluded a contract to supply Egypt with 3,000 tons. The attempt to send chilled meat by air in 1969/70 failed not so much because of Sudan's inability to supply meat of the agreed quality as because of disagreement over what the appropriate price should be.

(d) Prices

Import prices, c. and f. Cairo, agreed for 1970/71 were $12\frac{1}{2}$ pt per kg liveweight for cattle, $13\frac{1}{2}$ pt for calves and 21-22 pt for sheep. Exporters, however, would not accept this price in the following year and at the time of writing no agreement had been reached. So long as the present high costs and risks of transporting livestock via Wadi Halfa and Shellal persist, their requests for higher prices appear justified.

(a) See Amin, G. (1966), Food Supply and Economic Development, Cairo University.

Under present conditions, air-freighting should be distinctly cheaper (see Section 3 below).

In 1971 beef retail prices in Cairo, fixed by government and not indicative of market forces, were as follows (pt per kg):

	With Bone	Boneless
Imported (4-5 years)	0.31½	0.45
Local, 2 years (including buffalo)	0.40½	0.58½
Local beefling (1 year)	0.47	0.65

(e) Duties

None were noted.

(f) Health Requirements

Requirements for live animals are not particularly stringent; cattle are merely required to have been in quarantine for 21 days and sheep must be accompanied by evidence of vaccination against anthrax. Nevertheless, it was reported from Wadi Halfa that the Egyptian veterinary representatives at Aswan had been known to re-quarantine Sudanese animals for a further 21 days after entering Egypt. In the case of animals exported as beef, vaccinations are required ten days before slaughter against rinderpest, anthrax and H.S. Ante- and post-mortems are also specified.

(g) Religious Factors

These do not appear to be significant in the context of meat imports.

(h) Demand Projections and Conclusions

If Egypt's meat consumption were determined by supply and demand, it would almost certainly increase rapidly, as would imports, since substantial expansion in local supply is restricted by shortage of land, competition from cash crops and scarcity of animal feed. However, it is assumed that demand will be controlled at a level of a 1 per cent annual increase in the quantity of all meat consumed per head. Total population is assumed to increase at 2.5 per cent per year and local

slaughter numbers by 2. 4 per cent per year for beef and 3. 9 per cent per year for mutton. The resulting pattern is summarised in Table A4. 19.

TABLE A4. 19 Egypt - Projected Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	266. 9	5. 97	221. 3	45. 6	22. 8
Mutton	37. 8	0. 85	34. 7	3. 1	0. 4
Camel	24. 0	0. 54			
Poultry	157. 8	3. 53			
Total:	486. 5	10. 89			

Egypt will always be useful to Sudan as a mass market for "traditional" quality beef animals, but in economic terms it has the great disadvantage of bringing no foreign exchange returns to the Sudan. Nevertheless, it is in both countries' interests to reduce the present high costs of exporting livestock.

Among those who assisted in this survey were: Dr. Tawfiq Ragab of the General Organisation for Meat; Dr. M. Hadi Maghrabi, Deputy Chairman, U. A. R. General Authority for Supply Commodities; and senior members of the Animal Production Department, Ain Shams University, Cairo.

2. 6 Libya

(a) Imports

Libya's livestock and meat imports between 1966 and 1969 (the last complete year available in official statistics) are shown in Table A4. 20. These demonstrate that imports, especially of live sheep, beef and

TABLE A4. 20 Libya, Livestock and Meat Imports, 1966-1969

Country of Origin	1966	1967	1968	1969
Cattle (Nos.)				
Lebanon	915	1,200	661	100
Tunisia	434	32	-	-
Turkey	336	1,845	50	-
Eastern Europe	814	10,596	16,693	1,748
Others	667	2,308	1,187	1,401
Total:	3,166	15,981	18,591	3,249
Sheep (Nos.)				
Lebanon	49,127	18,125	23,880	13,455
Syria	22,159	11,537	4,689	8,336
Tunisia	4,042	42,996	56,560	30,338
Eastern Europe	107,385	240,206	308,269	406,048
Others	10,910	33,256	49,391	46,871
Total:	193,623	346,120	442,789	505,048
Beef, Chilled or Frozen (Tons)				
Tunisia	323.6	482.3	251.5	505.5
Chad	176.9	37.7	-	-
Sudan	87.9	48.5	5.9	39.6
East Africa	45.0	11.1	12.1	331.3
Eastern Europe	70.1	348.4	298.3	981.3
Others	184.9	268.7	248.9	478.3
Total:	888.4	1,196.7	816.7	2,336.0
Mutton, Chilled or Frozen (Tons)				
Tunisia	489.5	621.3	616.6	558.6
Turkey	-	-	123.2	138.2
China	-	1.5	213.2	-
Australia	10.5	-	10.2	65.2
East Africa	-	-	44.6	53.8
Eastern Europe	60.3	128.5	506.5	846.3
Sudan	15.8	13.5	11.6	9.5
Others	104.8	116.6	55.8	91.5
Total:	680.9	881.4	1,581.7	1,763.1
Canned Meat - Total (Tons)	333.6	392.9	N.A.	709.3

Source: Libya Foreign Trade Statistics.

mutton have been rising very rapidly indeed - a consequence of the rapid rise in income per head in Libya in recent years and the very limited scope for increasing Libyan livestock production. It will be noted that East European countries have, in a very short space of time, taken a dominant position in all four categories of product shown. Sudanese exports of meat, never very significant, declined during this period of overall expansion.

(b) Consumption

Libya's internal statistics were the best encountered during the market survey. Household budget surveys carried out in Tripoli and Benghazi in 1969 indicated an urban income elasticity of demand for meat of about 0. 8, which served as a basis for estimates in other Middle Eastern countries. Average urban expenditure on meat per head was LL. 26. 1 which at prevailing retail prices indicated an urban meat consumption of 33. 8 kg per head per year.

Official slaughter estimates, after some upward adjustment for outside slaughter, fitted fairly well with imports and probable offtake from local livestock (in 1968 population estimates were: sheep 1. 7 million, goats 1. 4 million, cattle 122, 000 and camels 235, 000)[(a)]. With the human population in 1968 estimated at 1. 8 million, it was possible to calculate a national average meat consumption of 21. 8 kg per year. This, in combination with the urban result obtained separately, indicated an average consumption outside the main cities of 17. 7 kg per head. The national pattern of consumption is summarised in Table A4. 21.

TABLE A4. 21 Estimated Meat Consumption, Libya, 1968

	Total (Tons)	Kg/head
Beef	7, 110	3. 9
Mutton	19, 910	11. 0
Camel	11, 215	6. 2
Poultry	1, 200	0. 6
Total:	39, 435	21. 8

(a) Statistical Abstract (1968), Ministry of Planning, Libyan Arab Republic.

Beef consumption is confined mainly to the cities while the high consumption of camel-meat is principally in the desert areas. But the main emphasis, as everywhere else in the Middle East except Egypt, is on mutton.

(c) Quality Preferences

The quality of the desert sheep is preferred but the demand is for young tender animals (10-15 kg carcases), which the East European countries are supplying. Taste in beef is also sophisticated compared with other countries in the region, possibly as a result of Mediterranean influence. Young lean beef and even real veal are in demand among most urban income-groups. Sudanese beef has a poor reputation among private Libyan traders. Imports of live Sudanese cattle (while the Suez canal route was open) were prohibited in 1965 on the grounds that they had led to an outbreak of foot and mouth disease. The discontinuation of the 1970/71 contract for chilled beef between the Libyan Agricultural Bank and the Sudanese Government, apparently owing to a decline in quality, has been a further setback. Nevertheless, if a regular supply of good quality lamb and beef can be provided at a reasonable price and old policies and attitudes can be seen to have been changed, Libyan importers can be expected to be very responsive.

(d) Prices

The market for mutton is probably more competitive than that for beef. The Sudanese Government was offered c. and f. prices of $48\frac{1}{2}$ pt/kg carcaseweight for mutton and 39 pt/kg for beef. East European lamb is imported at a similar price and some undercutting could no doubt occur if Sudanese mutton imports increased substantially. However, the market is not so competitive as Kuwait. The problem of having to freeze chilled meat because of failure to sell it in time seems to arise only infrequently; in any case, the loss is not so great since frozen prices average only 20-25 per cent less than chilled. The Sudanese beef was being imported at a price distinctly lower than that paid for the best "veal" carcases

(45 pt/kg carcaseweight) and marginally less than that for the average older beef carcase (40½ pt/kg).

(e) Duties

Live animals are not charged duty. Meat imported in pieces weighing less than 10 kg is subject to 30 per cent duty; larger pieces (i. e. carcases) are free of duty.

(f) Health Requirements

Apart from the Lebanon, Libya is probably the country most concerned about health regulations in the Middle East. Cattle whose meat is destined to Libya should be vaccinated with tissue culture vaccine 40 days before slaughter in addition to anthrax and H. S. vaccines. Sheep should be vaccinated against anthrax before slaughter. All carcases are required to be chilled for 24 hours at 20-25°F before despatch.

(g) Religious Factors

There was a campaign last year by Libyan religious teachers against importing meat from non-Muslim countries and this could help to place Sudan in an advantageous position in relation to some of her competitors.

(h) Demand Projections and Conclusions

Assumptions were made with regard to an annual 3. 5 per cent population growth rate, a 1. 4 per cent increase in income per head and an income elasticity of demand for meat of 0. 8. Taste was assumed to move, similarly to elsewhere, away from mutton and towards beef and poultry and local production was allowed, somewhat generously, to increase at 4. 6 per cent per year on the grounds that substantial livestock development might take place in Kufrah oasis. The resulting picture is indicated in Table A4. 22.

TABLE A4. 22 Libya - Projected Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	22. 4	7. 63	4. 7	17. 7	12. 1
Mutton	33. 7	11. 44	12. 0	21. 7	15. 8
Camel	5. 4	1. 83			
Poultry	24. 0	8. 14			
Total:	85. 5	29. 04			

Libya is distinctly the most attractive Middle East market for Sudan in terms of price and every effort should be made to secure a place in this market. The quality required is high, but the project proposals should ensure that these can be met. It is important that the next major attempt to enter this market be carefully prepared and that there are no faults in the chilling techniques or transport arrangements.

Among those who gave assistance to this survey were Sayed Achmed Saad Mansur; Achmed Gendy; and the Census and Statistical Department, Ministry of Planning.

2.7 Lebanon

The market in Lebanon (1970 population: c. 2. 7 million) was not studied in the same detail as others in the Middle East and is therefore described more briefly. The official import statistics for 1970 are summarised in Table A4. 23. Large numbers of live animals are imported from nearby Syria and Turkey, and consequently meat imports are low compared with other countries in the Middle East; most of the meat imported is frozen. Both live animals and meat are imported duty-free. Some livestock and meat products are re-exported to other Middle Eastern countries.

TABLE A4. 23 Lebanon - Livestock and Meat Imports, 1970

Country of Origin		Country of Origin	
Cattle (Nos.)		Chilled and Frozen Beef (Tons)	
Syria	61,716	South America	401.4
Turkey	21,015	Eastern Europe	293.0
Others	115	China	75.0
Total:	82,846	Others	339.2
		Total:	1,108.6
Sheep and Goats (Nos.)		Chilled and Frozen Mutton (Tons)	
Syria	308,476	Argentina	2,470.4
Turkey	235,429	China	362.3
Eastern Europe	51,960	Australia	131.4
Others	1,414	Others	154.2
Total:	597.279	Total:	3,118.3
		Canned Meat (Tons)	
		Total:	2,360.4

Source: Lebanon External Trade Statistics.

The local livestock population is estimated at about 106,000 Cattle, 220,000 Sheep and 450,000 Goats. On the basis of the import statistics and estimated local off-take (with an upward adjustment similar to that applied to the Kuwait statistics), 1970 consumption was reckoned to be of the order indicated in Table A4. 24. The poultry element is probably underestimated.

TABLE A4. 24 Estimated Meat Consumption, Lebanon, 1970

	Total (Tons)	Per Head (Kg)
Beef	26, 140	9. 6
Mutton	41, 660	15. 3
Poultry	1, 080	0. 4
Total:	68, 880	25. 3

Lebanese import prices are low, especially for mutton; the 1970 trade statistics indicate an average c. and f. price of about 35 pt/kg carcase-weight. The relative unattractiveness of Lebanese mutton prices is reflected in the much lower degree of East European competition than in Kuwait or Libya. Average import prices for beef were shown to be about $31\frac{1}{2}$ pt/kg, but Sudanese exporters with connections in the Lebanon estimated that the price for good average quality beef could now be up to $34\frac{1}{2}$ pt/kg. Beef therefore looks a better long-term prospect than mutton, but of the "quality" markets in the Middle East, Lebanon appears the least favourable for substantial penetration, unless very cheap air-freight terms can be obtained.

Health regulations are the most stringent in the Middle East. A large quarantine station was built at the port of Tripoli specifically for the reception and isolation of imported livestock from Africa but the closure of the Suez Canal precluded its use for this purpose and African imports now have to be in the form of meat, which is treated with considerable suspicion. There is a particular fear of foot and mouth disease being introduced by African meat and several consignments of Sudanese meat in the 1960's were destroyed on arrival at Beirut airport. All cattle intended for slaughter and export to Lebanon are required to be vaccinated against this disease with OAC as well as against rinderpest and anthrax. They are also supposed to be kept isolated in special quarantine away from other export animals. It is further specified that all beef (but not mutton) should

be de-boned before export, but this provision is now understood to be under discussion and is expected to be removed. In the 1960's a Sudanese exporter attempted to send boneless beef to Lebanon (at a c. and f. price of about LS. 1. 00 per kg), but the boning equipment and the butchers to operate it had to be imported at heavy cost and the process proved uneconomic.

The projected pattern of demand, based on similar assumptions to those used for other importing countries, is given in Table A4. 25.

TABLE A4. 25 Lebanon - Projected Meat Consumption and Beef and Mutton Imports, 1982/3

	Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	43. 2	11. 4	5. 9	37. 3	26. 5
Mutton	45. 7	12. 1	9. 5	36. 2	27. 0
Poultry	29. 2	7. 7			
Total:	118. 1	31. 2			

3. THE CHOICE BETWEEN EXPORTING LIVE AND CHILLED

Certain Middle East countries (Libya and Lebanon) can at present only be supplied with meat by air. Choosing the form in which to export meat to the other countries in the region will depend on:

(a) Consumer preference (e. g. preference for local slaughter in Saudi Arabia).

(b) Availability of alternative forms of transport (e. g. return loads by air are unlikely to be obtained to the Trucial States).

(c) Comparative incidental costs.

(d) The technical efficiency likely to be achieved by Sudan in meat chilling and freighting in the near future.

(e) The requirement of the Sudanese tanning industry for additional hides and skins.

The question of comparative costs is discussed briefly below. Much will depend on the freight rates obtainable from Sudan Airways or air charter companies, but if an average rate is assumed of 6.75 pt per ton/mile (50 per cent higher than the unusually low rate charged by Tradewinds to Libya), and facilities for transporting livestock are improved as recommended in the proposal, the cost differences are often marginal. Sheep entail higher incidental costs per kg when transported live than cattle, so that in most cases, such as the Kuwait example below (where three possible routes exist), it would probably be cheapest to send mutton chilled and beef live, especially when the relatively high value of slaughtered sheep's hides and offals are taken into account. The alternative cost schedules are set out in Table A4.26, though the effect of duty on meat imports has not been included.

The situation with regard to exports to Egypt is particularly interesting. Incidental costs of exporting cattle via Wadi Halfa under present conditions are reckoned to be about 11 pt/kg carcaseweight. Under improved conditions it is expected that these could be reduced to about $7\frac{1}{2}$ pt/kg, while the incidental costs of air-freighting would (on the same basis of reckoning as above) also be $7\frac{1}{2}$ pt/kg (excluding returns from hides and offals). In the case of mutton, air-freighting should be much the cheapest method.

4. CENTRAL AFRICAN MARKETS

A brief market survey was carried out in 1970 by MAP representatives in Zaire and the Central African Republic, which are both importers of meat, predominantly beef. There is already an uncontrolled movement of poor quality beef animals from South West Darfur into the Central

TABLE A4. 26 Costs of Transporting Meat to Kuwait by Different Means

	Cattle		Sheep	
	LS/head	Pt/kg Carcaseweight (@ 200 kg/hd)	Ls/head	Pt/kg Carcaseweight (@ 20 kg/hd)
(a) Rail to Port Sudan and ship direct to Kuwait				
Khartoum - Port Sudan[a]	4. 18	2. 09	0. 80	4. 00
Freight, etc. Port Sudan - Kuwait[b]	9. 00	4. 50	2. 06	10. 30
Feed (8 days)	1. 60	0. 80	0. 40	2. 00
Losses	1. 00	0. 50	0. 10	0. 50
Total:	LS. 15. 78	Pt. 7. 89	LS. 3. 36	Pt. 16. 80
(b) Rail to Port Sudan, ship to Jeddah and truck Jeddah - Kuwait				
Khartoum - Port Sudan[a]	4. 18	2. 09	0. 80	4. 00
Freight, etc. and losses Port Sudan - Jeddah	2. 60	1. 30	0. 59	2. 95
Feed, Jeddah (1 day)	0. 20	0. 10	0. 05	0. 25
Freight, Jeddah - Kuwait[c]	3. 44	1. 72	0. 78	3. 89
Losses	0. 66	0. 33	0. 06	0. 33
Total:	LS. 11. 08	Pt. 5. 54	LS. 2. 28	Pt. 11. 42
(c) Slaughtered in Khartoum and air-freighted				
Quarantine fees, vaccines, feeding in quarantine, etc.	1. 80	0. 90	0. 42	2. 13
Slaughter fees	0. 60	0. 30	0. 17	0. 85
Chilling[d]		0. 12		0. 12
Incidental costs to airport		0. 25		0. 25
Freight, Khartoum - Kuwait		8. 37		8. 37
Total		9. 94		11. 72
Credit value of hides and offals[a]	-2. 46	-1. 23	-1. 50	-7. 50
Total (crediting hides and offals)		Pt. 8. 71		Pt. 4. 22

(a) See Appendix III.

(b) Assuming return load.

(c) At 1, 100 Saudi Riyals per truckload of 27 cattle; or

(d) At LS. 48 per 40 tons (capacity of chilling room) per day.

African Republic and there appear to be possibilities of placing the trade on a more regular basis, with half the payment for Sudan's exports coming in foreign exchange form and half in kind. It is thought that a market exists for 10-12,000 cattle per year. During the survey the sale was observed of about 50 scrub animals (about 200 kg liveweight) for the equivalent of LS. 9.50 per head. Their purchase price in Darfur was probably below LS. 7.50.

Zaire is at present importing substantial quantities of air-freighted beef from Chad, but while retail prices in the capital, Kinshasa, are reported to be high (70 pt/kg for bone-in Chad beef), the c. and f. price quoted was 27 pt/kg and air-freight costs were high - 15 pt/kg. Unless much cheaper freight rates can be found or changes are made in the monopolistic buying structure, Zaire cannot be regarded as an attractive market at present.

Any expansion of trade with Central or West Africa would clearly be directed from Nyala or Wau rather than Khartoum.

APPENDIX IV

EXPORT MARKETS

1. SUDAN LIVESTOCK EXPORT STATISTICS

There are discrepancies between the figures given in the annual Foreign Trade Statistics and the records kept by the Ministry of Animal Production officials at Port Sudan and Wadi Halfa, the latter usually being higher. Because the MAP figures were available complete in monthly form from 1967 to 1971 inclusive, they were used in studies of seasonality patterns and for reasons of consistency were also employed in Volume I, Table 1.8 for live exports between those dates. The 1966 figures for live exports and all estimates of meat exports were, however, taken from the Foreign Trade Statistics[(a)]. For purposes of comparison and as a guide to the approximate values of past exports, the Foreign Trade Statistics figures for 1960 to 1970 inclusive are given in Tables A4. 1 and A4. 2. Figures for hides and skins exports over the same period are shown in Table A4. 3.

Monthly livestock export figures are given for Port Sudan (January 1967 - January 1972) in Table A4. 4 and Wadi Halfa (October 1969 - January 1972) in Table A4. 5. Since mid-1970 these valuable records have been collected and published in an annual report by the Head of the Quarantine Section of the MAP, together with figures of animals which have either died, been slaughtered or withdrawn while in quarantine. Losses are generally low at this stage, the major casualties occurring after animals leave the point of export. The 1970/71 pattern is shown in Table A4. 6.

(a) Alterations were made in the meat export figures where more accurate information seemed available from elsewhere.

TABLE A4. 1 Foreign Trade Statistics Estimates of Beef Exports, 1960-1970

	1960		1961		1962		1963		1964		1965		1966		1967		1968		1969		1970	
	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)	Nos.	Value (LS. 000)		Value (LS. 000)		Value (LS. 000)		Value (LS. 000)		Value (LS. 000)
(1) Live Cattle																						
Egypt	38,788	944.1	32,978	800.4	5,433	121.7	21,278	512.4	11,744	282.3	5,535	151.0	14,949	445.9	7,174	214.6	781	23.8	1,519	49.6	15,155	554.3
Saudi Arabia	729	15.3	13	0.6	674	6.4	804	20.5	360	6.6	2,810	81.4	1,726	51.9	1,798	60.2	6,235	198.0	6,335	219 2	5,463	200.1
Gulf States (incl. Kuwait)	-	-	-	-	666	14.7	-	-	-	-	-	-	-	-	270	6.8	1,067	27.6	1,614	48.8	480	14 4
Libya	-	-	-	-	-	-	-	-	310	10.9	1,210	42.8	534	14.4	-	-	-	-	-	-	-	-
Other	475	7.3	249	5.9	950	18.1	-	-	-	-	40	1.3	225	6.7	-	-	-	-	5	0.1	-	-
Total Exports:	39,992	966.7	33,240	806.9	7,723	160.9	22,082	532.9	12,414	299.8	9,595	276.5	17,434	518.9	9,242	281.6	8,083	249.4	9,476	317.7	21,098	768.8
(2) Chilled Beef (metric tons)																						
Egypt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	706.6	277.1	-	-
Saudi Arabia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	0.9	7.4	2.0
Libya	-	-	-	-	-	-	-	-	38.7	6.9	89.3	15.8	65.3	9.8	40.0	6.5	7.2	0.9	53.7	12.3	13.5	2.7
Lebanon	-	-	-	-	-	-	-	-	-	-	2.5	0.4	2.5	0.4	-	-	1.7	0.2	30.9	4 8	0.2	0.1
Total Exports:	-	-	-	-	-	-	-	-	38.7	6.9	91.8	16.2	67.8	10.2	40.0	6.5	8.9	1.1	796.3	295.1	21.1	4.8

TABLE A4. 2 Foreign Trade Statistics Estimates of Mutton Exports, 1960-1970

	1960		1961		1962		1963		1964		1965		1966		1967		1968		1969		1970	
	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)	Nos.	Value (LS.000)
(1) Live Sheep																						
Saudi Arabia	69,268	466.9	99,545	665.2	90,729	619.8	72,565	506.1	70,362	495.6	220,668	1,648.9	161,951	1,257.8	216,343	1,740.7	201,956	1,722.8	221,507	1,956.9	145,948	1,273.3
Egypt	-	-	-	-	-	-	400	3.0	9,000	71.6	5,351	43.1	1,100	9.5	-	-	-	-	250	2.0	27,852	247.3
Gulf States (incl. Kuwait)	3,385	20.1	-	-	2,500	20.0	-	-	-	-	-	-	-	-	2,400	20.4	7,900	68.0	-	-	-	-
Libya	-	-	-	-	-	-	-	-	180	2.3	200	1.5	-	-	800	6.8	650	3.7	260	2.1	500	4.3
Other	2,680	17.1	-	-	1,750	13.4	-	-	700	4.9	1,000	7.6	-	-	-	-	-	-	2,720	24.0	-	-
Total Exports:	75,333	504.1	99,545	665.2	94,979	653.2	72,965	509.1	80,242	574.4	227,219	1,701.1	163,051	1,267.3	219,543	1,767.9	210,506	1,794.5	224,737	1,985.0	174,300	1,524.9
(2) Chilled Mutton (metric tons)																						
Libya	-	-	-	-	-	-	-	-	-	-	39.3	8.4	21.5	5.0	9.3	3.1	19.0	4.3	16.2	4.1	-	-
Lebanon	-	-	-	-	-	-	-	-	-	-	0.5	0.2	-	-	-	-	2.0	0.3	3.8	0.6	-	-
Egypt	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.1	2.4	-	-
Saudi Arabia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	0.3	0.5	0.1
Gulf States (incl. Kuwait)	-	-	-	-	29.4	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Exports:	-	-	-	-	29.4	7.6	-	-	-	-	39.8	8.6	21.5	5.0	9.3	3.1	21.0	4.6	34.1	7.3	0.5	0.1

TABLE A4.3 Hides and Skins Exports, 1960-1970

	Hides		Sheepskins		Goatskins		Other Hides and Skins		Leather (heavy and light)	
	Tons	Value (LS. 000)	Tons	Value (LS. 000)	Tons	Value (LS. 000)	Tons	Value (LS. 000)	Tons	Value (LS. 000)
1960	3,281	536.7	1,059	348.7	383	103.0	95	36.3	6	3.4
1961	3,023	457.5	1,261	419.7	421	105.1	41	57.1	7	3.6
1962	3,101	500.4	1,023	315.4	362	100.6	34	57.6	2	1.0
1963	4,512	679.7	1,045	396.9	464	144.9	38	58.4	10	6.6
1964	1,572	250.8	1,457	522.6	378	98.8	58	108.4	4	3.0
1965	3,539	529.4	1,416	487.9	458	132.0	55	99.3	7	13.4
1966	3,461	622.8	1,616	570.3	682	251.0	128	159.7	-	-
1967	2,162	451.1	1,451	633.0	567	239.8	64	122.6	-	-
1968	3,018	580.4	1,468	681.0	481	182.4	33	63.3	-	-
1969	3,250	617.7	1,721	759.3	601	270.2	66	155.5	31	18.4
1970	3,944	693.6	1,409	674.1	472	186.3	56	361.6	-	-

Source: Department of Statistics.

TABLE A4. 4 Monthly Livestock Exports, Port Sudan, January 1967 - January 1972

	1967	1968	1969	1970	1971	1972
(1) Sheep						
January	23, 556	37, 710	44, 921	30, 200	24, 045	12, 670
February	23, 903	42, 697	18, 800	26, 575	12, 247	
March	25, 243	18, 550	14, 930	18, 260	19, 204	
April	30, 248	14, 100	15, 977	12, 750	13, 200	
May	19, 386	22, 293	7, 300	7, 747	11, 600	
June	11, 777	17, 350	5, 230	6, 200	2, 700	
July	1, 368	6, 332	900	1, 355	800	
August	6, 145	12, 900	2, 398	-	565	
September	20, 699	15, 650	9, 200	697	-	
October	18, 434	31, 642	22, 266	11, 120	9, 104	
November	39, 658	32, 974	42, 673	17, 482	4, 560	
December	48, 094	27, 126	35, 555	13, 813	6, 896	
Annual Totals:	268, 511	279, 324	220, 150	146, 199	104, 921	
(2) Cattle and Calves						
January	1, 591	996	410	1, 323	148	-
February	1, 294	1, 403	795	610	-	
March	507	997	622	779	104	
April	2, 110	530	1, 063	870	500	
May	2, 514	456	700	430	902	
June	1, 370	311	279	688	120	
July	1, 274	160	-	-	124	
August	-	-	-	-	-	
September	-	324	50	-	2	
October	213	1, 574	1, 155	105	-	
November	398	1, 822	1, 084	812	-	
December	2, 368	1, 073	877	300	-	
Annual Totals	13, 639	9, 646	7, 035	5, 917	1, 900	
(3) Goats						
Annual Totals:	4, 450	3, 220	2, 415	3, 500	846	
(4) Camels						
Annual Totals:	546	862	63	111	12	

Source: MAP Records, Port Sudan.

N. B. Until March 1968 the bulk of cattle exports were going to Egypt; thereafter all livestock was sent to Saudi Arabia and the Gulf States.

TABLE A4. 5 Monthly Livestock Exports, Wadi Halfa
October 1969 - January 1972

	1969	1970	1971	1972
(1) Cattle and Calves				
January	-	1,141	1,429	-
February	-	591	2,477	
March	-	1,813	3,004	
April	-	2,235	3,391	
May	-	724	1,762	
June	-	1,373	2,239	
July	-	913	1,532	
August	-	-	988	
September	-	-	632	
October	325[a]	570	1,015	
November	1,578	1,354	1,993	
December	1,561	2,218	-	
Annual Totals:	3,464	12,932	20,462	
(2) Sheep				
January	-	15,300	12,035	7,773[b]
February	-	2,700	-	
March	-	1,065	2,116	
April	-	-	-	
May	-	-	3,438	
June	-	-	1,454	
July	-	-	-	
August	-	-	-	
September	-	-	-	
October	-	-	-	
November	-	5,384	-	
December	-	2,441	-	
Annual Totals:	-	26,890	19,043	

(a) This was the first consignment after the creation of Lake Nuba.

(b) As at 21st January 1972.

Sources: MAP Quarantine Head Section, Khartoum and MAP Records, Wadi Halfa.

TABLE A4. 6 Quarantine Losses, July 1970 - June 1971

	Percentage of Animals Arriving at Quarantine								
	Adult Cattle			Calves			Sheep		
	Exported	Died	Withdrawn	Exported	Died	Withdrawn	Exported	Died	Withdrawn
Port Sudan	96. 7	0. 8	2. 5	54. 5	1. 8	43. 6	98. 9	0. 1	1. 0
Wadi Halfa	98. 5	1. 0	0. 5	99. 2	0. 5	0. 2	99. 0	0. 2	0. 8

Source: MAP Quarantine Head Section 1970/71 Report.

Records of meat exports are particularly confusing, the Foreign Trade Statistics and MAP figures rarely coming near to correspondence. This can be seen from comparing the figures in Tables A4. 1 and A4. 2 with those in Table A4. 7, which are taken from two sources: the MAP Animal Health Section and the Omdurman Slaughterhouse. These anomalies should be investigated as soon as possible, as well as those relating to live exports. The co-ordination of records should, in future, be a function of the Marketing Agency.

2. MARKETS FOR MEAT IN THE MIDDLE EAST

2. 1 Introduction

As part of this study, a member of the Consultants' team visited all the principal meat importing countries in the Middle East to investigate the market potential for Sudan. The characteristics of each market are discussed below under the following headings:

(a) current livestock and meat imports;
(b) estimated current meat consumption;
(c) quality preferences;
(d) prices;
(e) import duties;
(f) health requirements and
(g) religious factors.

TABLE A4.7 Estimates of Chilled Meat Exports, 1967-1971

		1967	1968	1969		1970		1971	
		Tons	Tons	Tons	Nos. of Animals	Tons	Nos. of Animals	Tons	Nos. of Animals
(1)	Beef								
	Libya	112.0	16.0	79.3	333[a]	107.6	686	291.5[b]	1,823
	Lebanon	-	5.0	44.6	-	0.2	100	-	-
	Kuwait	-	-	-	-	-	-	3.8[b]	22
	Egypt	-	-	305.0	2,606[a]	490.0	4,193	33.0[b]	-
	Saudi Arabia	-	-	5.6	-	9.3	-	14.0[b]	-
(2)	Mutton								
	Libya	31.2	24.0	4.0	200[a]	18.0	851	0.3[b]	7
	Lebanon	-	-	-	-	tr.	-	-	-
	Kuwait	-	-	-	-	-	-	12.2[b]	995
	Egypt	-	-	-	-	tr.	-	-	-

Note: Weight estimates from MAP Animal Health Section, animal numbers from Omdurman slaughterhouse.

(a) November and December 1969 only.

(b) Foreign Trade Statistics (January-August 1971 only) give the following estimates (in tons): Beef: Libya 307.9, Kuwait 0.9, Egypt 0.3, Saudi Arabia 4.5; Mutton: Libya 54.0, Lebanon 0.5, Kuwait 10.5, Saudi Arabia 3.1.

Finally, projections have been made of future demand and Sudan's prospects in each market are assessed. Contacts who were particularly helpful during the market survey are also mentioned.

2. 2 Saudi Arabia

(a) Imports

The most recent complete edition available of Saudi Arabia's Foreign Trade Statistics relates to 1968. Digests have been published for 1969 and 1970 but these do not contain breakdowns by country for each item imported. Unfortunately, little confidence can be placed in the 1968 figures, which quote imports from the Sudan which are higher than those in the Sudanese export records by 120 per cent in the case of cattle and 75 per cent in the case of sheep. It was assumed that the figures for all livestock imports in 1968 were distorted to a similar degree and the consequent adjustment produced figures which were of the same order as those for 1969 and 1970. The 1968 records indicated the following market shares (per cent):(a)

	Sheep	Cattle	Goats
Somalia	63	69	16
Sudan	29	24	37
Ethiopia	3	6	42
Australia	2	-	-
Other	3	-	5

More recent figures, collected from the records of the Department of Agriculture's veterinary inspector in Jeddah, indicate that the ratio of Sudanese to Somali imports dropped in 1970 to 13 : 87 for both sheep and cattle; the ratio for the first eight months of 1971 was the same in the case of sheep and fell to 11 : 89 in the case of cattle. Detailed figures are given in Table A4. 8, from which it can be seen that the Somali supplies, besides being much higher than the Sudanese, also maintain a much more even flow

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(a) In terms of numbers. The Somali sheep are in fact substantially smaller than the Sudanese (averaging about 15 kg carcaseweight against 22 kg) and fetch only a little over half their price per head. In value terms, therefore, the recent ratio has probably been about 20 : 80. But it will have fallen further in the second half of 1971.

TABLE A4. 8 Saudi Arabia - Monthly Livestock Imports from Somalia and Sudan, 1970-1971

		Cattle		Sheep	
		Somalia	Sudan	Somalia	Sudan
January	1970	1,502[a]	410[a]	45,434[a]	15,460[a]
February		1,314	1,420	101,786	30,029
March		1,456	1,159	57,772	21,360
April		1,565	462	21,010	7,556
May		830	798	22,742	9,050
June		3,910	-	42,971	3,200
July		4,608	150	87,747	2,555
August		4,043	-	77,541	-
September		2,248	-	78,540	697
October		1,990	170	96,334	9,420
November		4,356	105	94,609	15,312
December		4,327	315	113,154	13,386
January	1971	4,145	500	86,578	16,665
February		1,352	50	88,677	15,930
March		1,835	4	98,172	21,906
April		1,279	63	47,743	12,650
May		1,726	760	63,968	12,699
June		3,442	312	41,720	3,600
July		3,290	-	49,465	-
August		3,361	906	68,859	565
September		4,664[b]		51,340[b]	
October		2,249		59,796	
November		6,465		122,102	
December		3,366		110,109	

(a) Figures for January 1970 - August 1971 from Ministry of Agriculture, Riyadh.

(b) Figures for September - December 1971 from Jeddah Ministry of Commerce.

Note: Original data referred to Islamic months and conversion is only approximate.

throughout the year.

After the downward adjustment of the 1968 import figures, all import estimates were raised by 36 per cent on the basis of official urban slaughterhouse records[(a)]. It is very probable that import records would tend to be underestimated in view of the apparently substantial illegal movement of livestock into Saudi Arabia (there is some evidence of smuggling between north of Port Sudan and Yenbo). The revised import estimates are given in Table A4. 9 below. While it is realised that this treatment of official figures is unorthodox, it appeared the only way of obtaining some kind of internal consistency.

TABLE A4. 9 Saudi Arabia - Revised Livestock Import Estimates (000 head)

	1968	1969	1970
Cattle	41. 6	51. 7	62. 6
Sheep	1, 275. 8	1, 491. 7	1, 382. 8
Goats	31. 6	32. 7	32. 7
Camels	5. 4	13. 6	32. 7
Poultry	732. 2	644. 2	1, 562. 4

Imports of chilled and frozen meat are low (424 tons in 1968, plus 5, 122 tons of frozen chicken), partly because of the preference in Saudi Arabia for freshly slaughtered meat and partly because of the high duty applying until recently to imported meat. Canned meat imports are also small.

(a) Slaughter records for February - July 1969 gave a figure for imported animals of 10, 787 tons. After converting this to an annual total and allowing for 35 per cent of slaughtering being outside official premises, it appeared that imports were underestimated by 36 per cent.

(b) Consumption

The estimated livestock population of Saudi Arabia is: Sheep 2. 73 m, Goats 1. 39 m, Camels 1. 04 m and Cattle 0. 27 m[(a)]. According to senior representatives of the Ministry of Agriculture, 47 per cent of the country's mutton consumption is believed to be supplied from local sources and about 2 million locally produced sheep equivalents are slaughtered each year.

On the basis of these assumptions and the revised import estimates, the consumption figures in Table A4. 10 were reached.

Estimation of Saudi Arabia's per capita consumption is more than usually difficult owing to uncertainty about the size of the total population (estimates range between 4. 0 and 7. 7 million). It is assumed here to have been 4. 5 million in 1970.

TABLE A4. 10 Estimated Meat Consumption, Saudi Arabia, 1970

	Total (tons)	Kg/head
Beef	9,900	2. 2
Mutton	44,530	9. 9
Camel	21,400	4. 8
Poultry	8,590	1. 9
Total:	84,420	18. 8

There appears to be no very strong seasonal variation in consumption patterns, but demand is reported to be higher during the winter and 2-3 times higher than average during the month of Ramadan.

(a) FAO, Rome/Cairo (1971), Regional Study on animal husbandry, etc. in the Near East (draft).

(c) Quality Preferences

As Table A4. 10 shows, the Saudis are predominantly mutton eaters. Freshly slaughtered meat is generally preferred to chilled or frozen. Especially large numbers of sheep and goats are sacrificed during the major Muslim festivals, most notably at the Eid el Bairam, when many pilgrims from abroad visit Mecca. Preference is for the "traditional" desert sheep (castrated males) and the Sudanese animals rate very highly. However, their large size makes them more suitable for special feasts than ordinary family occasions, for which the smaller Somali animals are more convenient. Butchers are also said to favour Somali animals because they have a smaller percentage of bone and are easier to cut[(a)].

Towns near the western coast and the capital, Riyadh, obtain most of their imported supplies live through Jeddah. In Eastern Province, however, most imports come through Dammam and contain a larger proportion of frozen meat, much of it from Australia. Some live sheep have also been sent from Australia (by the Homeidi-Klausen firm operating in Kuwait). Their meat has not been well received so far but the low prices at which the animals are being offered could lead to a change in attitudes.

Demand for beef is said to be increasing fairly rapidly in urban higher income groups and the population of expatriates (predominantly beef-eating) is expected to double or treble in the next five years (up to 15-20, 000 Europeans may be working in Eastern Province alone). Imported cattle are generally of poor quality but some "good average" quality beef air-freighted from Ethiopia is consumed by Europeans. Small amounts of "frozen" beef fillet (1-2 tons/month) have recently been sent by air from Sudan to Jeddah. Since the removal of the heavy duty on imported meat (see below), there could be an increased market for

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(a) There is also a substantial consumption of goat-meat in Saudi Arabia. There is reported to be little consumer differentiation between sheep and goat-meat of Somali origin. However, Sudanese goat-meat is said not to be popular and fetches a price 20 per cent below that of sheep.

chilled beef, especially in Eastern Province and possibly Riyadh, where fresh supplies are scarcer than in Jeddah.

(d) Prices

The retail price of mutton is fixed by Jeddah municipality at 50 pt/kg[(a)] and importers quote a maximum c. and f. price equivalent to 19 pt/kg liveweight. One reason why imports of Sudanese sheep have been declining is that Sudanese exporters have been asking too high prices (e. g. up to LS. 11. 25 for an animal of 45 kg liveweight, or 25 pt/kg). Australian exporters are recently reported to have offered trial consignments to Jeddah for as little as $7\frac{1}{2}$ pt/kg c. i. f. liveweight, or about 17 pt/kg carcaseweight. The cost of freighting sheep to Riyadh is about 4 Saudi Riyals per animal (or 2 pt per kg carcaseweight).

Urban retail prices for beef appear to be about 20-30 per cent lower than those for mutton. Importers in Jeddah quote $8\frac{1}{2}$ pt/kg c. and f. liveweight (about 16 pt/kg carcaseweight) for cattle and calves from Somalia, but exporters from Sudan report having received offers between 20 pt and 25 pt/kg carcaseweight, depending on quality. The beef fillets from Sudan were coming in at about 67 pt/kg before the removal of the $27\frac{1}{2}$ per cent duty but they were not properly deep-frozen or packed and were overpriced compared with better quality frozen beef from other sources.

Livestock import prices are reported to rise by about 10 per cent during the summer months as a result of a decline in supply.

(e) Duties

No import duty is charged on live animals. Until January 1972 imported meat was liable to a duty of $27\frac{1}{2}$ per cent, but this has now been entirely removed.

A subsidy for the import of live animals was removed in 1970.

(a) Fixed retail prices in Riyadh and Dammam are about 58 pt/kg and 67 pt/kg respectively.

(f) Health Requirements

Saudi Arabia has no special sanitary requirements, but Sudan applies the same measures as for Egypt and Libya.

(g) Religious Factors

The preference for locally slaughtered meat is strong in traditional circles, but as far as imported meat was concerned it did not generally seem considered that religion would greatly favour Sudan at the expense of non-Islamic exporters.

(h) Demand Projections and Conclusions

In projecting Saudi Arabia's future demand for meat, it was assumed that population would increase by 2.8 per cent per annum and income per head by 2.6 per cent per annum[a]; and that the income elasticity of demand for all meats was 0.6 (comparable to other Middle East countries with similar conditions). It was also assumed that, with retail prices for different meats remaining in the same relation to each other as at present, expenditure on beef in 1982/3 would rise to 20 per cent of expenditure on all meats (compared with 11 per cent now), mutton fall to 50 per cent (against 59 per cent now), camel fall to 10 per cent from 22 per cent and poultry rise to 20 per cent from 8 per cent. The resulting values were then translated into quantity terms. Local livestock production (and offtake) was assumed to increase by 4.6 per cent per annum, on the basis of information supplied by the Ministry of Agriculture (new livestock development schemes are planned south of Riyadh and near Hofuf). The estimate of locally-produced meat was deducted from total projected consumption to give total imports. Finally, the proportion of meat consumed in frozen or preserved form was assumed to have increased by 1982/3 to 20 per cent in the case of beef and 10 per cent in the case of mutton. When this was deducted, an estimate was obtained

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(a) Annual GNP growth rate is predicted at 5.5 per cent in Moe, L. E. (1966), Supply and Demand Projections for Farm Products to 1975, USDA., ERS-Foreign 168.

of mutton and beef import requirements in live or chilled form. These results are shown in Table A4. 11.

TABLE A4. 11 Saudi Arabia - Projected Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	29. 7	4. 8	0. 7	29. 0	23. 0
Mutton	62. 8	10. 1	31. 7	31. 1	24. 9
Camel	16. 3	2. 6			
Poultry	36. 3	5. 8			
Total:	145. 1	23. 3			

Saudi Arabia is likely to remain the largest and easiest market (in terms of quality and accessibility) for exporters of Sudanese sheep in the foreseeable future. There are also attractive prospects for medium-quality beef, where competition will probably be less severe. Sudanese exports have been declining lately because of rising prices and costs in Sudan and inability to guarantee supplies on a regular basis. The 15 per cent export bonus and the proposals made for improving marketing in this Report should help to overcome these problems. Saudi importers have complained at times of not getting the type or size of animal agreed by contract, but this source of friction should also be removed if sales are made on a liveweight, graded basis. Importers are agreed that the quality of Sudanese mutton is superior to the Somali and they are generally well disposed to Sudanese products, but they are mostly acute businessmen and expect value for money and efficient marketing.

Among the most prominent of those who provided information for this survey were: Messrs. Abbar and Zainy, Jeddah; Awadh Etaiwi

and Sons, Jeddah; Sharbatly Food Corporation, Jeddah; Sheikh Mohammed Bad Kok of Kilo 10 Restaurant, Jeddah; Khalifa Algoseibi Cold Stores, Dammam and Jeddah; Spinney's Food Supplies, Riyadh; and the Ministry of Agriculture, Riyadh.

2.3 Kuwait

(a) Imports

The official Kuwait import figures for 1966-1970 are summarised in Table A4.12. It will be seen that Sudan has so far been insignificant as an exporter of livestock or meat to Kuwait. Over the five year period there was a marked shift towards importing chilled and frozen meat rather than livestock. The type of meat imported is unspecified in the statistics, but traders' estimates are that it is made up of 85 per cent mutton (equal parts chilled and frozen) and 15 per cent beef (all frozen). The principal suppliers of chilled mutton are East European countries and Turkey. As Table A4.12 shows, this trade has expanded very rapidly indeed in the last four years.

Examination of the slaughter records of Kuwait[(a)] indicate that the live import figures are, as often, underestimated, possibly on account of smuggling. After account was taken of local livestock production (very small), discrepancies were often still very large and it was decided that live imports should be adjusted upwards to be consistent with the slaughter figures. Thus in 1970, for example, the number of cattle and sheep actually imported was assumed to be as high as 9,960 and 490,000 respectively.

(b) Consumption

The livestock population of Kuwait is very small indeed and nearly all supplies are imported. There are estimated to be 100,000 sheep, 15,000 cattle, 50,000 goats and 7,000 camels. On the basis of these

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(a) Statistical Abstract (1971), Central Statistical Office, Kuwait.

TABLE A4. 12 Kuwait, Livestock and Meat Imports, 1966-1970

Country of Origin	1966	1967	1968	1969	1970
Cattle (Nos.)					
Iran	9,325	13,415	-	-	-
Syria	-	620	3,217	1,406	-
Somalia	307	-	409	1,093	1,893
Ethiopia	-	-	1,083	2,141	-
East Africa	375	195	563	510	2,345
Sudan	-	-	1,428	1,348	773
Others	251	482	1,440	925	176
Total:	10,258	14,712	8,140	7,063	5,187
Sheep and Goats (Nos.)					
Iran	329,854	93,133	2	89	786
Syria	15,768	43,035	68,229	45,698	20,229
Somalia	-	7,423	16,500	6,700	20
South America	-	8,500	64,666	37,313	18,857
Australia	137,803	152,323	158,369	129,744	223,726
Sudan	-	-	2,646	1,994	-
Others	15,921	44,790	43,426	757	10,519
Total:	499,346	349,204	353,874	222,295	274,137
Fresh, Chilled or Frozen Meat (Tons) (excluding poultry)					
China	114.7	282.3	2,625.7	1,326.3	2,445.6
Turkey	-	0.4	682.0	447.2	1,051.5
Eastern Europe	15.0	96.6	1,447.5	3,035.0	2,228.8
Australia	1,763.1	1,884.8	1,828.2	1,496.0	1,045.6
Denmark	267.3	181.0	327.6	431.2	434.7
East Africa	76.4	87.4	105.4	64.0	49.5
Sudan	-	-	-	-	0.2
Other	97.5	185.5	378.2	294.1	360.2
Total:	2,334.0	2,718.0	7,394.6	7,093.8	7,616.1
Canned Meat (Tons)					
Total:	546.1	547.8	572.6	655.1	474.7

Source: Kuwait Foreign Trade Statistics.

figures and the revised import estimates (and a human population of about 733, 200 in 1970), the consumption figures in Table A4. 13 were obtained.

TABLE A4. 13 Estimated Meat Consumption, Kuwait, 1970

	Total (tons)	Kg/head
Beef	2, 950	4. 0
Mutton	18, 240	24. 9
Camel	490	0. 7
Poultry	5, 510	7. 5
Total	27, 190	37. 1

Consumption per head is large but it does not seem improbable in view of the very high standard of living among nearly all classes in Kuwait (GDP per head in 1970 was equivalent to about LS. 1, 415). The emphasis on mutton is very marked.

There is a substantial fall in demand for meat in the summer months, when many Kuwaitis move out of their country to cooler areas such as Lebanon. Consumption is higher than average during Ramadan.

(c) Quality Preferences

With such a high income per head, Kuwait is a quality market for mutton, though less so for beef, which is relatively little eaten at present. The preference is for young lamb of 10-12 kg carcaseweight, with 20 kg the maximum. Chilled carcases sent from Eastern Europe and Turkey have been of this type. The Australian sheep imported by the firm of Homeidi-Clausen, which now dominates the live market, have tended to be 2-3 years old (26-27 kg carcaseweight) but realised good sales (mainly tenders to government departments) on account of their very low price. However,

it is reported that increasing competition from the suppliers of chilled meat has caused a movement towards younger lambs in the live market also.

There are considerable risks in dealing in chilled meat, especially in such a competitive market as Kuwait, since meat not sold quickly has to be frozen and fetches only about half the price. Several firms consider that the recent enthusiasm for competing in the chilled market will wane but others see few signs of this occurring. One or two consignments of Sudanese mutton were sent by air in 1970/71 but they were not successful; importers' complaints were that the carcases were "not fat enough" and that the meat was badly chilled and discoloured on arrival. However, purely in terms of meat quality, Sudanese mutton should enjoy an advantage over most major suppliers at present in that animals fed on dry grazing (and subsequently fattened) are preferred to those which are pasture-fed.

A movement in consumer preference towards beef is discernible, but good quality is required. The fact that the movement is only slow suggests that quality beef is in relatively short supply. Importers express a preference for live cattle. No chilled beef is imported at present, but if it were it would have to be of prime quality (not older than eight months). Whole carcases are not in demand.

A notable increase in demand is reported among lower and middle income groups for frozen meat and (especially) chicken. Since ownership of refrigerators is widespread in Kuwait, this demand will no doubt continue to grow rapidly, but prices for frozen meat are very low.

(d) Prices

Average import prices for chilled mutton range from 37-40 pt/kg carcaseweight. One of the reasons for the low mutton prices prevailing in Kuwait is that when the East European countries first entered the market they subsidised their costs and were offering prices as low as 31 pt/kg. Prices were then raised steadily after a share of the market had been captured; in late 1971 the import price for East Europeans'

meat was reported to be up to 41½ pt/kg and it seemed that they were being undercut by the Turks and running into various difficulties. The additional competition from the chilled mutton suppliers has also affected the price of live animals, and wholesale selling prices for Australian sheep are said to have declined from 45½ pt to 33 pt per kg carcaseweight in the last three years (the c. i. f. price in 1970 was about 24 pt/kg).

Live cattle were fetching import prices of only 22 pt/kg carcase-weight in 1970 but, as the countries of origin in Table A4. 12 show, quality was not outstanding. It is believed that properly finished animals could fetch prices up to 30 pt/kg and possibly above, but further market research is required to test this.

C. i. f. prices for frozen mutton legs range from about 26 pt/kg (Australia) to 19 pt/kg in the case of Chinese mutton, which is reported as of "decent quality". The margin between chilled and frozen meat prices is illustrated by the fact that if chilled mutton is not sold on the day of arrival, the retail price slips from 52 pt/kg to 47 pt/kg the next day and is thereafter classified as "frozen", selling at only 26 pt/kg.

(e) Duties

Live animals are imported duty free but all meat is subject to 4 per cent duty.

(f) Health Requirements

Cattle are required to be vaccinated against rinderpest, anthrax and H. S. ; they should also be tested against C. B. P. P. and vaccinated against this disease 20 days before departure from the exporting country; they should also be dipped against ectoparasites. Sanitary measures for other categories of livestock and meat are the same as in the case of Egypt and Libya (see below). The necessary health certificates are required, but some smuggling to evade these is reported from Iraq. Veterinary officials in Kuwait are not satisfied with the present health arrangements and attempts are being made to impose stricter measures on importers.

(g) Religious Factors

While there is still a substantial traditional element in Kuwait society, the recent large increases in meat imports from non-Islamic countries suggests that little importance is attached to the provenance of meat provided that evidence is given of slaughter according to Mohammedan law.

(h) Demand Projections and Conclusions

Kuwait's population increased at a rate of over 9 per cent per annum during the 1960's but it was assumed to drop to 5 per cent during the period of analysis. The annual increase in income per head was projected at 1.6 per cent, with a 0.8 income elasticity for meat. In view of the present price differentials between meats and the relatively low beef consumption, a movement was assumed away from mutton and towards beef and poultry, so that in 1982/3 expenditure on all meats would be in the proportion of 20 per cent on beef, 55 per cent on mutton and 25 per cent on chicken. Provision was made for an increase in the present very small indigenous livestock offtake and the proportion of meat consumed in frozen or canned form was assumed to rise by 1982/3 to 50 per cent in the case of beef and 35 per cent in the case of mutton. The results of these assumptions are shown in Table A4.14.

TABLE A4.14 Kuwait - Projected Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	14.1	10.3	0.2	13.9	6.8
Mutton	28.8	21.0	1.4	27.4	17.3
Poultry	21.8	15.9			
Total:	64.7	47.2			

The market for mutton in Kuwait at present appears to be almost saturated. Entry into the live market is particularly difficult. However, if competition in the chilled market eases, there might be an opening for Sudanese mutton in view of local preference for the desert type animal. Even so, it is only likely to become an attractive market if some kind of subsidy in air-freight rates were provided, which is a distinct possibility in view of the need for the new Sudan Airways planes to visit Kuwait at least once a week. The best market to aim for in the near future could well be that for live cattle of good average quality; Kuwaiti importers believed that movement by truck from Jeddah was the quickest and cheapest route, but this would have to be investigated carefully by the Marketing Agency before major commitments could be made.

Many Kuwaiti importers are anxious in principle to import Sudanese meat products and some have made fairly intensive studies of livestock production and marketing in the Sudan. Provided certain essential infrastructural improvements were carried out (e. g. with regard to railway transport) some businessmen in Kuwait would probably consider investing in large-scale livestock production in Sudan.

Among those who gave assistance to this survey in Kuwait were: Messrs. A. & M. Abughazaleh; Mr. Al-Barakat; Mr. Al-Wazzan; Mr. Yousuf Al-Saqer; Dr. Khalil Osman of Gulf Fisheries; and Dr. Abdal Rahman Salman, Director of Animal Husbandry.

2. 4 The Trucial States, Bahrain and Qatar

(a) Imports

Visits were made to Bahrain and Dubai. Statistics of livestock imports in both states were unreliable (in Bahrain 80 per cent of live imports are reckoned to go unrecorded) but figures for meat imports were accepted. Total live imports were estimated on the basis of experienced opinion in Bahrain and on slaughterhouse figures in Dubai. The figures are summarised briefly in Table A4. 15. Bahrain imports most of its cattle from South Iran; until recently the same was true in

the case of sheep, but now about 30,000 per year or almost half the estimated imports come from Australia (through the firm of Homeidi-Klausen in Kuwait). Dubai obtains the bulk of its livestock from South Iran (most of the importing is carried out by merchants with relatives on the Iran coast); half its total imports (or about 70,000 sheep and 5,000 cattle per year) are re-exported to other states such as Abu Dhabi, Qatar or Bahrain.

TABLE A4.15 Bahrain and Dubai - Estimated Livestock and Meat Imports, 1970

	Bahrain	Dubai
Cattle (Nos.)	8,000	10,000[a]
Sheep (Nos.)	60,000	140,000[a]
Chilled or Frozen Beef (Tons)	60	375[b]
Chilled or Frozen Mutton (Tons)	245	1,215[b]
Canned Meat (Tons)	222	472

(a) Of which half assumed to be consumed in Northern Trucial States and half re-exported.

(b) Assuming that all imported meat is made up of: Beef 20 per cent, Mutton 65 per cent, Poultry 15 per cent (importer's estimate).

Sources: Official statistics for meat imports.

(b) Consumption

Livestock production in the Gulf States is negligible (Bahrain is credited with 10,000 sheep and 5,000 cattle)[a]. Estimated human populations in 1970 were: Bahrain 210,000; Qatar 112,000; Abu Dhabi 60,000; and Northern Trucial States 150,000 (of which Dubai had 60,000). On the uncertain information available, meat consumption in Bahrain and the North Trucial States was estimated to be on the lines indicated in Table A4.16.

(a) FAO, Rome/Cairo (1971), Regional Study on Animal Husbandry, etc., in the Near East (draft).

TABLE A4. 16 Estimated Meat Consumption, Bahrain and North Trucial States, 1970

	Bahrain		North Trucial States	
	Total (tons)	Kg/head	Total (tons)	Kg/head
Beef	1,220	5.8	1,450	9.7
Mutton	2,210	10.5	2,860	19.1
Camel	310	1.5	220	1.5
Poultry	1,015	4.9	340	2.2
Total:	4,755	22.7	4,870	32.5

In subsequent calculations it has been assumed that the per capita consumption pattern in Dubai and the North Trucial States is also representative of Abu Dhabi and Qatar.

Monthly slaughter figures from Dubai indicate a marked increase in Ramadan and, as in Kuwait, demand is reported to decline substantially in summer. Otherwise, the principal causes for fluctuations in consumption levels appear to be on the supply side; small ships are used to transport livestock from south Iran and their movement is greatly handicapped by rough seas between December and February.

(c) Quality Preferences

Average income per head in Bahrain is lower than in the surrounding states and there is a greater emphasis on beef than in Kuwait as well as on imports of cheap frozen and canned meats (partly a consequence of the substantial Indian and Pakistani element in the population). A similar pattern prevails in the Trucial States and Qatar which, despite their high standards of living, are too small and isolated to attract regular supplies of high quality meat. Australia air-freights 4-5 tons of chilled meat every month to Bahrain, mainly for European consumption, and just over 1 ton per month to Dubai, Abu Dhabi, through lack of alternative air connections,

air-freights meat at high cost from the U. K. All meat imports to Qatar are frozen.

Sudanese sheep are highly thought of in the Gulf States and the quality of their meat is much preferred to that of the Australian animals.

(d) Prices

Because of their relative inaccessibility, prices in the Gulf States tend to be high. Officials in Bahrain quoted up to 60 pt/kg carcaseweight c. and f. for Iranian or Somali sheep and 41 pt/kg for Australian sheep. Frozen mutton legs from Australia sell at almost half this price.

For the special consignment of Sudanese sheep to Abu Dhabi in Ramadan 1971, a price was agreed equivalent to 58 pt/kg carcaseweight f. o. b. Port Sudan or 68 pt/kg c. and f. Abu Dhabi. A similar price is reported to have been offered for a second consignment, together with an offer of 46 pt/kg carcaseweight c. and f. for calves under three years.

Import prices in Dubai are lower owing to its greater accessibility to Iran; Iranian sheep and goats have been priced at 33 pt/kg, but the quality was poor and Sudanese animals could be expected to obtain a substantial premium.

(e) Duties

Bahrain charges 3 per cent customs duty on live animals, 5 per cent on meat. Dubai has no charge for live animals but 4. 625 per cent on meat.

(f) Health Requirements

Measures are not very stringent, especially in Dubai, but efforts are being made there to apply quarantine regulations in order to control the import and re-export of livestock.

(g) Religious Factors

As far as could be seen, attitudes were similar to those in Kuwait.

(h) Demand Projections and Conclusions

Bahrain's population was assumed to increase at a rate of 2. 8 per cent per annum, that of the Trucial States and Qatar at 4 per cent per annum. Per capita expenditure on meat was projected to increase at the same rate as Kuwait in all states except Bahrain, where the rate chosen (1 per cent per annum) was somewhat lower. A movement was assumed from mutton to beef and chicken, so that proportions of all meat consumed in 1982/3 were (in the case of Bahrain) beef 30 per cent, mutton 45 per cent, chicken 25 per cent, and (in the other states) beef 35 per cent, mutton 50 per cent, chicken 15 per cent. The proportions of beef assumed to be in frozen or canned form were 30 per cent for Bahrain and 47 per cent for the other states; respective proportions for mutton were 45 per cent and 52 per cent. The resulting patterns are shown in Table A4. 17.

TABLE A4. 17 Gulf States - Project Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons)	Consumption/ Head (Kg)	Local Production (Tons)	Imports (Tons)	Imports (live and chilled only) (Tons)
Bahrain					
Beef	2, 390	8. 2	90	2, 300	1, 580
Mutton	2, 860	9. 8	60	2, 800	1, 510
Poultry	2, 396	8. 2			
Total:	7, 640	26. 2			
Trucial States & Qatar					
Beef	7, 860	14. 9	-	7, 860	4, 170
Mutton	8, 980	17. 0	-	8, 960	4, 300
Poultry	4, 040	7. 7			
Total:	20, 880	39. 6			

The Gulf States markets are potentially very lucrative and there is little price or quality competition, though there might be some difficulty in breaking the Iranian monopoly in Dubai. The main problem from Sudan's (and other exporters') point of view is the States' relative inaccessibility and small size. If flights were available, air-freighting would be the cheapest means of supplying Bahrain, Abu Dhabi and Dubai, but in the case of the latter two this seems unlikely to occur. The possibility of providing return loads for fertiliser ships from Kuwait therefore deserves serious attention (see Appendix V, Section 3).

Among those who assisted this survey were: The Meat Control Committee, Manama Municipality, Bahrain; Sayed Kamal Hamza, Director, Dubai Municipality and Dr. Hassan Othman, Dubai Municipality.

2.5 Egypt

(a) Imports

Egyptian import statistics appear to be, at best, incomplete, certainly with regard to live animals. However, since Sudan is the main supplier of livestock to Egypt (alternative sources have become difficult since the closure of Suez to shipping)[(a)], this deficiency can to some extent be made up by using Sudanese data. Thus total imports of cattle at present could be assumed to be about 35,000 (with Sudan's share 20-25,000); of sheep about 30,000 (nearly all from Sudan); and of camels perhaps 85,000 (again, nearly all from Sudan). Egyptian trade statistics for 1969/70 specified about 2,500 tons of imported frozen meat, divided mainly between Argentine (beef) and China (mutton); and 3,600 tons of canned meat, almost two-thirds of it from China. On the assumption that imported frozen meat is half beef and half mutton and imported canned meat half beef and one-third mutton, total imports (in terms of meat equivalent) would be in the region of 10,000 tons of beef, 3,000 tons of mutton and 21,000 tons of camel-meat.

(a) Some Somali supplies come through the Red Sea port of Safaja but the route is not an easy or convenient one.

(b) Consumption

Official 1968 figures for Egypt's livestock population were: Cattle 2.06 million, Buffaloes 1.94 million, Sheep 1.94 million and Goats 1.13 million[(a)]. 1970 figures for indigenous animals officially slaughtered were: Cattle 343,100, Buffaloes 312,100 and Sheep and Goats combined 424,600. It was considered that these figures should be multiplied by factors of at least 1.75 for cattle and buffaloes and 2.75 for sheep to obtain a reasonable estimate of total indigenous slaughter. This implied off-takes of 29 per cent for cattle, 28 per cent for buffaloes and 38 per cent for sheep and goats, which suggests that Egypt's livestock population is considerably underestimated.

Having increased the slaughter figures by the stated factors and added estimated imports, the consumption picture shown in Table A4.18 was reached (the total human population of Egypt in 1970 was taken to be 33.3 million).

TABLE A4.18 Estimated Meat Consumption, Egypt, 1970

	Total (tons)	Kg/head
Beef	176,500	5.3
Mutton	24,980	0.75
Camel	23,980	0.7
Poultry	96,570	2.9
Total:	322,030	9.65

Egypt is clearly in a very different category from the other countries in this survey with its much larger population, lower income and lower meat consumption per head. Estimates may possibly be low, since a budget survey in 1958/59 found an average per capita consumption of

(a) U. A. R. Statistical Handbook (1970).

13 kg of meat in urban areas and 10 kg in rural areas[a], but it is not improbable that the figure should have fallen since then. The Egyptian pattern is also different because of the emphasis on beef and camel, both cheaper meats, rather than mutton.

(c) Quality Preferences

Egypt is essentially a quantity rather than a quality market and has always been recognised as such by Sudanese exporters. Since Egypt does not operate a market economy, individual preferences have little impact on the total pattern of demand, which is determined to a large extent by the government. However, the Egyptian negotiators for the annual agreement on trade with the Sudan are anxious to improve quality as much as possible and are prepared to give a premium for younger beef. A Sudanese exporter noted that the Egyptians were now pressing for 30 per cent of total cattle exports to be 2-3 year old calves, 20 per cent under 5 years and 50 per cent adults, whereas previously there were no quality requirements.

The Egyptian authorities are willing and equipped to receive imports from the Sudan in the form of chilled meat and recently a Sudanese businessman concluded a contract to supply Egypt with 3,000 tons. The attempt to send chilled meat by air in 1969/70 failed not so much because of Sudan's inability to supply meat of the agreed quality as because of disagreement over what the appropriate price should be.

(d) Prices

Import prices, c. and f. Cairo, agreed for 1970/71 were $12\frac{1}{2}$ pt per kg liveweight for cattle, $13\frac{1}{2}$ pt for calves and 21-22 pt for sheep. Exporters, however, would not accept this price in the following year and at the time of writing no agreement had been reached. So long as the present high costs and risks of transporting livestock via Wadi Halfa and Shellal persist, their requests for higher prices appear justified.

(a) See Amin, G. (1966), Food Supply and Economic Development, Cairo University.

Under present conditions, air-freighting should be distinctly cheaper (see Section 3 below).

In 1971 beef retail prices in Cairo, fixed by government and not indicative of market forces, were as follows (pt per kg):

	With Bone	Boneless
Imported (4-5 years)	0.31½	0.45
Local, 2 years (including buffalo)	0.40½	0.58½
Local beefling (1 year)	0.47	0.65

(e) Duties

None were noted.

(f) Health Requirements

Requirements for live animals are not particularly stringent; cattle are merely required to have been in quarantine for 21 days and sheep must be accompanied by evidence of vaccination against anthrax. Nevertheless, it was reported from Wadi Halfa that the Egyptian veterinary representatives at Aswan had been known to re-quarantine Sudanese animals for a further 21 days after entering Egypt. In the case of animals exported as beef, vaccinations are required ten days before slaughter against rinderpest, anthrax and H.S. Ante- and post-mortems are also specified.

(g) Religious Factors

These do not appear to be significant in the context of meat imports.

(h) Demand Projections and Conclusions

If Egypt's meat consumption were determined by supply and demand, it would almost certainly increase rapidly, as would imports, since substantial expansion in local supply is restricted by shortage of land, competition from cash crops and scarcity of animal feed. However, it is assumed that demand will be controlled at a level of a 1 per cent annual increase in the quantity of all meat consumed per head. Total population is assumed to increase at 2.5 per cent per year and local

slaughter numbers by 2. 4 per cent per year for beef and 3. 9 per cent per year for mutton. The resulting pattern is summarised in Table A4. 19.

TABLE A4. 19 Egypt - Projected Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	266. 9	5. 97	221. 3	45. 6	22. 8
Mutton	37. 8	0. 85	34. 7	3. 1	0. 4
Camel	24. 0	0. 54			
Poultry	157. 8	3. 53			
Total:	486. 5	10. 89			

Egypt will always be useful to Sudan as a mass market for "traditional" quality beef animals, but in economic terms it has the great disadvantage of bringing no foreign exchange returns to the Sudan. Nevertheless, it is in both countries' interests to reduce the present high costs of exporting livestock.

Among those who assisted in this survey were: Dr. Tawfiq Ragab of the General Organisation for Meat; Dr. M. Hadi Maghrabi, Deputy Chairman, U. A. R. General Authority for Supply Commodities; and senior members of the Animal Production Department, Ain Shams University, Cairo.

2. 6 Libya

(a) Imports

Libya's livestock and meat imports between 1966 and 1969 (the last complete year available in official statistics) are shown in Table A4. 20. These demonstrate that imports, especially of live sheep, beef and

TABLE A4. 20 Libya, Livestock and Meat Imports, 1966-1969

Country of Origin	1966	1967	1968	1969
Cattle (Nos.)				
Lebanon	915	1,200	661	100
Tunisia	434	32	-	-
Turkey	336	1,845	50	-
Eastern Europe	814	10,596	16,693	1,748
Others	667	2,308	1,187	1,401
Total:	3,166	15,981	18,591	3,249
Sheep (Nos.)				
Lebanon	49,127	18,125	23,880	13,455
Syria	22,159	11,537	4,689	8,336
Tunisia	4,042	42,996	56,560	30,338
Eastern Europe	107,385	240,206	308,269	406,048
Others	10,910	33,256	49,391	46,871
Total:	193,623	346,120	442,789	505,048
Beef, Chilled or Frozen (Tons)				
Tunisia	323.6	482.3	251.5	505.5
Chad	176.9	37.7	-	-
Sudan	87.9	48.5	5.9	39.6
East Africa	45.0	11.1	12.1	331.3
Eastern Europe	70.1	348.4	298.3	981.3
Others	184.9	268.7	248.9	478.3
Total:	888.4	1,196.7	816.7	2,336.0
Mutton, Chilled or Frozen (Tons)				
Tunisia	489.5	621.3	616.6	558.6
Turkey	-	-	123.2	138.2
China	-	1.5	213.2	-
Australia	10.5	-	10.2	65.2
East Africa	-	-	44.6	53.8
Eastern Europe	60.3	128.5	506.5	846.3
Sudan	15.8	13.5	11.6	9.5
Others	104.8	116.6	55.8	91.5
Total:	680.9	881.4	1,581.7	1,763.1
Canned Meat - Total (Tons)	333.6	392.9	N.A.	709.3

Source: Libya Foreign Trade Statistics.

mutton have been rising very rapidly indeed - a consequence of the rapid rise in income per head in Libya in recent years and the very limited scope for increasing Libyan livestock production. It will be noted that East European countries have, in a very short space of time, taken a dominant position in all four categories of product shown. Sudanese exports of meat, never very significant, declined during this period of overall expansion.

(b) Consumption

Libya's internal statistics were the best encountered during the market survey. Household budget surveys carried out in Tripoli and Benghazi in 1969 indicated an urban income elasticity of demand for meat of about 0. 8, which served as a basis for estimates in other Middle Eastern countries. Average urban expenditure on meat per head was LL. 26. 1 which at prevailing retail prices indicated an urban meat consumption of 33. 8 kg per head per year.

Official slaughter estimates, after some upward adjustment for outside slaughter, fitted fairly well with imports and probable offtake from local livestock (in 1968 population estimates were: sheep 1. 7 million, goats 1. 4 million, cattle 122, 000 and camels 235, 000)[(a)]. With the human population in 1968 estimated at 1. 8 million, it was possible to calculate a national average meat consumption of 21. 8 kg per year. This, in combination with the urban result obtained separately, indicated an average consumption outside the main cities of 17. 7 kg per head. The national pattern of consumption is summarised in Table A4. 21.

TABLE A4. 21 Estimated Meat Consumption, Libya, 1968

	Total (Tons)	Kg/head
Beef	7, 110	3. 9
Mutton	19, 910	11. 0
Camel	11, 215	6. 2
Poultry	1, 200	0. 6
Total:	39, 435	21. 8

(a) Statistical Abstract (1968), Ministry of Planning, Libyan Arab Republic.

Beef consumption is confined mainly to the cities while the high consumption of camel-meat is principally in the desert areas. But the main emphasis, as everywhere else in the Middle East except Egypt, is on mutton.

(c) Quality Preferences

The quality of the desert sheep is preferred but the demand is for young tender animals (10-15 kg carcases), which the East European countries are supplying. Taste in beef is also sophisticated compared with other countries in the region, possibly as a result of Mediterranean influence. Young lean beef and even real veal are in demand among most urban income-groups. Sudanese beef has a poor reputation among private Libyan traders. Imports of live Sudanese cattle (while the Suez canal route was open) were prohibited in 1965 on the grounds that they had led to an outbreak of foot and mouth disease. The discontinuation of the 1970/71 contract for chilled beef between the Libyan Agricultural Bank and the Sudanese Government, apparently owing to a decline in quality, has been a further setback. Nevertheless, if a regular supply of good quality lamb and beef can be provided at a reasonable price and old policies and attitudes can be seen to have been changed, Libyan importers can be expected to be very responsive.

(d) Prices

The market for mutton is probably more competitive than that for beef. The Sudanese Government was offered c. and f. prices of $48\frac{1}{2}$ pt/kg carcaseweight for mutton and 39 pt/kg for beef. East European lamb is imported at a similar price and some undercutting could no doubt occur if Sudanese mutton imports increased substantially. However, the market is not so competitive as Kuwait. The problem of having to freeze chilled meat because of failure to sell it in time seems to arise only infrequently; in any case, the loss is not so great since frozen prices average only 20-25 per cent less than chilled. The Sudanese beef was being imported at a price distinctly lower than that paid for the best "veal" carcases

(45 pt/kg carcaseweight) and marginally less than that for the average older beef carcase ($40\frac{1}{2}$ pt/kg).

(e) Duties

Live animals are not charged duty. Meat imported in pieces weighing less than 10 kg is subject to 30 per cent duty; larger pieces (i.e. carcases) are free of duty.

(f) Health Requirements

Apart from the Lebanon, Libya is probably the country most concerned about health regulations in the Middle East. Cattle whose meat is destined to Libya should be vaccinated with tissue culture vaccine 40 days before slaughter in addition to anthrax and H.S. vaccines. Sheep should be vaccinated against anthrax before slaughter. All carcases are required to be chilled for 24 hours at 20-25°F before despatch.

(g) Religious Factors

There was a campaign last year by Libyan religious teachers against importing meat from non-Muslim countries and this could help to place Sudan in an advantageous position in relation to some of her competitors.

(h) Demand Projections and Conclusions

Assumptions were made with regard to an annual 3.5 per cent population growth rate, a 1.4 per cent increase in income per head and an income elasticity of demand for meat of 0.8. Taste was assumed to move, similarly to elsewhere, away from mutton and towards beef and poultry and local production was allowed, somewhat generously, to increase at 4.6 per cent per year on the grounds that substantial livestock development might take place in Kufrah oasis. The resulting picture is indicated in Table A4.22.

TABLE A4. 22 Libya - Projected Meat Consumption and Import Requirements for Beef and Mutton, 1982/3

	Meat Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	22. 4	7. 63	4. 7	17. 7	12. 1
Mutton	33. 7	11. 44	12. 0	21. 7	15. 8
Camel	5. 4	1. 83			
Poultry	24. 0	8. 14			
Total:	85. 5	29. 04			

Libya is distinctly the most attractive Middle East market for Sudan in terms of price and every effort should be made to secure a place in this market. The quality required is high, but the project proposals should ensure that these can be met. It is important that the next major attempt to enter this market be carefully prepared and that there are no faults in the chilling techniques or transport arrangements.

Among those who gave assistance to this survey were Sayed Achmed Saad Mansur; Achmed Gendy; and the Census and Statistical Department, Ministry of Planning.

2. 7 Lebanon

The market in Lebanon (1970 population: c. 2. 7 million) was not studied in the same detail as others in the Middle East and is therefore described more briefly. The official import statistics for 1970 are summarised in Table A4. 23. Large numbers of live animals are imported from nearby Syria and Turkey, and consequently meat imports are low compared with other countries in the Middle East; most of the meat imported is frozen. Both live animals and meat are imported duty-free. Some livestock and meat products are re-exported to other Middle Eastern countries.

TABLE A4. 23 Lebanon - Livestock and Meat Imports, 1970

Country of Origin		Country of Origin	
Cattle (Nos.)		Chilled and Frozen Beef (Tons)	
Syria	61,716	South America	401.4
Turkey	21,015	Eastern Europe	293.0
Others	115	China	75.0
Total:	82,846	Others	339.2
		Total:	1,108.6
Sheep and Goats (Nos.)		Chilled and Frozen Mutton (Tons)	
Syria	308,476	Argentina	2,470.4
Turkey	235,429	China	362.3
Eastern Europe	51,960	Australia	131.4
Others	1,414	Others	154.2
Total:	597.279	Total:	3,118.3
		Canned Meat (Tons)	
		Total:	2,360.4

Source: Lebanon External Trade Statistics.

The local livestock population is estimated at about 106,000 Cattle, 220,000 Sheep and 450,000 Goats. On the basis of the import statistics and estimated local off-take (with an upward adjustment similar to that applied to the Kuwait statistics), 1970 consumption was reckoned to be of the order indicated in Table A4. 24. The poultry element is probably underestimated.

TABLE A4. 24 Estimated Meat Consumption, Lebanon, 1970

	Total (Tons)	Per Head (Kg)
Beef	26, 140	9. 6
Mutton	41, 660	15. 3
Poultry	1, 080	0. 4
Total:	68, 880	25. 3

Lebanese import prices are low, especially for mutton; the 1970 trade statistics indicate an average c. and f. price of about 35 pt/kg carcase-weight. The relative unattractiveness of Lebanese mutton prices is reflected in the much lower degree of East European competition than in Kuwait or Libya. Average import prices for beef were shown to be about $31\frac{1}{2}$ pt/kg, but Sudanese exporters with connections in the Lebanon estimated that the price for good average quality beef could now be up to $34\frac{1}{2}$ pt/kg. Beef therefore looks a better long-term prospect than mutton, but of the "quality" markets in the Middle East, Lebanon appears the least favourable for substantial penetration, unless very cheap air-freight terms can be obtained.

Health regulations are the most stringent in the Middle East. A large quarantine station was built at the port of Tripoli specifically for the reception and isolation of imported livestock from Africa but the closure of the Suez Canal precluded its use for this purpose and African imports now have to be in the form of meat, which is treated with considerable suspicion. There is a particular fear of foot and mouth disease being introduced by African meat and several consignments of Sudanese meat in the 1960's were destroyed on arrival at Beirut airport. All cattle intended for slaughter and export to Lebanon are required to be vaccinated against this disease with OAC as well as against rinderpest and anthrax. They are also supposed to be kept isolated in special quarantine away from other export animals. It is further specified that all beef (but not mutton) should

be de-boned before export, but this provision is now understood to be under discussion and is expected to be removed. In the 1960's a Sudanese exporter attempted to send boneless beef to Lebanon (at a c. and f. price of about LS. 1.00 per kg), but the boning equipment and the butchers to operate it had to be imported at heavy cost and the process proved uneconomic.

The projected pattern of demand, based on similar assumptions to those used for other importing countries, is given in Table A4. 25.

TABLE A4. 25 Lebanon - Projected Meat Consumption and Beef and Mutton Imports, 1982/3

	Consumption (Tons 000)	Consumption/ Head (Kg)	Local Production (Tons 000)	Imports (Tons 000)	Imports (live and chilled only) (Tons 000)
Beef	43. 2	11. 4	5. 9	37. 3	26. 5
Mutton	45. 7	12. 1	9. 5	36. 2	27. 0
Poultry	29. 2	7. 7			
Total:	118. 1	31. 2			

3. THE CHOICE BETWEEN EXPORTING LIVE AND CHILLED

Certain Middle East countries (Libya and Lebanon) can at present only be supplied with meat by air. Choosing the form in which to export meat to the other countries in the region will depend on:

(a) Consumer preference (e. g. preference for local slaughter in Saudi Arabia).

(b) Availability of alternative forms of transport (e. g. return loads by air are unlikely to be obtained to the Trucial States).

(c) Comparative incidental costs.

(d) The technical efficiency likely to be achieved by Sudan in meat chilling and freighting in the near future.

(e) The requirement of the Sudanese tanning industry for additional hides and skins.

The question of comparative costs is discussed briefly below. Much will depend on the freight rates obtainable from Sudan Airways or air charter companies, but if an average rate is assumed of 6.75 pt per ton/mile (50 per cent higher than the unusually low rate charged by Tradewinds to Libya), and facilities for transporting livestock are improved as recommended in the proposal, the cost differences are often marginal. Sheep entail higher incidental costs per kg when transported live than cattle, so that in most cases, such as the Kuwait example below (where three possible routes exist), it would probably be cheapest to send mutton chilled and beef live, especially when the relatively high value of slaughtered sheep's hides and offals are taken into account. The alternative cost schedules are set out in Table A4.26, though the effect of duty on meat imports has not been included.

The situation with regard to exports to Egypt is particularly interesting. Incidental costs of exporting cattle via Wadi Halfa under present conditions are reckoned to be about 11 pt/kg carcaseweight. Under improved conditions it is expected that these could be reduced to about $7\frac{1}{2}$ pt/kg, while the incidental costs of air-freighting would (on the same basis of reckoning as above) also be $7\frac{1}{2}$ pt/kg (excluding returns from hides and offals). In the case of mutton, air-freighting should be much the cheapest method.

4. CENTRAL AFRICAN MARKETS

A brief market survey was carried out in 1970 by MAP representatives in Zaire and the Central African Republic, which are both importers of meat, predominantly beef. There is already an uncontrolled movement of poor quality beef animals from South West Darfur into the Central

TABLE A4.26 Costs of Transporting Meat to Kuwait by Different Means

	Cattle		Sheep	
	LS/head	Pt/kg Carcaseweight (@ 200 kg/hd)	Ls/head	Pt/kg Carcaseweight (@ 20 kg/hd)
(a) Rail to Port Sudan and ship direct to Kuwait				
Khartoum - Port Sudan[a]	4.18	2.09	0.80	4.00
Freight, etc. Port Sudan - Kuwait[b]	9.00	4.50	2.06	10.30
Feed (8 days)	1.60	0.80	0.40	2.00
Losses	1.00	0.50	0.10	0.50
Total:	LS. 15.78	Pt. 7.89	LS. 3.36	Pt. 16.80
(b) Rail to Port Sudan, ship to Jeddah and truck Jeddah - Kuwait				
Khartoum - Port Sudan[a]	4.18	2.09	0.80	4.00
Freight, etc. and losses Port Sudan-Jeddah	2.60	1.30	0.59	2.95
Feed, Jeddah (1 day)	0.20	0.10	0.05	0.25
Freight, Jeddah - Kuwait[c]	3.44	1.72	0.78	3.89
Losses	0.66	0.33	0.06	0.33
Total:	LS. 11.08	Pt. 5.54	LS. 2.28	Pt. 11.42
(c) Slaughtered in Khartoum and air-freighted				
Quarantine fees, vaccines, feeding in quarantine, etc.	1.80	0.90	0.42	2.13
Slaughter fees	0.60	0.30	0.17	0.85
Chilling[d]		0.12		0.12
Incidental costs to airport		0.25		0.25
Freight, Khartoum - Kuwait		8.37		8.37
Total		9.94		11.72
Credit value of hides and offals[a]	-2.46	-1.23	-1.50	-7.50
Total (crediting hides and offals)		Pt. 8.71		Pt. 4.22

(a) See Appendix III.

(b) Assuming return load.

(c) At 1,100 Saudi Riyals per truckload of 27 cattle; or

(d) At LS. 48 per 40 tons (capacity of chilling room) per day.

African Republic and there appear to be possibilities of placing the trade on a more regular basis, with half the payment for Sudan's exports coming in foreign exchange form and half in kind. It is thought that a market exists for 10-12,000 cattle per year. During the survey the sale was observed of about 50 scrub animals (about 200 kg liveweight) for the equivalent of LS. 9.50 per head. Their purchase price in Darfur was probably below LS. 7.50.

Zaire is at present importing substantial quantities of air-freighted beef from Chad, but while retail prices in the capital, Kinshasa, are reported to be high (70 pt/kg for bone-in Chad beef), the c. and f. price quoted was 27 pt/kg and air-freight costs were high - 15 pt/kg. Unless much cheaper freight rates can be found or changes are made in the monopolistic buying structure, Zaire cannot be regarded as an attractive market at present.

Any expansion of trade with Central or West Africa would clearly be directed from Nyala or Wau rather than Khartoum.

APPENDIX V

TRANSPORT

1. RAILWAYS

1.1 Present Movement of Livestock from West Sudan

Information was obtained from various railway stations (Nyala, Babanusa, Kosti, El Obeid and Wad Medani) on the number of livestock transported from stations in their respective regions in recent years. Records were also obtained from Atbara relating to livestock transported by rail from western stations between January 1969 and June 1971. Unfortunately, the Atbara records rarely corresponded to those of the regional stations and the same applied at the local level (e. g. the Nyala and Ed Da'ein figures supplied by the stations concerned were different from those supplied by the regional headquarters at Babanusa). It is suggested that these anomalies be investigated.

Nevertheless, figures were usually of a similar order and some useful (if tentative) conclusions can be drawn from them. The relative importance of different sectors as suppliers of livestock (based mainly on the Atbara figures) is shown in Table A5. 1. The two centres which rail the largest numbers of livestock are El Obeid and Nyala. Few cattle are railed from Blue Nile Province, but there is a notable movement of sheep from the Kosti, Sennar and Singa areas between July and September. This is the period when the Watish breed come onto the market; having to travel less far than the western sheep to reach the Gezira and the Three Towns, they are presumably better able to withstand the heat during travel at this time of year.

It is noticeable that the lowest number of sheep movements from the west occur in the summer, with the peaks coming in the winter months when supplies are greatest, whereas the opposite applies in the case of cattle. This suggests that cattle are usually trekked for

TABLE A5. 2 Seasonal Variations in Livestock Movements by Rail, 1970

	Arrivals Khartoum	Consumption Three Towns[a]	Exports[b]	Total Consumption and Exports	Percentage of Marketed Animals railed
Cattle					
January	2,918	8,287	6,496	14,783	20
February	574	5,938	1,293	7,231	8
March	1,008	7,710	2,697	10,407	10
April	1,868	7,066	3,155	10,221	18
May	1,760	7,091	1,154	8,245	21
June	1,445	6,039	2,061	8,100	18
July	602	7,174	329	7,503	8
August	2,251	7,479	-	7,479	30
September	1,706	7,773	-	7,773	22
October	897	8,520	1,255	9,775	9
November	374	7,344	4,183	11,527	3
December	557	8,878	1,734	10,612	5
Total, 1970	15,960			113,656	14.0
Sheep					
January	13,022	39,801	45,500	85,301	15
February	15,893	77,008	29,275	106,283	15
March	1,520	34,530	19,325	53,855	3
April	4,769	33,947	12,750	46,697	10
May	3,095	37,606	7,747	45,353	7
June	210	35,101	6,200	41,301	0.5
July	3,985	32,344	1,355	33,699	12
August	23,955	33,216	-	33,216	72
September	14,115	41,368	697	42,065	34
October	16,579	38,376	11,120	49,497	33
November	12,671	37,158	24,790	61,948	20
December	15,306	35,656	18,107	53,763	28
Total, 1970	125,120			652,978	19.2

(a) Omdurman slaughterhouse figures for cattle, and Omdurman slaughterhouse figures + 80 per cent (+50,000 at Eid el Bairam) for sheep.

(b) MAP figures.

TABLE A5. 3 Livestock Consignments by Rail to Port Sudan (December 1971 - January 1972)

Date	No. of Sheep	No. of Cattle	Date	No. of Sheep	No. of Cattle
1. 12. 71	100	-	3. 1. 72	400	-
2. 12. 71	800	-	5. 1. 72	400	-
6. 12. 71	500	40	6. 1. 72	1, 500	20
7. 12. 71	1, 100	-	7. 1. 72	400	-
8. 12. 71	400	-	8. 1. 72	600	-
10. 12. 71	-	20	9. 1. 72	600	-
11. 12. 71	300	-	10. 1. 72	600	-
12. 12. 71	800	-	11. 1. 72	100	-
13. 12. 71	500	-	12. 1. 72	2, 600	-
14. 12. 71	100	20	14. 1. 72	1, 100	-
15. 12. 71	1, 700	-	15. 1. 72	800	-
16. 12. 71	500	-	16. 1. 72	200	-
17. 12. 71	-	-	17. 1. 72	200	-
18. 12. 71	400	60	18. 1. 72	1, 500	-
19. 12. 71	1, 200	40	19. 1. 72	1, 100	-
20. 12. 71	-	-	20. 1. 72	900	-
21. 12. 71	500	20	22. 1. 72	100	-
22. 12. 71	500	-	23. 1. 72	200	-
23. 12. 71	1, 500	40	25. 1. 72	100	-
24. 12. 71	-	40	26. 1. 72	100	-
25. 12. 71	400	-			
26. 12. 71	600	40			
27. 12. 71	200	-			
28. 12. 71	200	120			
29. 12. 71	200	-			

Source: Port Traffic Superintendent, Port Sudan.

refrigerated wagons (18 ton capacity) which were used for carrying bananas and may shortly be reactivated for transporting fruit from Kassala. These would not be capable of sufficient refrigeration to carry frozen meat.

Estimation of the present demands made on railway wagons for transporting livestock is complicated by apparent inconsistencies in the railway records. Even allowing for the fact that the figures for individual stations used in the section above are not complete for the whole of Sudan, the figures published by Sudan Railways of livestock transported internally and for export appear to be too high. Nevertheless, even if these higher figures are accepted, it is apparent that with a reasonably efficient operational system (e. g. using complete livestock trains), Sudan Railways could cope with the present level of demand using Haywan wagons alone and having no recourse to Hadid wagons. This can be deduced from the following assumptions:-

(a) a "local" throughput of 41, 500 cattle and 325, 000 sheep per year; and an export throughput of 26, 000 cattle and 242, 000 sheep per year (official estimates for 1969/70 - the highest level in recent years);

(b) livestock trains with 35 wagons (770 cattle or 3, 500 sheep) on export runs and with 25 wagons (550 cattle or 2, 500 sheep) on local runs;

(c) average turn-round times of 12 days on local runs and 4 days on export runs.

On the basis of a 300-day year, the requirement would be for 103 export journeys and 206 local journeys per year; these could be performed by 2 export trains and 9 local trains, or 295 wagons in all.

1. 4 Future Wagon Availability and Requirements

Calculations of requirements in the near future are based on the same assumptions as in Section 1. 2 above, except that export throughput was taken to be 51, 000 cattle and 390, 000 sheep (the maximum

potential exports for 1972/3 - see Volume II, Table 1.4) and the local throughput 101,000 cattle and 615,000 sheep (animals eventually destined for export plus 50 per cent of estimated Three Towns consumption). On this basis, requirements for cattle alone would be 66 export journeys and 184 local journeys per year; these could be performed by 1 export train and 8 local trains, or 235 wagons in all.

Theoretically, this would leave 76 Haywan wagons available for sheep transport. Sheep exports could be achieved by 2 export trains, or 70 wagons, and the local traffic would require 10 trains, or 250 wagons. However, this would mean putting heavy reliance on Hadid wagons, especially up-country, which would be undesirable. More covered wagons will be required and it is logical that these should be double-deckered, if possible.

The provision of 35 double-deck wagons for export (giving a train-load of 7,000 sheep) would be amply sufficient to handle an annual load of 390,000 sheep and could be transferred to up-country work at certain times of the year, especially summer. Twenty-five double-deck wagons used permanently on up-country runs could take 125,000 sheep per year (or about 20 per cent of the total traffic), while the Haywan wagons not used for cattle could accommodate an additional 187,500 (or about 30 per cent). The remaining 50 per cent would have to be carried in open wagons.

2. LAKE NUBA BARGES

In estimating the capacity of the present fleet, it can be assumed to consist of four units, each including two barges. Each of these units can carry 300 cattle or 1,100 sheep. Assuming a turn-round time of 8 days, 37 journeys would be possible in a 300-day year. Total estimated exports to Egypt in the near future are not likely to exceed 25,000 cattle and 20,000 sheep per year (Volume II, Table 1.4) - or about 31,000 cattle equivalents. If supplies to Wadi Halfa were made on a regular basis, the present fleet should be capable of carrying almost 41,000 cattle equivalents per year.

In practice, the necessary coordination is missing, and because arrivals of livestock at Wadi Halfa are erratic and irregular, major delays occur before consignments can be cleared. A particularly unfortunate situation was witnessed in January 1972 when, after a period of over a month without any livestock arrivals, several consignments of sheep (intended to reach Cairo before the Eid el Bairam) were sent to Wadi Halfa in quick succession. The way in which delays built up are indicated in Table A5. 4.

TABLE A5. 4 Sheep Arrivals and Departures at Wadi Halfa, January 1972 (situation as at 21. 1. 72)

Consignment No.	Arrival Date	No. of Sheep Arriving	Departure Date	No. of Sheep Departing
1	2 January	3,000	7 January	2,100
			7 January	897
2	6 January	3,000	7 January	603
			9 January	500
			11 January	600
			18 January	1,100
			19 January	147
3	11 January	3,000	19 January	1,326
			20 January	500
			(Remainder unshipped at 21. 1. 72)	
4	13 January	400	(Unshipped at 21. 1. 72)	
5	16 January	2,700	(Unshipped at 21. 1. 72)	
6	19 January	2,500	(Unshipped at 21. 1. 72)	

Employment on the lake of the four new units (two barges each) now at Aswan, each capable of carrying about 600 cattle or 2,000 sheep and an average turn-round time of 6 days, would bring an additional capacity of up to 120,000 cattle equivalents per year, which is a far larger throughput than is likely to occur in the foreseeable future. If delays continue after the provision of the new barges, they will be solely the consequence of bad organisation and the Marketing Agency will be required to help in overcoming whatever problems arise.

3. SHIPPING AT PORT SUDAN

3.1 Port Sudan - Jeddah

Two Sudanese ships (the S. S. Sudani and S. S. Suakin, capable of carrying 4, 200 and 3, 600 sheep respectively, and owned by the September Trading Corporation) were used regularly for transporting livestock to Saudi Arabia until their withdrawal from service in mid-1971 and sale the following October. Their importance in the overall context of livestock exporting and the effect of their withdrawal are illustrated in Table A5. 5 below.

TABLE A5. 5 Livestock Shipments, Port Sudan - Jeddah, 1970-1971

	No. of Journeys		No. of Sheep Equivalents Carried		Av. No. of Sheep Equivalents per Shipment	
	Sudani/Suakin	Other	Sudani/Suakin	Other	Sudani/Suakin	Other
Jan-June '70	32	10	113, 647	16, 055	3, 551	1, 606
July-Dec '70	9	9	25, 353	18, 489	2, 817	2, 054
Jan-June '70	22	10	66, 758	28, 301	3, 034	2, 830
July-Dec '71	-	13	-	9, 663	-	743

Source: Port Traffic Superintendent, Port Sudan.

Total figures are substantially lower than the official export figures (the reason for this discrepancy is unknown), but the overall pattern is convincing. The fact that the size of shipments has declined so markedly since the withdrawal of the Sudanese vessels presumably reflects exporters' lack of confidence in obtaining regular transport for large consignments.

The size of the livestock vessel required to operate between Port Sudan and Jeddah has been determined by (a) the capacity of livestock trains between Khartoum and Port Sudan and (b) the potential market shares estimated in Volume II, Table 1. 4. On this basis, annual traffic to Jeddah could be of the order of 360, 000 sheep and

21,000 cattle in the near future, rising towards 560,000 sheep and 43,000 cattle in 1982/3. A vessel with capacity of 6,000-7,000 sheep or 1,300-1,550 cattle could, assuming a 300-day working year, carry the former load in 75 sailings per year (an average of 4 days turn-round period). The latter would require 120 sailings per year, or an average of $2\frac{1}{2}$ days turn-round. With faster loading techniques than used at present and improved docking facilities (especially at Jeddah, where the port is being modernised and expanded), this should be feasible. Records show that at times of fairly heavy exporting, even the Sudani and Suakin were capable of turn-rounds of 2-3 days (see Table A5.6).

TABLE A5.6 Movements of S.S. Sudani and S.S. Suakin (January-February 1970)

S.S. Sudani		S.S. Suakin	
Arrival Port Sudan	Departure	Arrival Port Sudan	Departure
6.1	6.1	2.1	3.1
17.1	18.1	6.1	7.1
20.1	25.1	10.1	10.1
27.1	27.1	13.1	13.1
30.1	31.1	15.1	17.1
3.2	3.2	3.2	4.2
9.2	9.2	7.2	7.2
12.2	9.3	11.2	12.2
		15.2	21.2
		24.2	24.2
		27.2	28.2

Source: Port Traffic Superintendent, Port Sudan.

Investigations revealed that a livestock carrier (built 1948, 2,515 dwt., 2 decks, speed of 13 knots) with a capacity of about 8,000 sheep was being offered for sale at US$500,000. It is assumed that a

smaller but newer vessel of the same type could be purchased for about this price. The cost of diesel oil consumption at 9 tons per day was estimated at LS. 85 daily and the cost of crew at LS. 80-100 per day; total running costs, including insurance and maintenance, were estimated at about LS. 250 per day or LS. 90,000 per year on average, though they would clearly vary according to the amount of freight carried. Cost estimates used in the calculations of the shipping company's repayment capacity in Appendix X are based on these assumptions.

3.2 Port Sudan - Arabian Gulf

There are at present no ships moving regularly between Port Sudan and the Gulf and such exports of livestock as have been made in recent years to places such as Kuwait and Qatar have been routed via Jeddah and then sent on by truck. The only recent use of the sea route round the Arabian peninsula was in October 1971, when a consignment of sheep was sent to Abu Dhabi for Ramadan.

Dubai, Abu Dhabi and Bahrain can be reached only by sea at present (air connections are a possibility in the future with Bahrain but unlikely in the case of the other two places). There are two possible ways in which these markets could be supplied:-

(a) By chartering Kuwaiti ships to take livestock as a return load to the Gulf after off-loading fertiliser in Port Sudan. At present about two shipments of fertiliser per month are being delivered from Kuwait to Sudan as part of a five-year contract, but the vessels are not returning directly to Kuwait. These ships should have space for 6,000-8,000 sheep equivalents.

(b) By the possible purchase of livestock ships by the Sheikh of Abu Dhabi, who is reported to be interested in doing so in order to obtain regular supplies of livestock direct from Sudan.

4. ROAD TRUCKS FOR LIVESTOCK

Mention was made in Volume II, Section 1. 13, of the possibility of moving livestock from the proposed APC schemes by road from Gedaref and El Masid to El Kadaro for slaughter, once the new Wad Medani-Gedaref road is completed or, if feasible, before then. Whether trucks with trailers (or semi-trailers) would be an economic alternative to using rail transport, in addition to providing greater flexibility, would have to be determined by the APC headquarters staff. Initial purchases might have to be made by the APC itself but if operations were financially attractive it would be preferable for them to be taken over by private haulage contractors, who would be more likely to ensure full use of the trucks by taking additional private livestock consignments and organising return loads.

If trucks with ten-ton capacity were used (carrying 27 cattle or 250 sheep, double-decked), each load would be sufficient to provide the equivalent of half the average requirement of an air-freighted consignment of meat. Two journeys would therefore have to be made for each consignment (or possibly the alternative of trucks with 20-ton capacities might be considered). Calculations of vehicle requirements have been made on the assumption that round trips from the Gedaref area to El Kadaro or to El Masid will take two days and round trips from El Masid to El Kadaro will take half a day. Combined with the estimates of off-take from the Gedaref cattle feedlot, the Qala' en Nahl sheep ranches and the Gezira sheep finishing area, these assumptions indicate that purchases would need to be made on the basis of one ten-ton truck in each of the following years of production: two, three, four, five and seven. A fleet of five trucks would probably remain sufficient until year twelve, when another would be required.

The total cost of a ten-ton livestock carrier could be expected to be in the region of LS. 11, 000, of which LS. 7, 200 would be in foreign exchange and LS. 3, 600 in duties.

APPENDIX VI

PROCESSING

1. THE KOSTI MEAT FACTORY

Several factors contributed to the failure of the meat factory operated by Liebig at Kosti between 1952 and 1957, but the main cause was a failure to obtain cattle at sufficiently low prices. Carlisle and Randag of Liebig's[(a)] have stated that the venture was based on the assumption that the corned beef produced would be sold in the U.K. with tariff protection, but when the Sudan became independent a 20 per cent import duty had to be paid which made further competition impossible. However, Khalifa[(b)] has shown that the factory was in trouble long before 1956 with regard to obtaining the supplies of cattle it required. The following paragraphs are taken from his recent thesis which studied the supply response of nomadic cattle producers to price changes:

> "In 1952/53 Liebig established a canning factory at Kosti in the Sudan which was operated by their subsidiary 'Sudan Meat Products' with a share capital of one million pounds...
>
> "The Kosti factory was intended to process 50,000 cattle per annum mainly from the Baggara nomad producers of Darfur Province. The meat products were mainly canned corned beef with limited quantities of meat extract and canned stewed steak ... The factory was located at Kosti as a convenient location for the cattle supplies of Darfur, Kordofan and the Southern Provinces. Kosti is also nearer to Port Sudan than Nyala, hence transport costs are lower for exporting. Furthermore Kosti lies on the Nile which on occasions can be used for cheap transportation and for dumping the factory waste.

(a) Carlisle, K.R.M. and A.C. Randag in 'Change in Agriculture' (1970), ed. H. Bunting, pp. 229-235.

(b) Khalifa, A.H. (1969), An Economic Appraisal of the Prospects of an Export Oriented Cattle Industry in the Sudan, Ph.D. Thesis, Leeds University.

"To the disappointment of the company only few cattle were available. For the whole five year period (1952-1957) the factory processed only 80,000 cattle[(a)], whereas its potential capacity was 250,000. Hence only one third of the full capacity was utilised.

"Besides difficulties arising from the supply shortage the producers' price per head increased more than expected.... Some idea of the situation that faced the company can be gained by examining the performance of the Nyala livestock market. Being the largest producer market, Nyala was chosen as the location of the company's buying office for nomad cattle. There was a decline in numbers marketed from 1952 to 1955, with supplies settling at a low level from 1955. Cattle supplies to the market during 1954 to 1958 averaged 19,000 head annually, compared with the average of 21,000 head over the whole post was period. There were also price increases during this period with the peak period being reached in 1957, when the price per head reached LS. 10.3, over 50 per cent above the average price of LS. 6.8 for the post war period."

Khalifa attributes this situation not to a perverse supply response on the part of the nomads but to poor buying policies by Liebig's and heavy competition from the traditional exporters of cattle to Egypt:

"If the factory were to succeed and expand, some form of co-ordination in the marketing channel had to be organised. The company tried to enlist the support of cattle merchants by giving them the opportunity to suscribe part of its one million pound share capital. Only 0.5 per cent of the total share capital was taken and this by one merchant who withdrew it two years later.

The company had to enter the market as a new independent buyer with a purchasing target of 50,000 cattle per year. The company,

---

(a) 1952/3: 4,000; 1953/4: 30,000; 1954/5: 19,000; 1955/6: 15,000; 1956/7: 12,000.

therefore, was the largest potential buyer and any future expansion would have increased its importance. Obviously the company presented a growing threat to the merchants' long established interest. They acted accordingly and adopted a policy of denying the factory cattle supplies.

Their first action was to by-pass the Nyala market where the company's buyer, an Englishman, was stationed. The merchants' agents, through their detailed knowledge of the nomads' movements and settlements over hundreds of square miles, were able to contact them at their camps and purchase their cattle. Other rather more dubious practices were adopted. One Sheikh accepted a large bribe to ensure none of his tribesmen sold cattle to the factory's buyer. Incidents of ambushes on the cattle route from Nyala to Kosti factory have been reported and losses were substantial ..... Obviously the established traders were at a considerable advantage over the English buyer, and the final result was that they drove Liebig out of the Sudan.

Having acquired these additional animals, the trade proceeded to export them to Egypt. Average annual exports rose to 70,000, an increase of 265 per cent over the annual average in the preceding period 1946-53. During one year alone, exports increased by 511 per cent and exceeded the home slaughterings by a third.

All these exports were bound to affect market conditions. The pressure of merchants' demands pushed the producer price from an annual average of LS 5.8 per head during 1946-53 to a peak of LS 10.3 in 1957."

2. PROCESSING FOR PET-FOOD

While there are strong economic arguments in favour of Sudan's exporting mutton and beef either live or in chilled form rather than canned or frozen, there appears to be some future for the development of small factories processing offals and condemned meat for pet-food. Several

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While there are strong economic arguments in favour of Sudan's exporting mutton and beef either live or in chilled form rather than canned or frozen, there appears to be some future for the development of small factories processing offals and condemned meat for pet-food. Several

private businessmen interviewed in Sudan claimed to have had requests for the supply of frozen offal and meat for this purpose (mostly from the U.K.) and one is known to have applied for a licence to set up a processing factory. The main problem is likely to be the lack of freezer wagons to transport the processed meat from Khartoum North to Port Sudan, but the businessman concerned has reported that he is investigating the possibilities of obtaining (or manufacturing) liquid nitrogen to supply the necessary refrigeration to ordinary container wagons.

3. HIDES AND SKINS IMPROVEMENT

Although the more sophisticated processes in the hides and skin sector are attracting substantial investment, there would seem to be room for further investment at a more modest level aimed at improving hide and skin quality in the rural areas. The hides and skins section of the MAP produced the following cost estimates (for establishment and first year's operation) for a Mobile Hide and Skin Improvement Unit which would aim to raise present standards of flaying, drying and trading (three might be required in all - one each for Darfur, Kordofan and Kassala Provinces):

Item	Estimated Price (LS)
Office	3,000
Vehicles and equipment	11,000
Hides Officer	530
2 Hide Overseers	500
3 Flaying Demonstrators	500
4 Hide Graders	1,200
4 Labourers	500
2 Drivers	400
12 Tents	n.a.

The need was also emphasised to establish more permanent rural markets which would give an opportunity to convey the significance of quality differences to the producer through the application of sharply

differing grades. This could be an additional function of the Mobile Unit, which would need to have a marketing officer attached to it for the purpose. If a pilot area were to be chosen for this venture, it is suggested that it should be the Bahr el Arab, since the establishment of regular hide and skin markets in this area could also lead to their becoming more substantial centres for the sale of live animals as well.

In the interests of hide and skin improvement, the officer also expressed the need for new slaughterhouses at Port Sudan, Wad Medani and El Obeid. This need was confirmed by MAP officials in the towns concerned. It was considered that buildings should be provided with cover, proper drainage and a similar line system (on a smaller scale) to that at Omdurman and machinery for processing by-products, at a total estimated cost of LS 20,000 each. There was also a request for the further provision of small slaughterhouses in smaller towns and rural areas, ranging from a type processing 100 cattle and 150 sheep daily costing LS 10,000, to one for 5 cattle and 10 sheep at LS 1,500.

APPENDIX VII

AGRICULTURAL CREDIT, WITH PARTICULAR REFERENCE TO THE LIVESTOCK SECTOR

1. INTRODUCTION

The principal sources of agricultural credit in Sudan are private money lenders, commercial banks and the Agricultural Bank of Sudan.

Private money lenders, operating usually at village level where they have a close knowledge of local farmers, advance funds for production and living expenses against pledge of the crop which they purchase at substantially less than the free market price. The incidence of village money lenders is diminishing gradually with the development of various government sponsored crop marketing schemes but they are still the only source of credit to many small farmers.

Commercial banks have confined their agricultural lending mostly to the financing of crop exports which permits quicker returns at lower risks than production financing. The minimal production credit provided in recent years has been restricted to large scale producers who can provide adequate security.

2. THE AGRICULTURAL BANK OF SUDAN

The Agricultural Bank of Sudan (ABS) was established by Government in 1957, with an authorised capital of LS 5 million, to provide an alternative source of credit to small and medium scale farmers. Although the legislation for the establishment of the Bank was enacted in 1957[(a)] the Bank did not commence operations until 1959 when a crisis in the cotton industry led to a withdrawal of commercial bank finance to private growers. The ABS was required, as a matter of extreme urgency, to take over this function. The financing and marketing of the cotton crop

(a) Act of Parliament No. 19 of 1957.

continued to be the Bank's principal activity until 1968, although it gradually assumed responsibility for the financing, storage and marketing of other crops including the management of two large grain silos which had been built with external aid funds.

In 1968 the Agrarian Reform Corporation took over the financing of the private growers' cotton crop, thus depriving ABS of its principal source of revenue arising from its cotton export activities, but leaving it with substantial irrecoverable debts in respect of cotton production loans. Many of these loans had been made, and firm action to effect their recovery inhibited, in compliance with Government policy. It was not possible for the Consultants to obtain precise details of the total amount of irrecoverable loans, but it is estimated that (inclusive of the residue of LS 750,000 of agricultural loans from various Government schemes which were transferred to the bank as part of its original capital) over LS 4 million must be regarded as irrecoverable. It is understood that discussions are proceeding between ABS and the Bank of Sudan (which assumed control of ABS on behalf of Government in September 1971) to resolve this situation.

The ABS is managed by a Managing Director, who is the chief executive, and a Board of Directors appointed by Government. Since the Bank of Sudan assumed responsibility for ABS it has also effectively appointed the Directors. Authorised share capital was increased in 1968 to LS 7 million and subscribed capital at the end of the 1970 financial year totalled LS 6,079,000.

The ABS is permitted by its legislation to make three types of loan:-

(a) Short term loans for production and marketing expenses which are normally issued for a period not exceeding 15 months.

(b) Medium term loans for such purposes as the purchase of farm equipment, machinery and livestock, the improvement of irrigation facilities, the consolidation of land and

the repair of farm buildings and warehouses. Medium term loans are normally for a period not exceeding five years.

(c) Long term loans for investments of longer maturity such as the installation of irrigation facilities and purchase or construction of farm buildings. Such loans are repayable with a period not exceeding ten years.

The ABS requires security to be provided for all loans and customarily the value of the security must not be less than 30 per cent in excess of the amount of the loan. Short term loans may be secured by moveable property including crops but medium and long term loans must be secured by immoveable property such as land and/or buildings.

Interest is charged at 7 per cent per annum on short term loans and at 9 per cent per annum on medium and long term loans except that interest charged to co-operative societies is 7 per cent per annum irrespective of the term of the loan.

It is claimed that the ABS adheres strictly to its security requirements, indeed, a criticism levelled by some potential borrowers is that it is too strict. Provided it is permitted to exercise its rights against recalcitrant borrowers the bank should be able to recover all medium and long term loans. However, in the case of short term loans recovery the bank is dependent on the vagaries of climate and markets and it is suggested that if bad debts are to be minimised in the future, the bank must be permitted to take prompt action against wilful defaulters.

The ABS is adequately staffed to fulfil its present functions but the procedures for providing up-to-date accounting information are considered to be entirely inadequate. In February 1972 the accounts for the financial year ended 30th June 1971 had not been completed. Unaudited accounts for the half year ended 31st December 1970 and audited accounts for the financial year ended 30th June 1970 were not

considered a satisfactory basis on which to form a judgement of the bank's recent performance. The accounts are audited by two external firms and a comment to the June 1970 accounts was to the effect that ABS internal audit and inspection system was unsatisfactory. In view of the considerable distances between the bank's branches and the difficulties of communications, it is imperative that the ABS should instigate an efficient and active inspection and audit system and it is recommended that immediate measures be taken to reinforce the Audit Department.

It is also important that the accounts for the financial year ending 30th June 1971 be completed as speedily as possible so that agreement can be reached between Government, Bank of Sudan and the ABS on the rationalisation of ABS's finances and the proposals can be implemented without delay. When such rationalisation has been completed and an efficient internal inspection and audit system brought into operation the ABS could be considered a suitable medium for administering external funds for development of the livestock sector.

3. FUTURE CREDIT REQUIREMENTS IN THE LIVESTOCK SECTOR

Lack of bank credit is not considered to be a constraint to the development of livestock production in its present form. Neither would it be practicable to provide credit to the vast majority of producers who are landless nomads, were this required. The need for some form of institutional credit will arise, however, if landowning or established tenant farmers are to be assisted to take up livestock production as an alternative or as an adjunct to crop production. Credit will be required for the purchase of breeding stock, the improvement of pastures and the provision of fencing and water supplies.

A demand exists for credit for marketing, particularly among dealers who hold animals for fattening before sale to the domestic market or for export. The operations of such dealers are restricted by the fact that they are unable to obtain credit (apart from the

traditional 15-30 days delayed payment terms) against their stock-in-trade, namely the livestock. This is a type of credit which the bank could well consider providing. Loans should be for a period of not more than four months and should be secured by a lien on all the dealer's livestock and be limited to fifty per cent of the assessed market value of the livestock at the time of loan approval. The lien on the livestock would provide for all sales to be made through the proposed marketing organisation.

APPENDIX VIII

SOILS FOR IRRIGATED LIVESTOCK ENTERPRISES (KHARTOUM AREA)

1. GENERAL DISCUSSION OF RELEVANT AREAS

It is very unlikely that any really good soils remain unused anywhere in the vicinity of Khartoum. Three sites are discussed in this appendix, all of which have been examined at some time at about the semi-detailed level: they are the Soba Fattening Scheme, Khartoum North - Wad el Garaga and Laota-Faragin (in the northern end of the Gezira Scheme).

1.1 Soba Fattening Scheme

During a survey of irrigable lands in the northern Gezira 14 sites within the boundaries of the Soba irrigated area were examined[(a)]. The whole area was classified as land class 6as with salinity and alkali levels unacceptably high for irrigated crops. The main crop under consideration was cotton, which to some extent is tolerant of salinity and alkali conditions, consequently the land would not have warranted a better rating for most other crops. Some analytical data are available for 12 of the 14 sites studied and all except one were placed in class 6. The exchangeable sodium percentages of the upper soil ranged between 4 and 52 with an average value of 20. The electrical conductivity had a range from 1.2 to 15.2 millimhos/cm. Lands with alkali and salinity in these ranges are considered to be unsuitable for general irrigation development, but may include small localised areas of better soils capable of irrigation. This appears to be the case, for the area is visibly very variable and a detailed survey before development would have facilitated more successful development of the better lands.

(a) Hunting Technical Services and Sir M. MacDonald and Partners, Roseires Soil Survey, Report No. 1, Gezira Extension Area, Soil Survey and Land Classification, 1963.

Reclamation of the more saline and alkali soils using good quality water from the Blue Nile should be technically possible but would take a very long time (5-10 years). In addition, the method required, including very heavy and frequent irrigations, precludes sustained cropping while reclamation is in progress. The cost of such measures would be prohibitive and consequently large scale animal production in the Soba area based on irrigated fodders is unlikely to be economic. The problems of reclamation at Soba are discussed further below.

1. 2 Khartoum North-Wad el Garaga

The development of a new irrigated livestock enterprise in this area was considered as it is conveniently close to both the proposed slaughterhouse and the quarantine station at Kadaro. However, such a scheme has been ruled out for the present on economic grounds, but the comments which follow also have relevance to the proposed extension to the Kuku Scheme.

The area was included in a soils reconnaissance study in 1963[(a)]. The purpose was to identify possible development areas for more detailed study, but the lands north of Khartoum were considered to be unsuitable for this. As for the Soba area survey suitability for cotton was an important factor.

The specifications for the survey called for only limited laboratory investigation, hence, many of the sites examined do not have data on salinity or alkalinity. The profile descriptions are available and show considerable textural variations within and between profiles, with gravel, local surface irregularities and some problems with excessive slopes.

The two profiles within the area for which analyses are available are both alkali soils except in their light textured surface horizons; one is non-saline but the other is saline at depth. Scrutiny of analyses

(a) Hunting Technical Services and Sir M. MacDonald and Partners, Roseires Soil Survey, Report No. 2, Blue Nile East Bank, Guneid to Khartoum - Soils and Engineering Reconnaissance, 1963.

for similar soils outside the area proposed for development shows that alkali conditions are general and salinity sporadic. The soils clearly have problems and it is essential that development should be on the better soils. A detailed soil survey should precede the future selection of lands and we recommend an intensity of examination of 12 sites per square kilometre. An appropriate mapping scale would be 1:20,000. Because classification will depend on salinity and alkali the survey will require full supporting chemical data. The survey should, of course, include sampling on contiguous areas which have already been developed (El Qureshi and Kuku irrigated areas) for comparative purposes.

1.3 El Laota-Faragin

These lands are to be taken progressively out of the Gezira cotton rotation and livestock production is a likely alternative use. The soil has been irrigated for many years on a wide rotation, based on cotton and sorghum. The choice of the best pasture to replace the low yielding cotton will require experimentation, using in the first place the crops such as lucerne, clitoria, forage sorghum and Dolichus lab lab for which experience is available. In the choice of land it would be reasonable in the first instance to rely on past experience with cotton, precise information for which is available from the Gezira Board in terms of 10 feddan holdings. Reference may also be made to the FAO - Soil Survey Division semi-detailed mapping of the area[(a)]. The maps however, are not of sufficiently large scale for use in the selection of development areas. The soils were classified in land capability classes 2a and 2p. The former are alkali soils and in fact include rather high values of exchangeable sodium and on the standards of the soil survey of the Soba area some of the higher values would have placed the soils in class 6a. The 2p lands have various ill-defined physical soil restrictions.

For many years these soils grew cotton successfuly but were characterised by lower yields than the southern Gezira. There is therefore no reason to suppose that these lands cannot be used for growing

(a) FAO, The Sudan, Semi-detailed Soil Survey of Parts of the Central Clay Plain, Rome, 1970.

pasture crops. The FAO - Soil Survey Division report gives suitability ratings for various Gezira soils for a range of crops. In general the soils are considered to be better suited to cotton than other crops. For example Suleimi clay, second class for cotton, is third class for lucerne and wheat, and second class for planted pasture.

Although lands available within the Gezira may not be ideally suited to the development of planted pastures or the cultivation of fodder crops, nevertheless the El Laota - Faragin area has distinct advantages over the two other sites discussed above. It is considered that provided areas for irrigated fodder production are carefully selected and given reasonable standards of management, sustained yields of fodder could be achieved.

2. SOBA SOILS AND RECLAMATION PROBLEMS

About 60 per cent of the present area of the scheme was covered by the semi-detailed soil survey carried out in 1962/63[(a)]. Fourteen sites were examined in what is now the Soba irrigated area and these fall into five different soil classes.

A subjective estimate on the ground and from the air suggests the following very approximate distribution of these soils over the Soba area.

Code	Soil Type	No. of Sites Examined	Approx. per cent of Soba Area
V 9	Netrargidic Mazustert: saline series	4	±35
E 5	Orthic Orthustent: non-saline/alkaline series	5	±30
V 1	Orthic Grumustert: saline series	2	±15
E 6	Orthic Orthostent: non-saline/non-alkaline series	2	±10
V 2	Orthic Grumustert: non-saline series	1	±10

The whole area was placed in land class 6as on account of generally

(a) Hunting Technical Services and Sir M. MacDonald and Partners, 1963, op. cit.

high saline/alkaline levels, this land class being described as: "non-irrigable due to an EC in the surface soil of over 5. 3 and/or in the 30 to 90 cm layer of over 8 and an ESP in the topsoil of over 15 and/or an ESP in the 60 to 90 cm layer of over 20".

Inspection of present cropping in the scheme shows clearly the extreme variability of the soils of the area over relatively short distances. Some areas of lucerne are reasonably healthy in appearance whereas lucerne in other areas has either failed to establish (in spite of a very high seed rate of 40 kg/feddan) or the stand is very poor. Further discussion of the soil types and the problems of improving the poorest soils will clarify the reason for this variation.

2. 1 Textures

The silt content (according to laboratory analyses of standard description) is well below 20 per cent over the full depth of 2 metres, except in the case of E 5 soils.

The clay and sand content is about the same throughout all soil types except for E 6 soils where the sand content is much higher ($\pm$ 60 per cent sand and $\pm$ 20 per cent clay).

A general description of the soils would be sandy clays ranging to sandy clay loams or loamy clays.

2. 2 Structure

The structure of the two main categories (E 5 and V 9) is slightly different. The V 9 soil shows a slight subangular blocky structure with vertical cracks down to about 40 cm, and is therefore moderately water absorbent. However, water penetration into the structure elements is probably poor. The E 5 soil type does not show a substantial structure, but is loose and friable in the top 65 cm, and absorbs water rapidly.

The other categories show a weak to moderate blocky structure with cracks near the surface and occasionally in the subsoil.

2. 3 Discussion of the Chemical Analyses Results and Soil Management Implications

(a) Soil with EC values of below 8 mmhos/cm are considered non-saline.

(b) All categories indicated as non-saline, except E 6, have salinity values just below 8 mmhos/cm. E 6 soils, which are below 4 mmhos, would permit the cultivation of all crops without significant yield reductions.

(c) Salinity levels of saline soils are high, but not excessively high, as the maximum value does not exceed 25 mmhos/cm. This means that reclamation would be fairly rapid and, more important, would not require an excessive amount of water.

(d) Reclamation of saline soils can be complicated, however, by the following factors:-

(i) poor or moderate water infiltration into the soil and low soil permeability;

(ii) high sodium level in the soil (alkalinity);

(iii) lack of adequate drainage in the case of high groundwater table, or when the water table is deep, insufficient deep percolation, to well below rooting zone.

Any one or a combination of these factors could make leaching very difficult.

(e) When leaching is possible, reclamation of saline and saline/alkaline soils under crops requires water in excess of the crop consumptive use to leach salts downwards. In many cases this will be provided by the percolation losses which almost always occur under local irrigation conditions, but this must be distributed evenly over the irrigated area.

(f) Sodium contents vary in the soil types under discussion. The exchangeable sodium content is below 15 for the

categories V 1, V 2 and V 9. The sodium content in general increases with profile depth. The structure of these soil types is typically firm and massive prismatic or angular blocky, with strong vertical cracks. Water penetration into the structure elements is in general very poor and exchange of ions during irrigation is slow. Therefore, reclamation of alkaline (E 5) soils would be very slow.

(g) In all categories the calcium content (in the form of lime and gypsum) is sufficiently high to avoid the deterioration due to irrigation of the alkaline and/or saline/alkaline soils into infertile and completely massive soils. With good soil management and mobilization of the available calcium in the soil (by ploughing/mixing of soil in order to get an even distribution of calcium), it is likely that the soil structure will improve slightly in such a way that soil aggregates will become less massive and water penetration will be improved.

(h) Almost all the soils of the Soba area are saline and much lower yields than the maximum possible are to be expected for many crops, particularly for sensitive crops such as lucerne (berseem)[(a)]. The costs of drainage to facilitate leaching would be prohibitively high, unless the soils are very permeable, because sub-surface drains would have to be close together.

In order to arrive at firm conclusions as to the future of cropping at Soba, various investigations and experiments to obtain more reliable information on the following points are required:-

(i) a detailed soil survey to establish the soil class boundaries more accurately;

(a) US Department of Agriculture, The Improvement of Saline and Alkaline Soils, Handbook 60.

(ii) infiltration rates of water penetration into the soil;

(iii) soil permeability of subsoil layer (down to about 5 metres);

(iv) soil salinity/alkalinity;

(v) irrigation intervals (based on infiltration rate and soil moisture retention);

(vi) optimum irrigation method (under high salinity conditions the basin method may be preferred);

(vii) drainage conditions (i. e. is the natural drainage sufficient to cope with the extra water applied for leaching).

TABLE A9.1 Capital Expenditure Sheep Ranching - Management Section H.Q. (LS)

	Project Cost	Foreign Exchange Component	Duty Component	Replacement Policy
Buildings:*				
Homestead (1)	10,000	2,000	1,670	
Houses (2)	11,000	2,200	1,833	
Men's Quarters	2,000	400	340	
Office, Store and Workshop	4,000	800	670	
	27,000	5,400	4,513	
Plant and Equipment:				
Tractors (2)	4,000	3,000	-	Replaced every 4 years
Land Rovers (3)	7,500	3,750	3,334	1 Replaced every 3 years and 2 Replaced every 4 years
Lighting Plant	2,000	1,500	570	Replaced every 10 years
Compressor	450	320	90	Replaced every 8 years
Fire Fighting Unit	650	480	130	Replaced every 10 years
Stock Handling Equipment	500	375	100	Replaced every 3 years
Workshop Equipment	600	450	170	Replaced (in part) every year
Welder	800	600	230	Replaced every 7 years
Offset Disc Plough	500	375	-	Replaced every 8 years
Diamond Harrows	200	150	-	Replaced every 8 years
Combine Planter	800	600	-	Replaced every 7 years
	18,000	11,600	4,624	
Homestead Bore*	9,000	5,400	1,800	
Roads and General Communications, etc.	12,000	7,200	1,000	
	66,000	29,600	11,937	

* To be established under contract.

TABLE A9. 2 Capital Expenditure Sheep Ranching - Costing Unit (LS) (Six per Management Section see Vol. II, Fig. 2. 3)

	Project Cost		Foreign Exchange Component		Duty Component
Fencing		16, 850		12, 637	4, 213
Watering Facilities*		15, 500		9, 330	2, 584
Yards and Dips:					
Three sets to be established per Management Section					
1st set with first Costing Unit	4, 000		2, 400		670
2nd set with third Costing Unit	2, 000		1, 200		330
3rd set with fifth Costing Unit	2, 000		1, 200		330
Outstation Huts:					
Two huts to be erected per Management Section					
1st with third Costing Unit	1, 500		300		250
2nd with sixth Costing Unit	1, 500		300		250
		32, 350		21, 967	6, 797
With the exception of watering facilities costing units are to be established by a project improvements team comprising:					
Development Supervisor (1)		4, 000		2, 000	-
Construction Personnel (15)		3, 100		-	-
		7, 100		2, 000	-

The development supervisor, an expatriate, is to be replaced in year three by a counterpart. From then onwards the costs of the services of the development team are reduced to LS 6, 100 with no Foreign Exchange or Duty Components.

In cases where multiple units are established each year additional construction personnel are employed in direct proportion to the number of units established; e. g. the establishment of three units per year would necessitate the employment of 45 construction personnel, all under the supervision of the development supervisor.

Finally, the costs of the improvements team have been capitalised.

* Incorporates one bore polythene pipe, tanks and troughs, together with 4 hafirs.

TABLE A9. 3 Operating Expenditure Sheep Ranching - Management Section H. Q. (LS)

	Project Cost	Foreign Exchange Component	Duty Component
Labour:			
Manager	5,000	2,500	-
Counterpart Manager	2,000	-	-
Livestock Supervisor	1,000	-	-
Mechanic	360	-	-
Book-keeper	1,200	-	-
Cook	250	-	-
Tractor Drivers (3)	600	-	-
General Hands (4)	900	-	-
	11,310	2,500	-
Stores and Rations	3,530	1,300	751
Fuel and Oil:			
Tractors	450	315	60
Lighting Plant	550	385	72
Land Rovers	300	225	86
Sundry Equipment	100	75	13
	1,400	1,000	231
Repairs and Maintenance: *			
Plant Tractors	700	420	161
Lighting Plant	130	78	30
Land Rovers	520	312	120
Ploughs	100	60	23
Planters	60	36	14
Other	10	6	2
Structures	580	74	-
	2,100	1,086	350
General:			
Postage and Telephone	500	150	-
Printing and Stationery	40	12	7
Travelling Expenses **	2,000	1,600	-
Other	2,000	1,500	334
	4,540	3,262	341
Total:	22,850	9,148	1,673

* Repairs and maintenance for most equipment items are expected to increase through the life of the items. The figures indicated above for repairs and maintenance are an average of this effect.

** Travelling expenses reflect fares for the expatriate manager and development supervisor. (The latter's salary has been capitalised with the development costs.) As these positions are replaced by indigenous personnel the travelling expense commitment will decrease to LS 500.

TABLE A9. 4 Operating Expenditure Sheep Ranching - Costing Unit (LS)

	Project Cost	Foreign Exchange Component	Duty Component
Labour:			
Head Stockman (1)	264	-	-
Stockmen (16)	3, 264	-	-
	3, 528	-	-
Stores and Rations	2, 550	675	424
Livestock Expenses:			
Drenching	310	248	-
Dipping	100	80	-
Inoculating	60	48	-
Other	30	24	-
	500	400	-
Supplementary Feeding	1, 600	1, 200	76
Contingencies	300	225	30
Total:	8, 478	2, 500	530

TABLE A9. 5 Capital Expenditure Sheep Finishing Area - Management Section H. Q. (LS)

	Project Cost	Foreign Exchange Component	Duty Component	Replacement Policy
Buildings:*				
Homestead (1)	10,000	2,000	1,670	
Houses (2)	11,000	2,200	1,833	
Men's Quarters	2,000	400	340	
Office, Store and Workshop	4,000	800	670	
	27,000	5,400	4,513	
Plant and Equipment:				
Tractors (2)	4,000	3,000	-	Replaced every 4 years
Land Rovers (3)	7,500	3,750	3,334	1 Replaced every 3 years and 2 replaced every 4 years
Lighting Plant	2,000	1,500	570	Replaced every 10 years
Compressor	450	320	90	Replaced every 8 years
Fire Fighting Unit	650	480	130	Replaced every 10 years
Stock Handling Equipment	500	375	100	Replaced every 3 years
Workshop Equipment	600	450	170	Replaced (in part) every year
Welder	800	600	230	Replaced every 7 years
Offset Disc Plough	500	375	-	Replaced every 8 years
Diamond Harrows	200	150	-	Replaced every 9 years
Combine Planter	800	600	-	Replaced every 7 years
	18,000	11,600	4,624	
Homestead Water*	1,000	600	167	
Roads, Communications, etc.	6,000	3,600	1,000	
	52,000	21,200	10,304	

* To be established under contract.

TABLE A9.6 Capital Expenditure Sheep Finishing Area - Costing Unit (LS)

		Project Cost	Foreign Exchange Component	Duty Component
Fencing		3,125	2,343	525
Irrigation Development*		15,000	11,250	2,500
Pasture Establishment**		10,900	8,175	1,817
Watering Facilities***		5,300	3,180	884
Yards:				
Two sets to be erected for the Management Section				
1st set with first Costing Unit	1,500		750	250
2nd set with third Costing Unit	1,500		750	250
		34,325	24,948	5,726

* Irrigation Development: Represents anticipated expenditure of gearing the irrigation area for production of irrigated pastures viz: levelling, check banks, ditching, etc.

** Pasture Establishment: It is proposed to establish lucerne pastures, involving land preparation of two ploughings and one planting together with a pre-emergance watering.
Each stand to be replaced every fifth year.

*** Incorporates a well, pump, troughs, polythene pipe and tanks, and also utilizes irrigation channels.

With the exception of watering facilities and irrigation developments the costing units are to be established by a project improvements team on the same basis as for sheep ranches.

TABLE A9. 7 Operating Expenditure Sheep Finishing Area - Management Section H. Q. (LS)

	Project Cost	Foreign Exchange Component	Duty Component
Labour:			
Manager	5,000	2,500	-
Counterpart Manager	2,000	-	-
Livestock Supervisor	1,000	-	-
Mechanic	360	-	-
Book-keeper	1,200	-	-
Cook	250	-	-
Tractor Drivers (3)	600	-	-
General Hands (4)	900	-	-
	11,310	2,500	-
Stores and Rations	3,500	1,300	751
Fuel and Oil:			
Tractors	450	315	60
Lighting Plant	550	385	72
Land Rovers	300	225	86
Sundry Equipment	100	75	13
	1,400	1,000	231
Repairs and Maintenance:*			
Plant Tractors	700	420	161
Lighting Plant	130	78	30
Land Rover	520	312	120
Ploughs	100	60	23
Planter	60	36	14
Other	10	6	2
Structures	580	174	-
	2,100	1,086	350
General:			
Postage and Telephone	500	150	-
Printing and Stationary	40	12	7
Travelling Expenses**	2,000	1,600	-
Other	2,000	1,500	334
	4,540	3,262	341
Total:	22,850	9,148	1,673

* Repairs and maintenance for most equipment items is expected to increase through the life of the item. The figures indicated above for repairs and maintenance are an average of this effect.

** Travelling expenses reflect fares for the expatriate manager and development supervisor. (The latter's salary has been capitalised with the development costs.) As these positions are replaced by indigenous personnel the travelling expense commitment will decrease to LS 500.

TABLE A9. 8 Operating Expenditure Sheep Finishing Area - Costing Unit (LS)

	Project Cost	Foreign Exchange Component	Duty Component
Labour:			
Head Stockman ($\frac{1}{2}$)	132	-	-
Stockmen (6)	1, 224	-	-
Irrigation Foreman (1)	264	-	-
Irrigators (3)	450	-	-
	2, 070	-	-
Stores and Rations	1, 675	503	279
Watering Costs*	8, 000	3, 600	700
Fertiliser	2, 590	2, 072	123
Contingencies	500	400	50
Total:	14, 835	6, 575	1, 152

* Watering costs are calculated on the basis of 20 waterings per year at 40 pt per acre per watering.

TABLE A9. 9 Capital Expenditure Sheep Assembly Areas - Costing Units (LS) see Volume II, Figure 2. 3

	Project Cost	Foreign Exchange Component	Duty Component
Abu Sinun and Jebel ed Dair			
Fencing	14, 800	11, 100	2, 470
Houses (2)	5, 000	1, 000	830
Men's Quarters	1, 000	200	166
Watering Facilities: 6 hafirs	7, 500	4, 500	1, 250
Yards	2, 000	1, 200	330
	30, 300	18, 000	5, 046
Abu Gabra *			
Fencing: External 28 miles Internal 20 miles	14, 800	11, 100	2, 470
Houses (2)	5, 000	1, 000	830
Men's Quarters	1, 000	200	166
Watering Facilities: 1 bore equipt.	13, 000	7, 800	2, 167
Yards	2, 000	1, 200	330
	35, 800	21, 300	5, 963

* Watering facilities in the form of a bore rather than hafirs are considered necessary for the sheep assembly area in this region.

With the exception of watering facilities, houses and quarters, all components to be established by a project improvements team on the same basis as for sheep ranches.

TABLE A9. 10 Operating Expenditure Sheep Assembly Areas (LS)

	Project Cost	Foreign Exchange Component	Duty Component
The following costs apply to each of the three assembly areas: Abu Gabra, Abu Sinun, Jebel ed Dair			
Labour:*			
Officer in Charge	500	-	-
Head Stockman (1)	150	-	-
Stockmen (20)	2,100	-	-
	2,750	-	-
Stores and Rations:	2,050	615	341
Repairs and Maintenance:			
Structures	800	240	-
General:			
Travelling	500	240	-
Other	500	400	50
Total:	6,600	1,655	391

* It is not likely that the Assembly Areas will operate year round.

The above labour costs have been budgeted (as an average) for a six month year.

TABLE A9. 11 Capital Expenditure Cattle Ranching - Management Section H. Q. (LS) Gawazat Ranch*

	Project Costs	Foreign Exchange Component	Duty Component	
Buildings: **				
Houses	10,000	2,000	1,670	
Plant & Equipment:				
Tractors (2)	4,000	3,000	-	Replaced every 4 years
Land rovers (3)	7,500	3,750	3,334	1 Replaced every 3 years and 2 replaced ever 4 years
Lighting plant	2,000	1,500	570	Replaced every 10 years
Compressor	450	340	90	Replaced every 8 years
Fire fighting unit	650	480	130	Replaced every 10 years
Stock handling equipment	500	375	100	Replaced every 3 years
Work shop equipment	600	450	170	Replaced (in part) every year
Welder	800	600	230	Replaced every 7 years
Offset Disc Plough	500	375	-	Replaced every 8 years
Diamond harrows	200	150	-	Replaced every 9 years
Combine (planter)	800	600	-	Replaced every 7 years
	18,000	11,620	4,624	
Total	28,000	13,620	6,294	

* The existing investment on the Gawazat Ranch site covers most of the requirements for houses, quarters and sheds, together with homestead watering facilities, roads, communications etc.

** To be established under contact.

Management Section Costs for Cattle Ranches at Muglad and Gedaref are identical to the Sheep Ranches and have not been repeated here.

TABLE A9. 12 Capital Expenditure Cattle Ranching - Initial Costing Unit Gawazat Ranch* (LS)

	Project Cost	Foreign Exchange Component	Duty Component
Additional Fencing: Internal 21 miles	4, 510	3, 382	752
Additional Watering Facilities: 4 hafirs	4, 000	2, 400	364
Additional Yards and Dips			
Two additional sets to be established for the Management Section at Gawazat, there is an existing facility already on the site.			
1st set with third Costing Unit	2, 000	1, 200	330
2nd set with fifth Costing Unit	2, 000	1, 200	330
Outstation Huts			
Three huts are to be erected for Management Section at Gawazat			
1st with the third Costing Unit	1, 500	300	250
2nd with the sixth Costing Unit	1, 500	300	250
3rd with the eighth Costing Unit	1, 500	300	250

* After the establishment of this initial unit the remaining seven units necessary to establish the Management Section are identical to the costing units for Muglad and Gedaref with an adjustment for the lower fencing requirements. The fencing costs per unit for developing the Gawazat Ranch are as follows: LS 9, 021 for project; LS 6, 765 in foreign exchange with a duty content of LS 1, 500.

TABLE A9. 13 Capital Expenditure Cattle Ranching - Costing Unit (LS) (Eight per Management Section see Vol. II, Fig. 2. 2)

	Project Cost	Foreign Exchange Component	Duty Component
Muglad, Gedaref Ranches			
Fencing	10, 300	7, 725	1, 128
Watering Facilities*	15, 080	9, 050	2, 514
Yards and Dips:			
Three sets to be established per Management Section			
1st set with first Costing Unit	4, 000	2, 400	670
2nd set with third Costing Unit	2, 000	1, 200	330
3rd set with fifth Costing Unit	2, 000	1, 200	330
Outstation Huts:			
Three huts to be erected per Management Section			
1st with third Costing Unit	1, 500	300	250
2nd with sixth Costing Unit	1, 500	300	250
3rd with eighth Costing Unit	1, 500	300	250

* Watering facilities are slightly cheaper than in sheep ranching as the cattle units require less troughing and polythene piping.

With the exception of watering facilities the costing units are to be established by a project improvements team on the same basis as for the sheep ranches.

TABLE A9. 14 Operating Expenditure Cattle Ranching - Management Section H. Q. (LS)

	Project Cost	Foreign Exchange Component	Duty Component
Labour:			
Manager	5,000	2,500	-
Counterpart Manager	2,000	-	-
Livestock Supervisor	1,000	-	-
Mechanic	360	-	-
Book-keeper	1,200	-	-
Cook	250	-	-
Tractor Drivers (3)	600	-	-
General Hands (4)	900	-	-
	11,310	2,500	-
Stores and Rations:	3,500	1,300	751
Fuel and Oil:			
Tractors	450	315	60
Lighting Plant	550	385	72
Land Rovers	300	225	86
Sundry Equipment	100	75	13
	1,400	1,000	231
Repairs and Maintenance:*			
Plant Tractors	700	420	161
Lighting Plant	130	78	30
Land Rovers	520	312	120
Ploughs	100	60	23
Planters	60	36	14
Other	10	6	2
Structures	580	174	-
	2,100	1,086	350
General:			
Postage and Telephone	500	150	-
Printing and Stationery	40	12	7
Travelling Expenses**	2,000	1,600	-
Other	2,000	1,500	334
	4,540	3,262	341
Total:	22,850	9,148	1,613

* Repairs and maintenance for most equipment items is expected to increase through the life of the item. The figures indicated above for repairs and maintenance are an average of this effect.

** Travelling expenses reflect fares for the expatriate manager and development supervisor (the salary of the latter has been capitalised with the development costs). As these positions are replaced by indigenous personnel the travelling expense commitment will decrease to LS 500.

TABLE A9. 15 Operating Expenditure Cattle Ranching - Costing Unit* (LS)

	Project Cost	Foreign Exchange Component	Duty Component
Labour:			
Head Stockman (1)	260	-	-
Stockmen (5)	1, 020	-	-
	1, 280	-	-
Stores and Rations:	1, 250	375	208
Livestock Expenses:			
Dipping	192	154	-
Drenching	102	81	-
Other	10	8	-
Supplementary Feeding:	1, 213	910	58
Contingencies	300	225	30
Total:	4, 347	1, 753	296

* These costs apply to the three ranch areas: Gawazat, Muglad and Gedaref.

TABLE A9. 16 Capital Expenditure Cattle Feedlot - Unit 1 (LS) (Capacity 8, 000 head throughput per year)

	Project Cost	Foreign Exchange Component	Duty Component	
Buildings:				
Manager's Residence (1)	10, 000	2, 000	1, 610	
House (1)	6, 000	1, 200	1, 000	
Men's Quarters	2, 000	400	330	
Sheds, office, etc.	3, 000	600	500	
	21, 000	4, 200	3, 440	
Plant and Equipment:				
Tractors (3)	6, 000	4, 500	-	Replaced every 4 years
Slasher 12 ft. (1)	950	710	-	Replaced every 4 years
Front End Loader (1)	360	270	-	Replaced every 7 years
Balers(2)	2, 600	1, 950	-	Replaced every 3 years
Trailers (2)	400	300	-	Replaced every 10 years
Bale Loader (1)	240	180	-	Replaced every 8 years
Hay Rake (1)	200	150	-	Replaced every 8 years
Fodder Storage)	20, 000	15, 000	5, 200	
Feeding and Mixing System)				
Land Rovers (2)	5, 000	2, 500	2, 200	Replaced every 4 years
Compressor	450	340	90	Replaced every 8 years
Workshop Equipment	400	300	110	Replaced (in part) every year
Welder	800	600	230	Replaced every 7 years
Lighting Plant	2, 000	1, 500	570	Replaced every 10 years
	39, 400	28, 300	8, 400	
Yards and Watering Facilities	9, 600	6, 240	1, 600	
Homestead Bore	9, 000	5, 400	800	
Contingencies	1, 000	600	230	
	80, 000	44, 740	14, 470	

TABLE A9.17 Capital Expenditure Cattle Feedlot - Unit 2 (LS) (Capacity 8,000 head throughput per year)

	Project Cost	Foreign Exchange Component	Duty Component	
Buildings:				
Housing	10,000	2,000	1,670	
Plant and Equipment:				
Tractors (3)	6,000	4,500	-	Replaced every 4 years
Slasher (1)	950	710	-	Replaced every 4 years
Balers (2)	2,600	1,950	-	Replaced every 3 years
Trailers (2)	400	300	-	Replaced every 10 years
Bale Loader	250	180	-	Replaced every 8 years
Hay Rake	200	150	-	Replaced every 8 years
Storage, Mixing and Feeding System	20,000	15,000	5,200	
Yards and Watering Facilities	9,600	6,240	1,600	
Contingencies	1,000	600	230	
	51,000	31,630	8,700	

All buildings, the storage, mixing and feeding systems, and the yards and watering facilities are to be erected under contract for both Units 1 and 2.

Say 9%

TABLE A9. 18 Operating Expenditure Cattle Feedlot - Unit 1 (LS)

	Project Cost	Foreign Exchange Component	Duty Component
Labour:			
Manager	5,000	2,500	-
Counterpart Manager	2,000	-	-
Feed-lot Overseer	1,000	-	-
Feed Milling Overseer	800	-	-
Tractor Drivers (4)	1,200	-	-
General Hands (6)	900	-	-
Plant Operators (3)	900	-	-
Feed-lot Hands (7)	1,750	-	-
Mechanics (2)	720	-	-
Cook	250	-	-
	14,520	2,500	-
Stores and Rations	6,100	2,265	1,308
Repairs and Maintenance:*			
Plant: Slasher	50	30	12
Tractors	900	540	208
Baler	150	90	35
Land Rovers	350	210	81
Automatic Mixing Equipment	1,000	600	231
Lighting Plant	130	78	30
Structures	100	30	-
Other	100	60	30
	2,780	1,638	627
Fuel and Oil:			
Tractors	700	490	92
Land Rovers	200	140	58
Lighting Plant	550	385	72
Feed Mixing Equipment	600	420	79
Other	100	70	14
	2,150	1,505	315
General:			
Postage and Telephone	400	120	-
Printing and Stationery	40	12	7
Travelling Expenses**	1,000	800	-
Other	2,000	1,500	334
	3,440	2,232	341
Total:	28,990	10,140	2,591

* Repairs and maintenance for most equipment items is expected to increase through the life of the item. The figures indicated above for repairs and maintenance are an average of this effect.

** Travelling expenses reflect fares for the expatriate manager. When his position is replaced the travelling expense commitment will decrease to LS 500.

TABLE A9. 19 Operating Expenditure Cattle Feedlot - Unit 2 (LS)

	Project Cost	Foreign Exchange Component	Duty Component
Labour:			
Tractor Drivers (4)	1, 200	-	-
General Hands (6)	900	-	-
Plant Operators (3)	900	-	-
Feed-lot Hands (7)	1, 750	-	-
Mechanics(2)	720	-	-
	5, 470	-	-
Stores and Rations	3, 850	1, 430	826
Repairs and Maintenance:			
Slasher	50	30	12
Tractors	900	540	208
Balers	150	90	35
Automatic Mixing Equipment	1, 000	600	231
Other	100	60	30
	2, 200	1, 320	1, 342
Fuel and Oil:			
Tractors	700	490	92
Feed Mixing Equipment	600	420	79
Other	100	70	14
	1, 400	980	185
Total:	12, 920	3, 730	2, 353

TABLE A9. 20 Ration Costs - Beef Sub-Project

	Per cent in Ration	LS/ton on Ranch	
		El Meiram and Gawazat	Doka
(i) Protein Energy Supplement			
Dura grain	20	14	12
Urea	8	44	40
Dicalcium phosphate	52	44	40
Salt	20	13.2	9.2
Mixing and distribution		2	2
Supplement total:	100	34	30
		Pt/lb on Ranch	
		1.51	1.34
Feed cost/animal consuming			
1 lb/day : 90 days		LS. 1.36	LS. 1.21
120 days		1.81	1.61

	Per cent in Ration	LS/ton	Pt/Kg	Cost/day/animal (pt.) (a)
(ii) Feedlot Ration Gedaref				
Dura grain	32	12.0	1.18	3.8
Molasses	32	4.4	0.43	1.4
Dura stubble (milled)	27	4.8	0.47	1.3
Urea, Dicalcium phosphate, Vitamin A, Antibiotic	9			1.2
			Total:	7.7

(a) Daily consumption 9.23 Kg/head.

TABLE A9. 21 Capital Cost - Wad Medani Dairy Farm (Sudanese Pounds)

	Quantity	Project Cost	Foreign Exchange Component	Duty
Irrigation Works[a]				
Additional canalization works (@ LS 30/feddan)	700 feddans	21,000	11,550	1,200
Tractors and Equipment				
Tractor and scoop	1	2,750	2,565	-
Tractors	4	6,000	5,700	-
Disc plough (3 furrow)	1	270	250	-
Disc harrow	1	350	330	-
Seed drill	1	700	670	-
Trailers	3	1,050	990	-
Forage harvester	1	1,600	1,500	-
Mower	1	250	225	-
Land Rover	1	2,500	1,250	1,100
Miscellaneous (A. I. and dairy equipment)		1,000	950	-
Sub-total		16,470	14,430	1,100
Cattle Pens (half-shaded with water and feed troughs @ LS 350)[b]	45	15,750	3,940	945
Buildings				
Cow sheds (double range each for 80 cows)	2	16,400	8,200	3,300
Mixing plant and feed store	1	2,000	1,000	400
Staff housing				
Senior staff @ LS 4,000	3	12,000	2,400	960
Labourers @ LS 600	40	24,000	2,400	960
Office and stores (expansion of existing)		5,000	2,500	1,000
Sub-total:		59,400	16,500	6,620
Milking Parlours[c]				
Herringbone parlour (10 stall transportable)[a]	2	13,000	10,000	2,500
Refrigerated bulk tank (400 gallon)	2	5,000	3,850	950
Foundations with operator's pit (@ LS 20/m^3 concrete)	2	2,200	550	220
Sub-total:		20,200	14,400	3,670
Crushing and Mixing Plant[d]				
Grain crusher	1	1,700	1,300	325
Steamer	1	260	200	50
Sub-total:		1,960	1,500	375
Delivery Vans[b]				
Diesel engined	3	7,260	4,740	2,340
Livestock				
Heifers (2-3 year old @ LS 40)	565	22,600	-	-
Bulls (Friesian @ LS 700)	15	10,500	10,500	-
Sub-total		33,100	10,500	-
Grand sub-total:		175,140	77,560	16,250
Contingencies at 20%		35,030	15,510	3,250
Grand Total:		210,000	93,000	19,500

Sources:
(a) Based on estimates from Neishersheba management.
(b) Based on Animal Production Corporation estimates.
(c) Messrs. Hosier Ltd., Marlborough, Wiltshire, U. K.
(d) Messrs. Bentalls, Maldon, Essex, U. K.

TABLE A9.22 Capital Cost - Atbara Dairy Farm (Sudanese Pounds)

	Quantity	Project Cost	Foreign Exchange Component	Duty
Irrigation Works[a]				
Canalization, structures, pumps, etc. at LS 80/feddan	1,200	96,000	52,800	5,300
Tractors and Equipment				
Tractor and scoop	1	2,750	2,565	-
Tractors	6	9,000	8,550	-
Disc ploughs	2	540	500	-
Disc harrows	2	700	660	-
Seed drills	1	700	670	-
Trailers	4	1,400	1,320	-
Forage harvester	1	1,600	1,500	-
Mowers	2	500	450	-
Land Rover	1	2,500	1,250	1,100
Miscellaneous		1,500	1,425	-
Sub-total:		21,190	18,890	1,100
Cattle Pens (half shaded with water and feed troughs @ LS 350)[b]	65	22,750	5,700	1,400
Buildings				
Cow sheds (double range each for 80 cows)	3	24,600	12,300	4,950
Mixing plant and feed store	1	2,000	1,000	400
Staff housing[b]				
Senior staff @ LS 4,000	3	12,000	2,400	960
Labourers @ LS 600	60	26,000	3,600	1,400
Offices and stores		10,000	5,000	1,000
Sub-total:		84,600	24,300	8,710
Milking Parlours[c]				
Herringbone parlours (10 stall transportable)	2	13,000	10,000	2,500
Refrigerated bulk tanks (500 gal)	2	6,250	4,800	1,200
Foundations with operators' pit (at LS 20/m^3 concrete)	2	2,200	550	220
Sub-total:		21,450	15,350	3,920
Crushing and Mixing Plant[d]				
Grain crusher	1	1,700	1,300	325
Steamer	1	260	200	50
		1,960	1,500	375
Delivery Vans[b]				
Diesel engined	4	9,700	6,320	3,120
Livestock				
Heifers (2-3 year old @ LS 40)	784	31,360	-	-
Bulls (Friesian @ LS 700)	21	14,700	14,700	-
Sub-total:		46,060	14,700	-
Grand sub-total		303,710	138,060	23,925
Contingencies at 20%		60,740	27,610	4,785
Grand Total:		LS 364,000	166,000	29,000

Sources: (a) Estimates based on updated rates from: Roseires Pre-investment Survey, Report No. 7, Pump Projects on the Main and Blue Niles, Hunting Technical Services and Sir M. MacDonald and Partners, June 1967.

(b) Based on Animal Production Corporation estimates.

(c) Based on data from Messrs. Hosier Ltd., Marlborough, Wiltshire, U. K.

(d) Estimate supplied by Messrs. Bentalls Ltd., Maldon, Essex, U. K.

TABLE A9. 23 Capital Cost of El Qureshi Expansion (Sudanese Pounds)

	Quantity	Project Cost	Foreign Exchange Component	Duty
Tractors and Implements[a]				
Tractor (165 diesel)	1	1,500	1,425	-
Disc plough (3 furrow)	1	270	250	-
Tractors (185)	4	10,000	9,500	-
Scoop set for 185	1	210	190	-
Sub-total:		11,980	11,365	-
Cattle Pens (half-shaded with water and feed troughs @ LS 350)	43	15,050	3,760	940
Milking Parlours[b]				
Herringbone parlours (10 stall)	2	13,000	10,000	2,500
Refrigerated bulk tanks (300 gal)	2	4,160	3,200	800
Foundation with operators' pit	2	2,200	550	220
Sub-total:		19,360	13,750	3,520
Crushing and Mixing Plant[c]				
Grain crusher	1	1,700	1,300	325
Steamer	1	260	200	50
Building (incl. feed store)	1	2,000	1,000	400
Sub-total:		3,960	2,500	775
Delivery Vans (diesel engined)[a]	3	7,250	4,700	2,350
Staff Housing[a]				
Labourers at LS 600	30	18,000	1,800	720
Senior staff at LS 4,000	3	12,000	2,400	960
Sub-total:		30,000	4,200	1,680
Grand sub-total:		87,600	40,275	9,265
Contingency at 10%		8,760	4,028	927
Grand Total:		96,000	44,000	10,000

Sources: (a) Animal Production Corporation.

(b) Messrs Hosier Ltd., Marlborough, Wiltshire, U.K.

(c) Messrs. Bentalls, Maldon, Essex, U.K.

TABLE A9. 24 Capital Cost for the Extension of the Kuku Tenant Dairy Scheme (Sudanese Pounds)

	Quantity	Project Cost	Foreign Exchange Component	Duty
Irrigation Works	1,000 feddans			
Earthworks for canals		8,000	4,800	-
Earthworks for channels		8,000	4,800	-
Pipe regulator and steelwork		4,000	1,600	800
Concrete piping and channel gates		4,000	1,600	800
Drains		8,000	4,800	-
Strengthening of canal		2,000	1,200	-
Sub-total:		34,000	18,800	1,600
Tractors and Implements				
Tractor and scoop	1	2,750	2,565	-
Tractor (MF 165 diesel)	1	1,500	1,425	-
Disc plough (3 furrow)	1	270	250	-
Disc harrow	1	350	330	-
Trailer	1	350	330	-
Sub-total:		5,220	4,900	-
Milking Points				
Milking points at LS 4,000	4	16,000	8,000	2,000
Shower and W. C. (4 for new points and 2 for existing)	6	2,400	1,200	300
Sub-total:		18,400	9,200	2,300
Cattle Compounds				
Simple yards with shade area at LS 100	100	10,000	1,000	250
Milk Transport	4	10,000	6,265	3,130
Grand sub-total:		77,620	40,165	7,280
Contingencies at 10%		7,760	4,020	730
Grand Total:		85,000	44,000	8,000

Source: Animal Production Corporation - updated.
(Canalisation costs are approximate and require detailed estimate following ground survey.)

TABLE A9. 25 Capital Cost of a Milk Sterilization Plant: 1, 000 gallons/day Capacity (Sudanese Pounds)

	Quantity	Project Cost	Foreign Exchange Component	Duty
Section I - Process				
Transporter milk tanks (1, 500 gals)	1	4, 800	3, 200	1, 600
Storage tank (2, 000 gals)	2	3, 000	2, 400	600
Centrifugal pump (FM-1)	1	400	320	80
Plate preheater (500 gals) (P5-RB)	1	9, 375	7, 500	1, 875
Centrifugal clarifier	1	3, 350	2, 680	670
Homogeniser 550 g. p. h. (SH 20)	1	5, 000	4, 000	1, 000
Buffer tank (200 gals)	1	625	500	125
Interconnecting pipework	Set	1, 250	1, 000	250
Section II - Boiler and Electrical Services				
Steam boilers (oil fired with oil storage tanks)	2	16, 250	13, 000	3, 250
Electrical power room	1	1, 680	1, 200	480
Section III - Bottling and Crating				
Bottles	24, 000)			
Crates (incl. corks and pallets)	800)	5, 250	3, 500	1, 750
Trucks	2)			
Bottle washer (4, 000 bottles/hr)	1	10, 938	8, 750	2, 188
Bottle filler/crown corker & capper	1	10, 938	8, 750	2, 188
Autoclaves (with spray cooling)	2	9, 375	7, 500	1, 875
Conveyors	1	9, 625	7, 700	1, 925
Section IV				
Cleaning-in place		3, 125	2, 500	625
Sub-total:		94, 981	74, 500	20, 481
Building[(a)] (approx. 535 sq. metres floor space @ LS 17 m^2)		9, 100	4, 600	1, 840
Sub-total:		104, 080	79, 100	22, 320
Commissioning (20% of LS 74, 500)		14, 900	14, 900	-
Contingencies at 10%		11, 900	9, 400	2, 232
Grand Total:		130, 880	103, 400	24, 550

(a) Approximate floor space required:

Section	I	II	III
Dimension metres	12 x 12	6 x 8	11 x 11

Source of equipment and commissioning estimates:

Messrs. Alfa-Laval, Brentford, Middlesex, U. K.

TABLE A9. 26 Dairy Sub-project Operating Costs (L$)

Year:	Project Cost	1 Foreign Exchange Component	Duty	2 P.C.	F.E.	D	3 P.C.	F.E.	D	4 P.C.	F.E.	D	5 P.C.	F.E.	D	6 P.C.	F.E.	D	7 P.C.	F.E.	D	8 Onwards P.C.	F.E.	D
Wad Medani Dairy Farm																								
Salaries and wages	13,300	2,175	-	15,570	2,175	-	18,300	2,175	-	18,300	2,175	-	14,300	-	-	14,300	-	-	14,300	-	-	14,300	-	-
Irrigation expenses	8,000	1,600	470	8,000	1,600	470	8,000	1,600	470	8,000	1,600	470	8,000	1,600	470	8,000	1,600	470	8,000	1,600	470	8,000	1,600	470
Running and maintenance of vehicles, equipment and buildings	3,190	1,840	325	3,935	2,200	400	4,520	2,550	455	8,460	2,820	500	5,240	3,000	550	5,550	3,095	550	5,550	3,095	550	5,550	3,095	550
Supplies (seeds and concentrates)	2,750	-	-	3,600	-	-	3,860	-	-	3,860	-	-	4,930	-	-	5,580	-	-	6,220	-	-	6,630	-	-
Miscellaneous (Vet, A.I., office expenses, etc.)	280	170	15	810	490	40	1,190	715	60	1,400	840	70	1,400	840	70	1,400	840	70	1,400	840	70	1,400	840	70
Total	27,525	5,785	810	31,915	6,465	910	35,870	7,040	985	40,020	7,435	11,365	33,870	5,440	1,090	34,825	5,535	1,090	35,470	5,535	1,090	35,875	5,535	1,090
Atbara Dairy Farm																								
Salaries and wages	15,300	2,500	-	17,900	2,500	-	21,000	2,500	-	21,000	2,500	-	17,000	-	-	17,000	-	-	17,000	-	-	17,000	-	-
Irrigation expenses	10,200	2,040	600	10,200	2,040	600	10,200	2,040	600	10,200	2,040	600	10,200	2,040	600	10,200	2,040	600	10,200	2,040	600	10,200	2,040	600
Running and maintenance of vehicles, equipment and buildings	4,200	2,420	425	5,175	2,900	530	5,950	3,360	600	6,400	3,710	660	6,900	3,940	700	7,300	4,180	700	7,300	4,180	700	7,300	4,180	700
Supplies (seeds and concentrates)	3,000	-	-	4,860	-	-	5,220	-	-	5,220	-	-	6,660	-	-	7,540	-	-	8,400	-	-	8,940	-	-
Miscellaneous (Vet, A.I., office expenses, etc.)	400	240	20	1,160	700	60	1,700	1,020	85	2,000	1,200	100	2,000	1,200	100	2,000	1,200	100	2,000	1,200	100	2,000	1,200	100
Total	33,100	7,200	1,045	39,295	8,140	1,190	44,070	8,920	1,285	44,820	9,450	1,360	42,760	7,180	1,400	44,000	7,420	1,400	44,900	7,420	1,400	45,440	7,420	1,400
El Qureshi Expansion																								
Salaries and wages	2,500	-	-	2,500	-	-	3,000	-	-	3,500	-	-	3,500	-	-	3,500	-	-	3,500	-	-	3,500	-	-
Irrigation expenses	1,000	200	60	1,000	200	60	2,000	400	120	3,000	600	180	4,000	800	240	4,000	800	240	4,000	800	240	4,000	800	240
Running and maintenance of vehicles, equipment and buildings.	3,670	2,055	440	4,000	2,240	480	4,270	2,390	510	4,820	2,700	570	4,820	2,700	570	4,820	2,700	570	4,820	2,700	570	4,820	2,700	570
Supplies (seeds and concentrates)	1,500	-	-	1,500	-	-	1,500	-	-	1,500	-	-	1,945	-	-	2,330	-	-	2,830	-	-	3,165	-	-
Miscellaneous (Vet, office expenses, etc.)	100	60	10	200	120	10	300	180	20	500	300	30	500	300	30	500	300	30	500	300	30	500	300	30
Total	8,770	2,315	510	9,200	2,560	550	11,070	2,970	650	13,320	3,600	780	14,765	3,800	840	15,150	3,800	840	15,650	3,800	840	15,985	3,800	840
Kuku Extension																								
Salaries and wages	6,500	-	-	6,500	-	-	6,500	-	-	6,500	-	-	6,500	-	-	6,500	-	-	6,500	-	-	6,500	-	-
Irrigation expenses	10,000	200	590	10,000	200	590	10,000	200	590	10,000	200	590	10,000	200	590	10,000	200	590	10,000	200	590	10,000	200	590
Running and maintenance of vehicles, equipment and buildings	2,680	1,590	340	2,680	1,590	340	2,680	1,590	340	2,680	1,590	340	2,680	1,590	340	2,680	1,590	340	2,680	1,590	340	2,680	1,590	340
Supplies (seeds)	3,500	-	-	3,500	-	-	3,500	-	-	3,500	-	-	3,500	-	-	3,500	-	-	3,500	-	-	3,500	-	-
Miscellaneous	500	300	50	500	300	50	500	300	50	500	300	50	500	300	50	500	300	50	500	300	50	500	300	50
Total	23,180	2,090	980	23,180	2,090	980	23,180	2,090	980	23,180	2,090	980	23,180	2,090	980	23,180	2,090	980	23,180	2,090	980	23,180	2,090	980
TOTAL:	92,575	17,390	3,345	103,590	19,255	3,630	114,190	21,020	3,900	121,340	22,575	14,485	114,575	18,510	4,310	117,195	18,845	4,310	119,200	18,845	4,310	120,480	18,845	4,310

TABLE A9. 27 Animal Production Corporation Headquarters - Operating Costs
(LS)

	Project Cost	Foreign Exchange	Duty
Salaries and Wages			
General Manager	7,000	3,500	-
Assistant General Manager	2,000	-	-
Chief Accountant	1,800	-	-
Accounts Clerks (4)	2,000	-	-
Chief Technical Officer	5,000	2,500	-
Purchasing Officer	1,800	-	-
Purchasing Agents (3)	3,000	-	-
Planning and Development Officer	1,800	-	-
Administration and Personnel Officer	1,800	-	-
Technical Specialists (7)	10,500	-	-
Clerks (3)	1,200	-	-
Drivers (2)	600	-	-
Messengers (2)	300	-	-
Other Junior Staff	1,000	-	-
	39,800	6,000	-
Operation and Maintenance costs of Vehicles, Buildings and Equipment			
Cars (2)	800	480	240
Buildings @ 1%	800	150	50
Miscellaneous (office equipment, office supplies, electricity & telephone bills)	1,000	100	25
	2,600	730	315
Travelling & Subsistence Allowances	2,650	-	-
Contingencies @ 10%	4,500	670	30
Total	49,550	7,400	345

APPENDIX X

SUPPORTING DETAILS OF ECONOMIC AND FINANCIAL ANALYSES

1. COST AND BENEFIT ASSUMPTIONS FOR BEEF AND MUTTON SUB-PROJECTS

1.1 Opportunity Cost of Land and Labour

The proposed cattle and sheep ranches will occupy an estimated 1.3 million feddans. The removal of this area from its current intermittent use by nomadic herdsmen and small-scale dura producers is not expected to have a significant effect on the total beef and grain production of the Sudan. The area required is relatively small in terms of the total area of land available, particularly as the ranch sites have been located away from existing watering facilities. The ranches near Gedaref will displace some dura producers, but the bulk of these producers are on land which is marginal for dura production, and the ranch areas involved are insignificant when compared with the total area of marginal land available for dura production in that region. The opportunity cost of land for ranches and assembly areas has therefore been assumed to be zero.

In the case of the 8,000 feddans required for the sheep finishing area an opportunity cost of LS. 6.50 per feddan per annum has been adopted to reflect the loss of net returns to the economy from its present use. This value is representative of the net returns foregone from the use of the land to produce cotton in this marginal area for cotton. The finishing area would not be displacing cotton producers as the land will in any case be taken out of cotton (since production in this area is becoming uneconomic) and tenants will be settled elsewhere.

The assumptions concerning the opportunity costs of labour and management present some difficulties. Unskilled labour would have virtually no other opportunity for productive employment in the remoter areas (El Meiram and the sheep assembly areas). But in the Gedaref

region some opportunity cost might be attributable to unskilled labour in view of the considerable employment available in connection with grain production. In the Sudan it has often been assumed that unskilled labour has no opportunity cost and therefore wage costs have been excluded from economic analyses. Over an extended period of analysis, however, this assumption implies the pessimistic view that under-employment will always exist.

In the case of semi-skilled and skilled personnel on the other hand, salaries do not reflect the true value to the economy of labour and management. This is because there is a general shortage of trained staff in the Sudan. Consequently in the economic analyses wage and salary costs have been charged at market rates on the assumption that the over-valuation of unskilled labour is balanced by the under-valuation of skilled labour.

Why are these two types of labour quantitatively related ?

1. 2 Foreign Exchange Costs and Returns

In the analyses at economic prices the foreign exchange elements of costs and benefits have been increased by 25 per cent to reflect more closely the real cost of this scarce resource to the economy. The adjustment is not, of course, required in the foreign exchange analyses as only the foreign exchange costs and benefits are compared and the premium value would not change the relationship between the cost and benefit streams.

1. 3 'Without Project' Assumptions

Where cattle and sheep breeding is concerned, the project's output is considered to represent a 100 per cent benefit to the economy. However, the store trading activities must be assumed to deprive the economy of certain net benefits which would have accrued to it from private sector trading in the absence of the project. These 'without project benefits' are difficult to estimate since they depend on many uncertain factors such as the amount of extra "slack" which can be absorbed from the natural off-take, the rate of increase in Sudan's meat consumption

and the rate at which other meats are substituted for mutton and beef. However, since the maximum annual number of animals traded by the project is a very small proportion of Northern Sudan's off-take (about 2. 5 per cent in the case of cattle and 3 per cent in the case of sheep), it has been considered a reasonable reflection of the private sector's abilities to assume that, of the animals bought and sold under the project, 30 per cent of the cattle and 50 per cent of the sheep would have gone for export anyway in the project's absence, the rest remaining untraded.

It was assumed that animals exported under 'without project' conditions would be relatively unfinished and be sold in traditional markets such as Jeddah, cattle at 180 kg carcaseweight against 200 kg under with project conditions, and sheep at 17 kg against 20 kg with the project. Without project beef prices were estimated at 22 pt per kg carcaseweight in the foreign exchange analysis against 29 pt for the with project price. Respective figures in the economic analysis (including the 25 per cent increase for shadow pricing of foreign exchange) were 27. 5 pt and 36. 75 pt. Mutton prices in the foreign exchange analysis were 40 pt/kg without project and 44 pt/kg with project. The corresponding prices used in the economic analysis were 50 pt/kg and 57 pt/kg.

2. SUPPORTING TABLES

Tables A10. 1 - A10. 4 present the benefit and cost streams of the sensitivity analyses and the combined APC investment which are referred to in Volume II, Chapter 3. Table A10. 5 and A10. 6 illustrate the repayment capacities of the Marketing Agency and livestock vessel investments as discussed in Volume II, Section 3. 5. 2.

TABLE A10.1 Sensitivity Analyses Costs and Benefits - Cattle Sub-Project

Year	Increased Development Intensity			Increased Store Trading Percentage on Ranches			10% Reduction on Export Prices		
	Costs	Benefits	Net Benefits	Costs	Benefits	Net Benefits	Costs	Benefits	Net Benefits
1	417.0	15.0	(402.0)	417.0	15.0	(402.0)	417.0	13.6	(403.4)
2	496.9	116.4	(380.5)	355.0	67.7	(287.3)	355.0	101.3	(253.7)
3	596.4	545.9	(50.5)	392.2	350.9	(41.3)	392.2	309.0	(83.2)
4	662.4	773.2	110.8	513.6	551.5	37.9	507.2	419.3	(87.9)
5	480.2	1080.6	600.4	523.7	811.0	287.3	510.1	604.8	94.7
6	479.7	1029.1	549.4	479.8	842.8	363.0	457.6	645.2	187.6
7	471.9	985.6	513.7	506.6	889.5	382.9	484.1	693.6	209.5
8	500.5	937.3	436.8	563.6	929.9	366.3	542.7	737.0	194.3
9	428.5	831.3	402.8	446.8	931.2	484.4	424.5	728.7	304.2
10	414.1	683.0	268.9	423.2	822.4	399.2	403.2	595.1	191.9
11	402.8	559.0	156.2	425.4	717.9	292.5	394.0	485.5	91.5
12	349.8	424.2	74.4	386.0	604.8	218.8	358.1	375.4	17.3
13	355.1	412.2	57.1	369.8	546.6	176.8	346.3	369.7	23.4
14	373.8	636.4	262.6	357.4	502.9	145.5	371.0	573.7	202.7
15	393.1	667.3	274.2	389.9	569.5	179.6	400.6	601.3	200.7
16	365.6	664.0	298.4	365.0	656.7	291.7	364.3	598.6	234.3
17	379.4	660.0	280.6	369.8	665.7	295.9	368.3	595.0	226.7
18	373.7	624.0	250.3	375.1	646.7	271.6	374.5	561.3	186.8
19	384.2	647.0	262.8	394.0	646.7	252.7	394.0	588.2	191.2
20	358.9	647.0	288.1	356.7	646.7	290.0	356.8	585.2	228.4

TABLE A10. 2 Sensitivity Analyses Costs and Benefits - Sheep Sub-Project

Year	Increased Development Intensity			Increased Store Trading Percentage on Ranches			10% Reduction on Export Prices		
	Costs	Benefits	Net Benefits	Costs	Benefits	Net Benefits	Costs	Benefits	Net Benefits
1	347.1	-	(347.1)	347.1	-	(347.1)	347.1	-	(347.1)
2	331.0	131.0	(200.0)	333.1	131.7	(201.4)	331.0	111.0	(220.0)
3	362.5	239.3	(123.2)	362.5	258.6	(103.9)	362.5	199.9	(162.6)
4	435.4	371.3	(64.1)	435.1	378.5	(56.6)	435.1	311.6	(123.5)
5	645.2	509.2	(136.0)	455.4	521.1	65.7	455.4	429.0	26.4
6	711.1	533.5	(177.6)	432.3	555.8	123.5	432.3	465.7	33.4
7	793.0	574.3	(218.7)	453.0	584.6	131.6	453.0	536.8	83.8
8	570.8	630.7	59.9	638.1	612.0	(26.1)	638.1	593.4	(44.7)
9	550.2	807.9	257.7	669.6	677.1	7.5	669.6	567.4	(102.2)
10	551.6	1073.3	521.7	666.6	702.6	36.0	666.6	651.4	(15.2)
11	547.6	1057.2	509.6	566.1	738.4	172.3	566.1	751.7	185.6
12	551.6	1069.4	517.8	557.5	706.8	149.3	557.5	935.7	378.2
13	551.6	1069.4	517.8	539.0	759.8	220.8	539.0	947.4	408.4
14	554.1	1069.4	515.3	543.4	865.8	322.4	543.4	953.0	409.6
15	570.7	1069.4	498.7	579.1	982.1	403.0	579.1	953.0	373.9
16	550.1	1069.4	519.3	549.4	1059.7	510.3	549.4	953.0	403.6
17	548.5	1069.4	520.9	540.6	1067.4	526.8	540.6	953.0	412.4
18	544.4	1069.4	525.0	552.8	1067.4	514.6	552.8	953.0	400.2
19	567.9	1069.4	501.5	573.8	1067.4	493.6	573.8	953.0	379.2
20	557.8	1069.4	511.6	539.0	1067.4	528.4	539.0	953.0	414.0

TABLE A10.3 All A.P.C. Production Schemes - Economic Analysis
Net Cash Flow Tables (LS 000)

Year	Cattle	Sheep	Dairy	A.P.C. Head-quarters	Total (a) A.P.C. Net Cash Flow
1	(402.0)	(347.1)	(797.5)	(193.5)	(1740.1)
2	(238.6)	(200.0)	(179.3)	(51.2)	(663.7)
3	(49.3)	(123.4)	(166.9)	(51.2)	(390.8)
4	(26.5)	(63.8)	(52.8)	(51.2)	(194.3)
5	179.3	53.8	(212.6)	(31.7)	(11.2)
6	278.3	115.2	5.2	(31.7)	367.0
7	305.2	170.1	25.1	(31.7)	468.7
8	295.4	45.6	38.3	(31.7)	347.6
9	404.6	(13.5)	38.3	(31.7)	397.7
10	278.0	79.7	(32.7)	(31.7)	293.3
11	163.7	287.7	47.2	(31.7)	466.9
12	65.4	493.0	47.2	(31.7)	574.1
13	65.6	536.2	47.2	(31.7)	617.3
14	265.7	526.0	47.2	(31.7)	807.2
15	266.4	490.3	(28.9)	(31.7)	696.1
16	299.6	520.0	47.2	(31.7)	835.1
17	291.4	528.8	47.2	(31.7)	835.7
18	249.2	516.6	47.2	(31.7)	781.3
19	252.7	495.6	47.2	(31.7)	763.8
20	289.9	530.4	47.2	(31.7)	835.8

(a) If this column is discounted at 10 per cent, the net present worth is LS. -30,900. Internal rate of return is thus just below 10 per cent.

TABLE A10.4 All A.P.C. Production Schemes - Foreign Exchange Net Cash Flow Tables (LS 000)

Year	Cattle	Sheep	Dairy	A.P.C. Head-quarters	Total (a) A.P.C. Net Cash Flow
1	(199.0)	(182.6)	(387.9)	(62.0)	(831.5)
2	(92.7)	(101.1)	1.5	(7.4)	(199.7)
3	87.2	(51.8)	(63.2)	(7.4)	(35.2)
4	125.8	(14.3)	6.3	(7.4)	110.4
5	309.2	73.7	(88.5)	(1.4)	293.0
6	375.0	124.9	75.1	(1.4)	573.6
7	406.8	181.7	63.9	(1.4)	651.0
8	413.4	152.4	100.5	(1.4)	667.7
9	474.4	129.9	100.5	(1.4)	703.4
10	363.3	202.6	46.5	(1.4)	611.0
11	263.2	320.6	108.4	(1,4)	690.8
12	197.9	498.9	108.4	(1.4)	803.8
13	193.6	539.8	108.4	(1.4)	840.4
14	384.3	525.0	108.4	(1.4)	1016.3
15	379.9	500.7	50.4	(1.4)	929.6
16	402.5	521.0	108.4	(1.4)	1030.5
17	400.9	526.8	108.4	(1.4)	1034.7
18	398.1	518.3	108.4	(1.4)	1023.4
19	382.8	504.4	108.4	(1.4)	994.2
20	402.6	528.0	108.4	(1.4)	1037.6

(a) If this column is discounted at 30 per cent, the net present worth is LS. -47,800. The internal rate of return is 29 per cent.

TABLE A10.5 Marketing Agency - Repayment Capacity (LS. 000)

Year:	1	2	3	4	5	6	7	8	9	10
Capital and Operating Costs	131.9	93.1	66.3	66.0	76.1	75.2	68.1	67.2	77.3	75.9
Revenue										
Export cattle @ LS. 1.00/head	12.5	25.0	28.1	31.2	34.3	37.5	40.6	43.7	46.8	50.0
Export sheep @ LS. 0.20/head	20.0	40.0	45.0	50.0	55.0	60.0	65.0	70.0	75.0	80.0
Local cattle @ LS. 0.10/head	2.5	5.0	5.6	6.3	6.9	7.5	8.1	8.8	9.4	10.0
Local sheep @ LS. 0.02/head	3.0	6.0	6.8	7.5	8.3	9.0	9.8	10.5	11.3	12.0
Total:	38.0	76.0	85.5	95.0	104.5	114.0	123.5	133.0	142.5	152.0
Net cash flow before financing and service charges	(93.9)	(17.1)	19.2	29.0	28.4	38.8	55.4	65.8	65.2	76.1
External Finance										
Long term loan @ 5%	70.0	-	-	-	-	-	-	-	-	-
Short term loan @ 6%	30.0	25.0	-	-	-	-	-	-	-	-
Net cash flow after financing and before service charges	6.1	7.9	19.2	29.0	28.4	38.8	55.4	65.8	65.2	76.1
Interest on long-term loan	1.8	3.5	3.5	3.2	2.8	2.5	2.1	1.8	1.4	1.1
Interest on short-term loan	0.9	3.3	3.3	3.1	2.5	1.9	0.7	-	-	-
Redemption of long-term loan	-	-	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Redemption of short-term loan	-	-	3.0	10.0	10.0	20.0	12.0	-	-	-
Total:	2.7	6.8	16.8	23.3	22.3	31.4	21.8	8.8	8.4	8.1
Net cash flow after financing and service charges	3.4	1.1	2.4	5.7	6.1	7.4	33.6	57.0	56.8	68.0
Cumulative cash flow	3.4	4.5	6.9	12.6	18.7	26.1	59.7	116.7	173.5	241.5

TABLE A10.6 Livestock Vessel - Repayment Capacity (with two alternative rates of revenue) (LS. 000)

Year:	1	2	3	4	5	6	7	8	9	10
Capital and Operating Costs	300.0	60.0	70.0	80.0	100.0	100.0	100.0	100.0	100.0	100.0
(1) Revenue at present rates										
Sheep @ LS. 0.40/head	72.0	86.4	100.3	114.6	144.0	144.0	144.0	144.0	144.0	144.0
Cattle @ LS. 2.00/head	21.0	25.2	29.9	33.4	42.0	42.0	42.0	42.0	42.0	42.0
Total:	93.0	11.6	130.2	148.0	186.0	186.0	186.0	186.0	186.0	186.0
Net cash flow before financing and service charges	(207.0)	51.6	60.2	68.8	86.0	86.0	86.0	86.0	86.0	86.0
Loan at 5%	250.0	-	-	-	-	-	-	-	-	-
Net cash flow after financing and before service charges	43.0	51.6	60.2	68.8	86.0	86.0	86.0	86.0	86.0	86.0
Interest @ 5%	9.4	12.5	12.5	10.0	7.5	5.0	2.5	-	-	-
Redemption of loan	-	-	50.0	50.0	50.0	50.0	50.0	-	-	-
Total:	9.4	12.5	62.5	60.0	57.5	55.0	50.0	-	-	-
Net cash flow after financing and service charges	33.6	39.1	(2.3)	8.8	28.5	31.0	33.5	86.0	86.0	86.0
Cumulative cash flow	33.6	72.7	70.4	79.2	107.7	138.7	172.2	258.2	344.2	430.2
(2) Revenue at 75% of present rates	69.8	83.7	97.7	11.6	139.5	139.5	139.5	139.5	139.5	139.5
Net cash flow before financing and service charges	(230.2)	23.7	27.7	31.6	39.5	39.5	39.5	39.5	39.5	39.5
Loan at 5%	250.0	-	-	-	-	-	-	-	-	-
Net cash flow after financing and before service charges	19.8	23.7	27.7	31.6	39.5	39.5	39.5	39.5	39.5	39.5
Interest @ 5%	9.4	12.5	12.5	12.5	11.3	10.0	8.8	7.5	6.3	5.0
Redemption of loan	-	-	-	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Total:	9.4	12.5	12.5	37.5	36.3	35.0	33.8	32.5	31.3	30.0
Net cash flow after financing and service charges	10.4	11.2	15.2	(5.9)	3.2	4.5	5.7	.	8.2	9.5
Cumulative cash flow	10.4	21.6	36.8	30.9	34.1	38.6	44.3	51.3	59.5	69.0

APPENDIX XI

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APPENDIX XI

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