

ISLAMIC REPUBLIC OF MAURITANIA

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Ministry of Economy and Finance

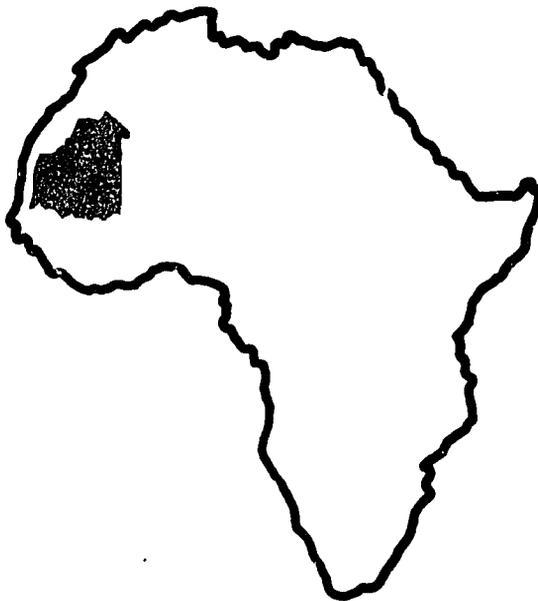
Directorate of Studies and
Programming

RAMS PROJECT

Rural Assessment and Manpower Surveys

Agricultural Production:
Analysis of Selected Aspects
of Mauritanian Agriculture

AS-4



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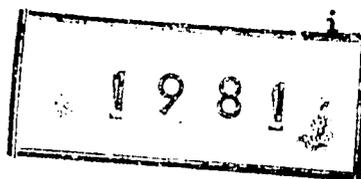


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Chapter 1

Introduction and Summary

This report summarizes some of the studies undertaken by members of the RAMS Production Unit and also includes a summary of the findings of the Production Survey Conducted in 1979/80. Comparative budgets for crop and livestock enterprises are presented, and some of the issues in the livestock and crop subsectors are discussed including questions of pricing and marketing of cereals.

The Livestock Subsector

This subsector habitually contributes 15-20% of Mauritania's GDP at factor cost. It is estimated that about 55 million ha. (over one half the country's surface) are suitable for grazing with greatly varying capacities and variable seasonal feed production. Thus, Mauritania is part of a Sahelian livestock production system with a considerable portion of the herd grazing at least part of the year in Mali and Senegal.

The Livestock production budgets show that returns per man day to herders is exceeded only in oasis culture. Non-herder investment income is modest for cattle and camels, but relatively high for sheep and goats. The proportion of the sedentary crop farmers who also own livestock totals 34% of all responding farmers in the RAMS Production Survey. Another 22% were livestock herders only.

As an incentive to increase offtake it is suggested that a rural savings-investment fund be set up that would pay interest

at a higher rate that can be obtained from herding. Herders in such a case might be tempted to sell animals for slaughter in excess of their immediate cash requirements putting the additional monies into the fund. It would also offer an additional alternative investment to non-herder investors.

To earn an adequate return, the fund would probably have to invest a substantial portion of its monies in the international money market.

The Crop Subsector

The subsector contributes less than 2% of GDP, although we believe that the values are underestimated. However, it is apparent that production in the subsector and particularly cereals production has trended downward over a long period, and at present domestic cereals production accounts for less than 20% of domestic disappearance, the balance coming from commercial imports and charitable donations. Examination of the farm budgets reveals the very low rates of return to labor in traditional rainfed/recessional agriculture and the Production Survey shows the small exploitation, and largely subsistence nature of farm production. Attempts to minimize farming risks include joint crop-livestock operations as well as combining types of farming (particularly rainfed/recessional culture) to extend the growing season and possibly offset climatic irregularities. Productivity in traditional rainfed/recessional culture could be substantially increased through the use of simple improved production techniques. However, we doubt that progress of the sort required to lower the rapidly increasing cereals deficit will be forthcoming in the foreseeable future.

With the prospective construction of the Manantali Dam, considerable additional land will be available for irrigation. Costs, however, will be high, but they must be compared to a potential structural deficit in cereals production brought about by a recession agriculture on the walo, that could be require imports and/or donations to a possible value of \$40 - \$50 million annually over the next decade or so. Rice production in the Senegal River Basin is competitive with lower cost imports in the rural areas of southern Mauritania but is not competitive with imports in the Nouakchott market because of high transport costs. More attention should also be given to alternative cereal cultures, particularly wheat, maize and sorghum. Some interesting work with these crops is being conducted on the Senegalese side of the River.

Oasis culture, which contributes more to value in the crop subsector than any other type of activity, is extremely profitable. However, possibilities for expansion are severely limited, at least under current production techniques.

The Production Survey

Chapter V summarizes the findings of the Production Survey, Farms and land cultivated were examined both by size and by type of farm in the Agro-Ecological Zones and in Administrative Regions. We attempted to expand the sample based on several expansion factors, and it appears that total land cultivated in 1979/80 was about 95,000 ha. Production of millet and sorghum, the principal crops grown was about 25,000 mt.

Chapter II

Agriculture in the Mauritanian Economy

The Rural Sector contributes 20% to 25% of Mauritanian GDP in both current and constant terms, according to the latest revision of the Country's National Accounts (Tables II-1 and II-2). According to these estimates the Livestock Subsector is by far the largest contributor in terms of value added - 15 to 20% of the total. Crop agriculture and fisheries currently made about comparable, though minor contributions. Earlier in the last decade, the data show that fishing was far more important than crop production but its value has declined sharply in real term, primarily due to the reduction in output of modern industrial fishing.

There are presently two sets of Mauritanian National Accounts estimates - those compiled by the Banque Centrale de Mauritanie (BCM) since 1972 (hereinafter referred to as the BCM Estimates) and a new compilation by the Division de la Statistique with assistance from a UN Mission and first published in September 1980 (hereinafter called Revised Estimates).

In previous reports RAMS has questioned the BCM estimates of production and value added in the Rural Sector. In particular, we believe that the contribution of the Crop Subsector to GDP in current prices has been consistently undervalued and its value should be doubled or tripled. We regard the Revised Estimates as an improvement in this regard (Table II-3), but believe that the estimates are still too low. In Chapter IV prices and production of selected crops are discussed more fully. However, at this point, in spite of incomplete 1979 crop production data in the Revised

Estimates, it is possible to show officially reported production of certain crops valued according to farmgate prices estimate derived from the RAMS Production Survey as follows:

<u>Crop</u>	<u>Value</u> (million UM)
Millet and sorghum	333.5
Dates	500.2
Rice	.4
	<hr/>
	834.1

If we allow 10% of gross production for intermediate consumption, the value added to the subsector by these three crops alone - 751 million UM is more than 40% greater than the value shown for the entire subsector in the Revised Estimates. (See Table II - 3).

Fisheries

Table II - 4 shows the estimated financial structure of the Mauritanian fishing industry. Artisanal fishing, both riverine and maritime has usually amounted to about 25 - 30 percent of the estimated gross value of output and from 30 - 35% of the subsector's contribution to GDP. However, as shown in Table II-2 the real value added in the fishing industry has trended downward since 1973. Any evaluation of the resources for development of the fishing industry must take into account the potential of the fisheries off the Mauritanian Coast, the sustainable volume and quality. Proposed increases in the size of the domestic fleet must consider the feasibility of appropriate rates and costs of domestic consumption, export potential and markets.

Table II - 1
Contribution of the Rural Sector to GDP in
1973, 1978, 1979, in Current Prices

	<u>1973</u>		<u>1978</u>		<u>1979</u>	
	Value (million US\$)	Percent of GDP	Value (million US\$)	Percent of GDP	Value (million US\$)	Percent of GDP
Agriculture	273	2.3%	410	1.7%	521	2.0%
Livestock	1,823	15.4%	5,027	21.9%	4,548	17.7%
Fishing ¹⁾	771	6.5%	607	2.6%	503	2.0%
Forestry	49	0.4%	87	0.4%	104	0.4%
Total Rural Sector	2,916	24.6%	6,131	26.7%	9,676	22.1%
Total GDP	11,848	100.0%	22,946	100.0%	25,651	100.0%

¹⁾ Includes both modern industrial and artisanal fisheries.

Division de la Statistique.

Sources: Aggregates de Comptes Nationaux et Indicateurs Socio-Economiques 1970 - 1980, Sept., 1980.

(Hereinafter referred to as Revised National Accounts)

Table II-2

Contribution of the Rural Sector to GDP in 1973 Constant Prices

	<u>1973</u> Value	Percent of GDP	<u>1978</u> Value	Percent of GDP	<u>1979</u> Value	Percent of GDP
Agriculture	273	2.3	225	1.7	201	1.8
Livestock	1,823	15.4	2,514	18.2	2,115	14.7
Fishing ¹⁾	771	6.5	491	3.5	527	3.7
Forestry	43	0.4	54	0.4	58	0.4
Total Rural Sector	2,910	24.6	3,284	23.8	2,901	20.5
Total GDP	11,840	100.0	13,777	100.0	14,409	100.0

¹⁾ includes modern industrial and artisanal fisheries.

Source : Same as Table II-1.

Table II. 3
Comparative Estimates of Contribution to GDP
by the Rural Sector
(millions of DM in current prices)

	<u>1978</u>		<u>1979</u>	
	<u>ECM</u>	<u>Revised Estimates</u>	<u>ECM</u>	<u>Revised Estimates</u>
Agriculture	203	410	385	521
Livestock	5,142	5,027	6,171	4,548
Forestry	377	607	243	503
Fishing	57	87	57	194
Total	6,279	6,131	7,456	5,676

Source : ECM and Revised Estimates

Table II - 4

Financial Structure of the Mauritanian Fishing Industry 1972 - 1979
(million UC)

Year	Contribution to GDP			Value of Production			Value of Autoconsumption in Artisanal Fishing
	Industrial	Artisanal	Total	Industrial	Artisanal	Total	
1973	521	250	771	761	310	1,091	190
1974	592	295	888	848	355	1,203	120
1975	500	230	730	800	233	1,033	65
1976	440	211	651	704	200	904	88
1977	450	235	685	720	289	1,009	95
1978	400	207	607	725	290	1,021	98
1979	363	140	503	599	175	774	60

Source: Revised National Accounts Estimates.

Forestry

The principal products from the forestry subsector are charcoal, the principal fuel in Mauritania, largely derived from Acacia Nilotica, a species that grows widely throughout Mauritania, particularly along streambeds. It is not possible to estimate the amount of charcoal produced, but stands of trees are progressively disappearing.

The other major product is gum arabic produced from Acacia Senegal. Stands of these species were severely damaged by the drought and sales of gum arabic have declined in recent years. SONIMEX has a monopoly on sales of gum arabic (Table II -- 5).

Table II -- 5

Quantity and Value of Gum Arabic Sold by SONIMEX
1973 -- 1980

	<u>Tons</u>	<u>Value</u> <u>(million UM)</u>
1973	725	17.0
74	510	15.6
75	1,635	93.4
76	441	10.6
77	293	11.3
78	123	4.5
79	485	18.5
80	131	5.0

Source: SONIMEX, 1980.

Climatic

A subtropical high pressure system dominates Mauritania. Consequently most of the country is desert. The system shifts southward in winter, with the result that small amounts of rainfall occur in the north in January through March. Some nomadic and transhumanic groups establish northern camps to use the water and pasture at the time.

In summer, the system moves northward, and most of the country receives some rainfall between July and October. Rainfall is generally heaviest in the south and decreases progressively as the system moves north (Figure 1). The rains are frequently short but intense -- as much as 4-5 mm per hour, followed by protracted dry periods. The early rains are usually heavy enough to encourage planting and germination in rainfed culture but the following dry period with high temperatures may result in partial or total loss of the crop stand. In some years crops may be replanted two or three times, with significant effects on yields.

In addition, precipitation varies greatly from year to year, and successive years of below average rainfall can bring about prolonged droughts, as was the case in the most recent drought cycle which began in 1968, and seems to have continued through the decade of the 1970's with only an occasional year of relatively good rainfall.

Figure III.1 shows the northward bulge in the isohyetal pattern with its higher rainfall in the west-central part of the country. In 1972, however, the 150 mm isohyet, considered the usual northern limit for cattle grazing, moved 400 km to the south from

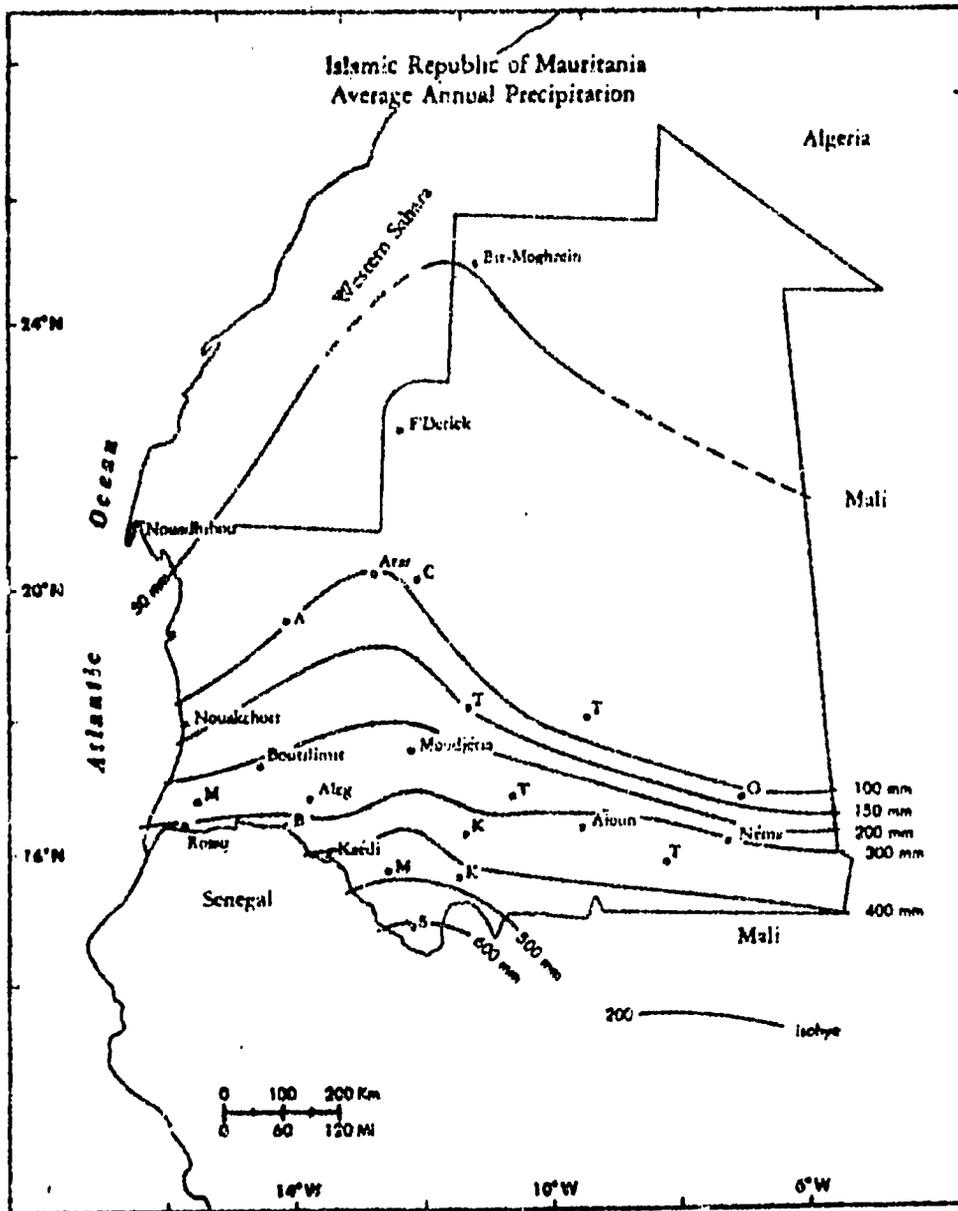


FIG 1.1

Source: Based on a monograph Cattle, Climate and Culture: Collision Course in Mauritania, 1980, D. Vermeer, Louisiana State University.

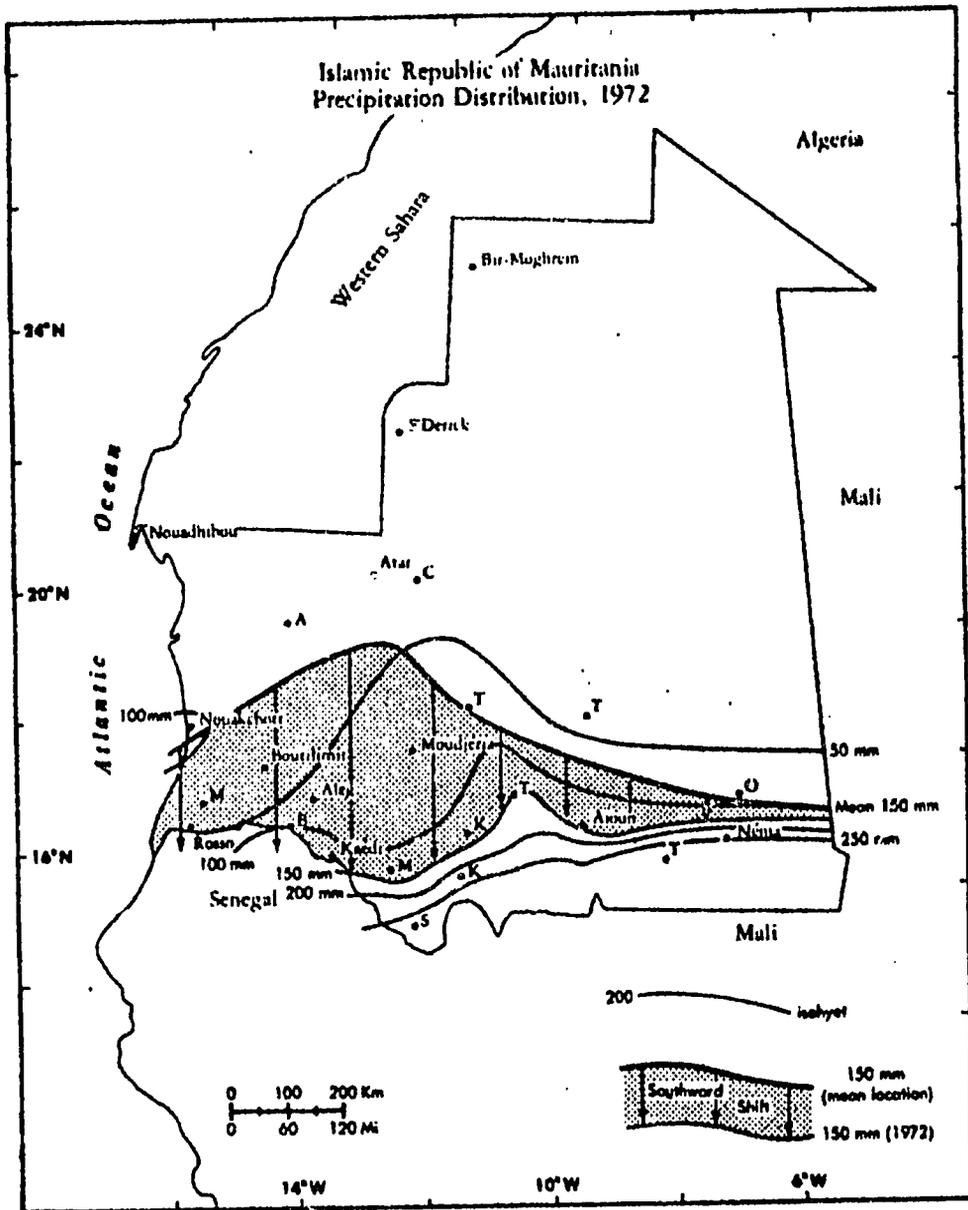


FIG 1-2

Source: Op. Cit.

its normal location in the zone of the rainfall bulge, affecting over 250,000 km² of grazing and crop land (Figure 1-2). None of the country received over 250 mm of rain. In 1978, the year of lowest grain production in Mauritania's recent history, only two small areas received more than 400 mm of precipitation -- the minimum usually considered necessary for successful rainfed cropping (Figure 1-3)¹⁾.

One major observation resulting from a comparative evaluation of the three figures is that southwestern Mauritania, the rural region containing more people, more livestock and more farmland than any other rural area has been subjected to great fluctuations in rainfall during the past decade. Both farming and livestock production have been seriously affected. At this stage it is not possible to judge the total long-term effects on the grazing resource but it is evident from field observations by RAMS team members and others that a period of several years of adequate rainfall will be required to restore the carrying capacity of the rangeland.

Land Use and the Agro-Ecological Zones

The tabulation below shows estimated land use in Mauritania in 1973 (000 ha.):

Total Area	103,070
Land Area	103,040
Arable Land	192 ²⁾
Permanent Pasture	39,250
Forest and Woodland	15,134
Other Land	48,461

1) These figures were constructed during the RAMS consultancy of Prof. Donald Vermeer of Louisiana State University and are a part of a monograph entitled Cattle, Climate and Culture: Collision Courses in Mauritania, 1990.

2) Includes temporary fallow land.

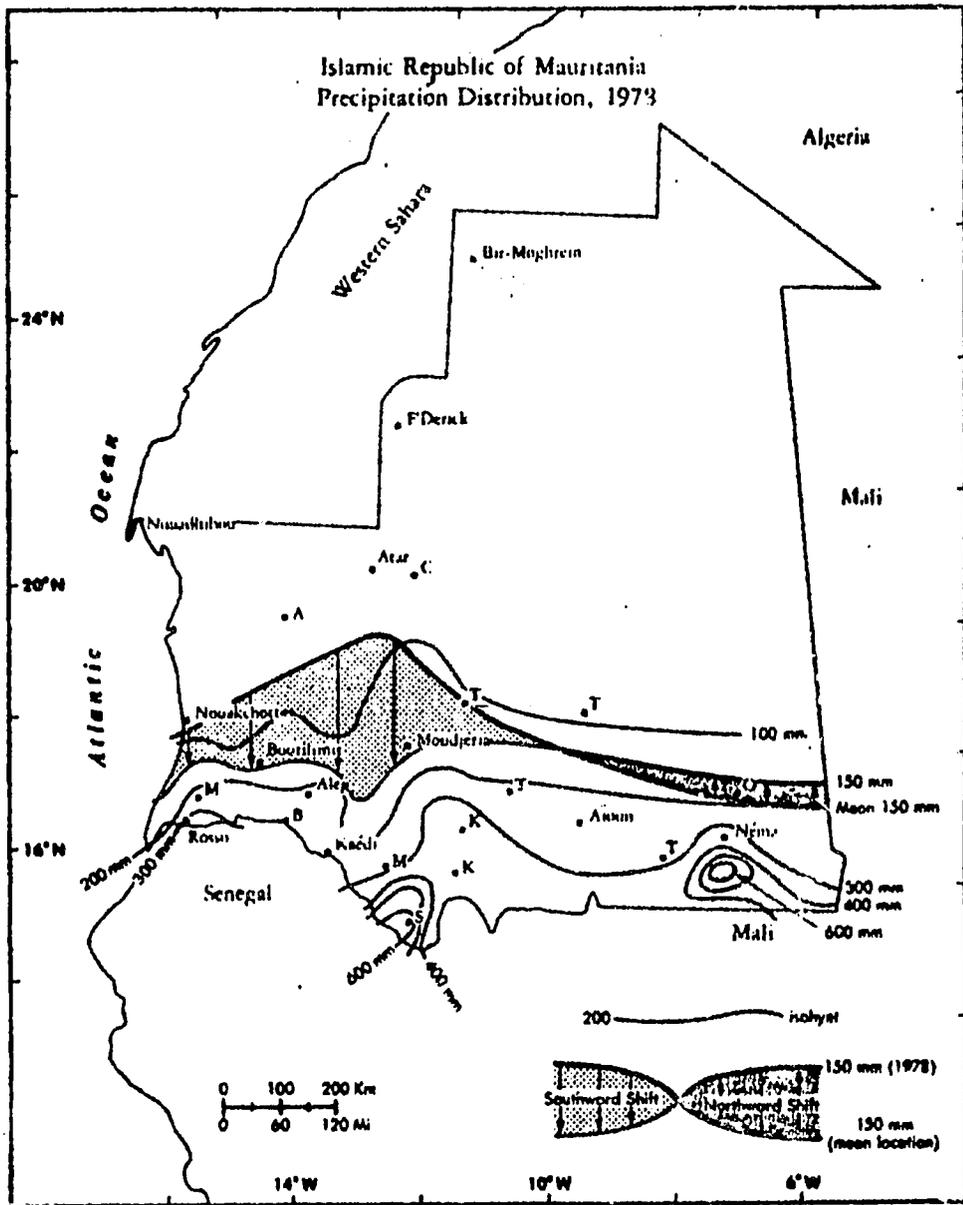


FIG 1.3

Source: Op. Cit.

The above breakdown is much too gross to be of any use in land use planning or analysis. Then, too, it is doubtful that it is even particularly accurate. A more useful classification is the concept of agro-ecological zones, dividing Mauritania into areas predominantly devoted to specific types of agriculture and livestock raising. These zones are outlined in Figure 1 - 4 and described below:

Zone 1: The Senegal River Valley.

This is the alluvial floodplain of the Senegal River, extending a distance of 950 km along the Mauritania-Senegal border with a width of up to 15 km. It is the most intensively farmed area of the country because of the alluvial deposits put down by the River during its flood season (June to October). Recession agriculture is practiced along the banks of the River and its tributaries ("falo"), on the tops of the levee ("fonde") and the broad alluvial floodplain ("oualo"), probably the most productive of the non-irrigated soils. Most of the small irrigation projects are on fonde soils, and rice is the principal crop. Rainfed ("dieri") agriculture is also practiced in areas not subject to seasonal flooding. Millet and sorghum are the principal crops grown.

Rainfall varies from an average of about 650 mm in the south (Guidimackha) to about 300 mm in the more northern areas.

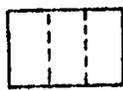
Zone 2: Rainfed agriculture and livestock.

The rainfall in this zone ranges from about 600 mm in the south to the 350 mm isohyet in the north. This is the principal

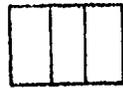
1. Agro-ecological Zones



1. Senegal River Valley



350 mm
+0
450 mm

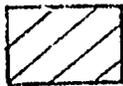


450
+0
650 mm

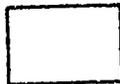
2. Rain-fed cultivation



3. Oued floodland cultivation



4. Palm - groves (oasis)



5. Pastoral zone

Overlapping zone



1. Oued floodland cultivation and Palm Groves

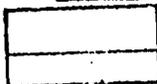


2. Oued floodland cultivation and rain-fed cultivation (between 350 mm & 450 mm)



3. Intermixing of 3 zones - Palm groves
- Oued floodland cultivation
- Rain-fed cultivation
(between 350 mm & 450 mm)

2. Special ecological zone



Majabat Al Koubra

3. Other non-ecological zones

○ Modern urban zones

... Transitional zones: recently paved roads.

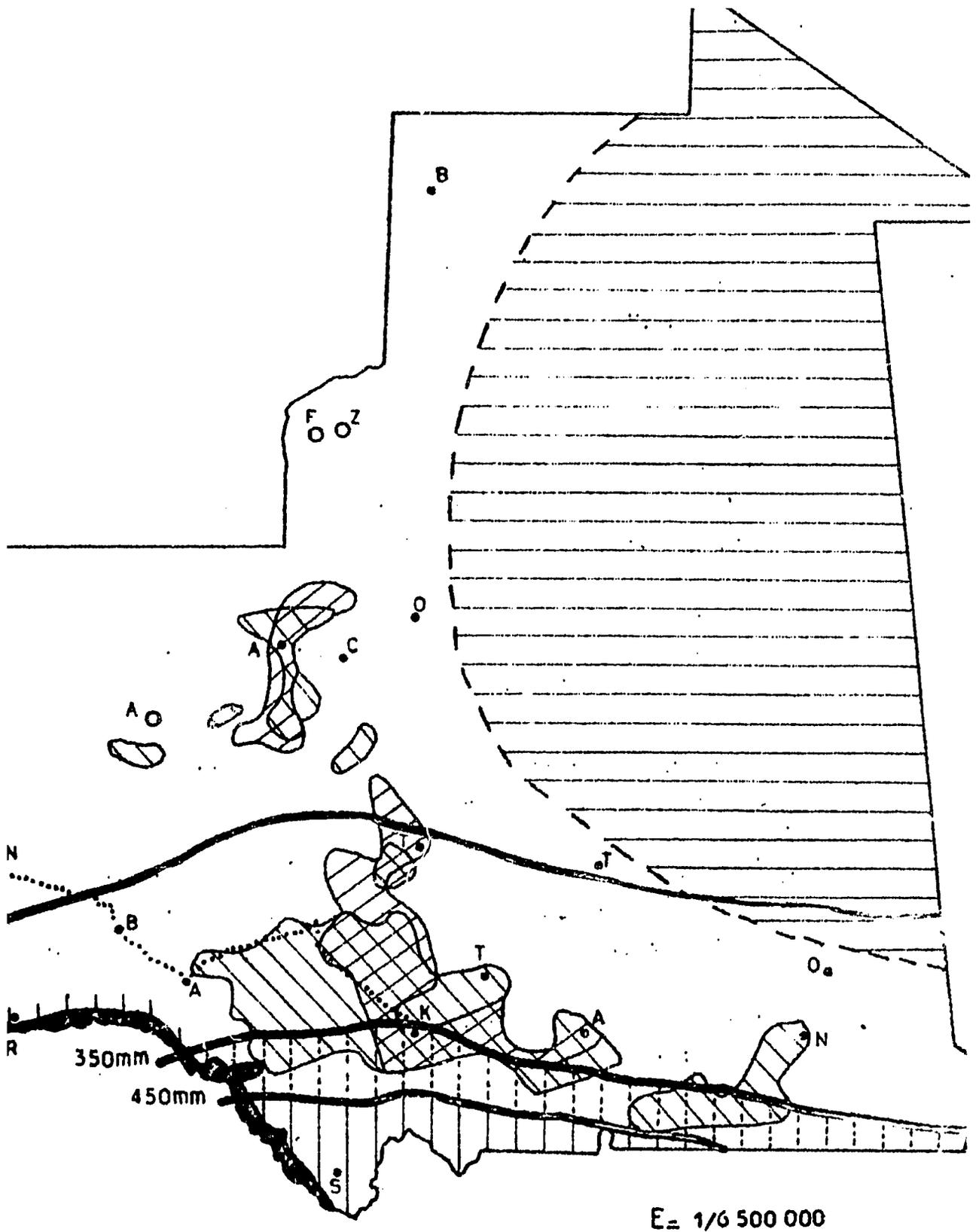


FIG 1_4

zone of rainfed agriculture in Mauritania and is also the main region for cattle production. Agriculture is traditional and shifting cultivation (several years of cultivation followed by long fallow periods) is practiced. The majority of agricultural soils are sands of aeolian origin, alluvial soils being rare. The percentage of clay is low with the exception of soils of the southern Hodhs which consists of red orange silty sands. With adequate rainfall above 400 mm per year, millet is a highly adapted productive crop on such sands.

Zone 3: Recessional agriculture along streams using small dams.

This type of agriculture is practiced between the 350 mm isohyet in the south and the 100 mm isohyet in the north. Most of these dams are traditional earth structure but some are being replaced gradually by more durable, permanent works. Millet and sorghum are the principal crops, but some maize is grown. Trans-humanic herding extending north to the 150 mm isohyet (its northern limit). Sheep, goat and camel herds are common throughout the zone.

Zone 4: Oasis culture.

Oasis culture is economically the most important part of the crop subsector in terms of its contribution to GDP and its returns to date palm growers. As shown in Figure II-4 oasis culture is scattered throughout a large triangle from Atar in the north to Kiffa in the southeast and Nema in the southeast. The basis of oasis culture is the date palm (*Phoenix dactylifera*) but associated cultures are often grown. These include vegetables, cereals and forage crops. Principal determinants of the zones of

oasis culture are a mean temperature in excess of 28°C, absence of rain during fruiting and an ample supply of pure water, at least 3,000m³ per hectare. In many cases oasis culture is accompanied by livestock enterprises.

Zone 5: Pasture

Aside from scattered plantings of millet and sorghum in recessional areas, transhumant livestock herding, principally camels, but including sheep and goats is the principal activity. The zone extends north from the 200mm isohyet and is characterized by an arid climate and by temperature extremes.

Zone 6 : Desert

This zone comprises the "Empty Quarter", about one-fourth of the entire country, and area of about 250,000 km². Only occasional camel herds use a portion of this area, and for the most part it is uninhabited and is one of the world's most inhospitable regions.

Agricultural Employment

An estimated 126,000 workers were employed in agriculture in 1977, compared to 156,000 engaged in livestock herding (Table II-6). The low number of agricultural workers coupled with the relatively small labor pool is indicative of the currently low productivity and output in the crop subsector. Furthermore, continued reports of regular labor shortages in this subsector appear to be justified, since the RAMC sample survey shows instances

of wages for unskilled labor reaching 150 UM/day. The average wage, however, appears to be 80 - 100 UM/day. In this connection it is interesting to note that the average wage in northern Senegal is reportedly about 300 UM/day or two and one-half or three times the average Mauritanian pay.

The foregoing figures, however, may be somewhat misleading, in that a considerable portion of the labor is seasonally employed in other activities, returning to work in agriculture during the growing season. Thus, the actual extent of the overall shortage is impossible to measure except in terms of the above-mentioned wage levels.

Most farm labor comes from family members, but here too, increasing shortages occur because progressive emigration has reduced family members remaining at home. This emigration both internal and external, but out of the rural sector, is probably the most dynamic feature of the Mauritanian economy. As a result of both the drought and the manpower exodus, production in the crop subsector has been reduced to a secondary role in income generation, and farming has become increasingly (80-85%) subsistence oriented.

Table II-6

Rural Population and Agricultural Employment in
Mauritania, 1977
 (thousand persons)

<u>Total Rural Population</u>	1,032
Sedentary ¹⁾	592
Nomadic	440
 <u>Rural Employment</u>	 326
Sedentary ²⁾	179
Farming ³⁾	103
Herding	36
Other Rural	40
Nomadic	147
Farming ²⁾	23
Herding	116
Other	8
 <u>Rural Unemployment</u>	
Sedentary	17
Nomad	3

1) Non-urban sedentary population

2) Includes oasis culture

3) About 10-12,000 persons are estimated to be employed in irrigated agriculture.

Chapter III

Livestock Production

This chapter considers selected aspects of the Mauritanian livestock economy, in relation to herd numbers, prices, costs of production and herd management.

Herd Numbers

As shown in Table III-1, there is little agreement among various sources on the number of animal utilizing Mauritanian grazing resources. Their estimates particularly those of the Livestock Service change greatly over short periods of time. As Table III-1 shows, the Service, over a nine month period, lowered its estimates of herd numbers by 34% (measured in UBT's) bringing its estimates more closely in line with those of FAO.

The UBT uses a rainfall model based on a three year moving average of rainfall at 12 meteorological stations as a proxy independent variable for pasture conditions. These averages were then related to livestock numbers during the period 1972-78 through a set of equations. The model was found to be inapplicable in 1979 when observational evidence and the rainfall records throughout Mauritania suggested a low rainfall year, poor pasture conditions and high death losses which would result in somewhat lower herd numbers than in 1978. The model, however, was not found to be applicable in this instance, showing an increase in the size of the herd in all categories.

The actual fact is that probably no one knows what the population of a freely moving, largely migratory herd is, with the

result that any estimates are highly uncertain.

Mauritania is a part of a Sahelian livestock system with major producing areas also in Senegal and Mali. Herds move freely throughout this region and are trekked to major markets in Dakar and Abidjan. This intercountry movement makes it doubly difficult to estimate the size of a national herd particularly when it is intermingled with herders from other countries.

Although estimates vary, it is probable that about 60% of the cattle, 25% of the sheep and goats and 8 to 10% of the camels graze for at least a part of the year outside Mauritania.

In an earlier RAMS report, future projections of herd numbers were made based on the BCM model, subject to an assumed upper limit on carrying capacities under various conditions of good, fair and poor rainfall. The projection model revealed that under the herd growth and offtake rates generated by the model regardless of rainfall levels, the upper limit to livestock numbers in Mauritania would be reached well before the year 2000, even under the best of conditions. The purpose of the exercise was to focus attention on the need for increased emphasis on herd offtake and meat production. See Table III-1.

RAMS is currently constructing a new model of the subsector which, it is hoped will provide an improved method for projections of both numbers and values.

Table IIX-1

Estimates of Numbers of Livestock in Mauritania
1979/1980
(in millions)

	<u>Livestock Service</u>			<u>BCM</u>		<u>FAO</u>	
	<u>End</u> <u>1979</u>	<u>May</u> <u>1980</u>	<u>Fall</u> <u>1980</u>	<u>(Jan. 1979)</u>	<u>(Jan. 1980)</u>	<u>(1979)</u>	<u>(1980)</u>
Cattle	1.80	1.40	1.20	1.186	1.245	1.68	1.20
Sheep and Goats	8.50	6.00	5.00	7.500	7.963	8.45	5.45
Camels	0.75	0.75	0.72	0.720	0.735	0.72	0.720
UBT (millions)	3.450	2.700	2.370	2.743	2.859	3.188	2.438

UBT Conversions based on the following:

1 camel	=	1 UBT
1 mature cow	=	0.75 UBT
1 sheep or goat	=	0.15 UBT

Source : Livestock Service, BCM and EAC Yearbook, 1979, and FAO computer printout.

The Grazing Resource of Mauritania

CISS (Comite Inter etats de Lutte Contre la Secheresse au Sahel) estimates that about 55 million ha. in Mauritania are suitable for grazing with carrying capacities ranging from a low of 70 ha/UBT to as high as 4 ha/UBT in the more climatically favored regions of the South. An average of about 14-16 ha/UBT is postulated for the country which could give a long term carrying capacity of 3.4 - 3.6 UBT's.

Much of this grazing is seasonal due to limitations of water and grass. The result is the previously mentioned migratory intra and intercountry herd movement, either nomadic (the complete family moves with the herd) or transhumanic (a herder accompanies the animals while the remainder of the family is sedentary).

The drought years of the late 1960's and the 1970's broken only by a few years of adequate precipitation in the mid 1970's, has resulted in an overall decline in carrying capacity of the rangeland. Some of the land had probably been more or less permanently damaged by the effects of desertification, whereas the remainder will undoubtedly need a number of years of good rainfall to return to anything like its pre-drought capacity. Unfortunately, the amounts of land affected by desertification and degradation are not known. However, an early and continuous system of grassland appraisal is warranted.

In addition, the drought and consequent decline of the range have led to greatly increased risk in livestock herding. Previously, herds could survive one or two years of low rainfall because enough residual forage existed. This is no longer the situation, and a single bad year can cause widespread loss of animals.

Price and Marketing.

Table III-2 shows trends in prices paid to farmers or herders for the various species of livestock from 1970-79, as reported by the CIEM's Statistical Office. (The 1980 figures were not ready at the time of writing). The variations shown supposedly represent upper and lower limits to prices during the year. The salient feature of the table, however, is the extent of price increase for all classes of livestock -- a two to three-fold increase since 1974.

1979 producer prices as developed in the RAMS Production Survey are shown in Table III-3. These data show a wider range of prices than do the official estimates, and are, in general, somewhat lower. They also break out the different classes within each species. It should be remembered, however, that the survey was limited to sedentary farmers and herders. Nomads may have a different price structure. Our belief is that the official figures may represent prices for mature animals sold in urban markets by traders, rather than prices received at farmgate or equivalent. Nonetheless, the official estimates do reveal the changes over time, an important consideration when assessing subsector activities.

During December 1980 and January 1981, RAMS has conducted weekly price surveys at the Nouakchott abattoir. Table III-4 shows the range of prices and the averages during the period for each class of livestock. This series should be continued and expanded to other centers after the RAMS Project is completed. In particular, information on short term price movements and seasonal variations will be useful for planning by the Livestock Service, if it attempts to launch a campaign to increase herd take-off.

Table III-2

Producer Prices for Live Animals 1970 - 1979
(expressed in US\$)

Year	Cattle	Sheep	Goats	Camels
1970	2,035	340 a 650	650	5,500
1971	3,000	400 a 720	540	5,520
1972	5,400	400 a 700	600	10,000
1973 ¹	1,500 a 2,500	500 a 1,600	300 a 1,000	5,000 a 7,000
1974	3,400 a 9,000	1,000 a 2,500	500 a 1,800	5,500 a 15,000
1975	4,000 a 10,000	1,500 a 3,000	600 a 1,900	6,000 a 10,000
1976	6,000 a 14,000	1,500 a 3,500	650 a 1,950	12,000 a 20,000
1977	10,000 a 15,000	1,600 a 3,600	1,000 a 2,000	15,000 a 25,000
1978	11,000 a 16,000	1,7000 a 4,000	1,000 a 2,100	15,000 a 25,000
1979	11,000 a 16,000	1,7000 a 4,000	1,100 a 2,400	16,000 a 25,000

¹) Large scale movements to markets occurred in 1973 because of lack of pasturage.

Source: Directorate of Statistics.

The extent of price increases in Mauritania of beef and mutton is at least partly determined to a considerable degree by price in the two major markets for Sahelian livestock, Abidjan and Dakar. Until the early 1970's these markets were almost totally supplied by Sahelian beef, trekked to or near the market and slaughtered there, although Abidjan received some chilled beef moved by rail from Ouagadougou. However, since that time, a large and increasing portion of beef consumed in Abidjan has come from non-Sahelian sources notably the EEC and Latin America. It has been estimated that by 1976, 75% of the beef in Abidjan was imported frozen or chilled, much of it from non-Sahelian sources. Outside imports, originally mainly limited to Class 1 (de luxe) beef, have also increasingly invaded the Class 2 (traditional African) markets in the coastal region as major world exporters searched for new markets.

Thus prices for Sahelian (and consequently Mauritanian) livestock are no longer effectively insulated from outside influences. Fortunately, demand has risen in the two major urban markets, and world prices (including those subsidized by the EEC) have also risen. However, shipments from outside sources are now a reality and could become increasingly important.¹⁾

1) For a more complete discussion of livestock marketing in the Ivory Coast, see C. Delgado and J. Staats Livestock and Meat Marketing in West Africa,-- Volume III Ivory Coast and Mali, University of Michigan, 1980.

Table III - 3

Prices Paid to Farmers for Livestock 1979
(UR/Head)

	<u>Low</u>	<u>High</u>	<u>Estimated Average</u>
<u>Attie</u>			
Bulls	4,000	15,000	10,000
Cows	4,000	20,000	9,000
Young Bulls	3,500	12,000	7,000
Heifers	3,000	9,000	5,000
Calves	1,500	5,000	3,000
<u>heep</u>			
Rams	1,600	3,000	2,200
Wethers	700	2,200	1,500
Ewes	800	5,300	1,800
Heavy Lamb	700	1,800	1,200
Baby Lamb	400	1,000	600
<u>Goats</u>			
Adults	600	2,500	1,300
Yearlings	600	1,500	1,200
Kids	300	1,200	400
<u>Camels</u>			
Adults	7,000	27,000	20,000
Young	5,000	18,000	10,000

Source: RAMS Production Survey, 1980.

Table III - 4

Price Per Head at the Nouakchott Abattoir

Dec. 1980 - Feb. 1981 (OOO UM)

		<u>Live Price (Entry)</u>			<u>Carcass Price (Exit)</u>		
		<u>Large</u> ¹⁾	<u>Medium</u> ¹⁾	<u>Small</u> ¹⁾	<u>Large</u> ¹⁾	<u>Medium</u> ¹⁾	<u>Small</u> ¹⁾
<u>Camels</u>	(101) ²⁾ (5 217) ³⁾						
Low		17.0	12.0	8.0	20.0	9.0	15.0
Mean		22.7	18.4	13.1	25.7	15.3	21.7
High		30.0	25.0	16.0	35.0	20.0	30.0
<u>Cattle</u>	(558) ²⁾ (13 279) ³⁾						
Low		14.0	12.0	7.0	18.0	9.0	15.0
Mean		19.6	15.2	12.6	23.5	14.6	19.8
High		26.0	20.0	15.0	30.0	20.0	25.5
<u>Sheep</u>	(437) ²⁾ (7 738) ³⁾						
Low		2.0	1.5	1.0	2.5	1.2	2.0
Mean		3.2	2.7	1.8	4.2	2.4	3.3
High		5.0	4.0	3.0	5.1	3.6	5.0
<u>Goats</u>	(230) ²⁾ (4 820) ¹⁾						
Low		2.0	1.5	1.0	2.5	1.2	2.0
Mean		3.2	2.4	1.8	3.9	2.3	3.1
High		4.5	4.2	3.0	5.5	3.5	4.5

1) Size of animals is a relative measure based on carcass weight on the specific slaughter day. In general, however, the following categories apply (kg/head).

	<u>Large</u>	<u>Medium</u>	<u>Small</u>
Camels	200 +	150-200	Less than 150
Cattle	180 +	140-180	Less than 140
Sheep	30 +	20- 30	Less than 20
Goats	30 +	20- 30	Less than 20

2) Number of head slaughtered during the 10 visits.

3) Number of head slaughtered during the year as reported by the Inspection d'Élevage.

Livestock Budgets

Livestock budgets for the three major species of livestock are shown in Table III-5. In contrast to the crop budgets in Chapter IV which evaluate costs and returns per hectare regardless of farm size, these are unit budgets in which the number of animals that can be attended by one herder constitutes the operating unit. Furthermore, these budgets in each case supply to a specialized herd (ie. cattle only), whereas under actual conditions cattle and camel herds usually contain some sheep and goats.

The results show that returns per labor day for herder owners are exceeded only by oasis culture which is severely constrained by land availability. In addition, the rate of return on investment by non-herders although quite moderate, is probably higher than most other available investments in rural Mauritania. The high return on the sheep and goat enterprise (nearly double the other two) is not unexpected, since prices are favorable, costs are low and demand in urban markets is high while supplies are often limited.

RAMS estimates from the various surveys show that about 30% of the nomads and 40% of the sedentary rural residents who own livestock hire herders. In addition, livestock is a popular investment for urban dwellers so that a reasonable estimate might be that about 40% of the National herd is owned by non-herders.

Table III - 5
Livestock Budgets in Mauritania
(values in UM)

<u>Income</u>	<u>Cattle</u>	<u>Camel</u>	<u>Sheep + Goat</u>
Number of Animals (Value/head)	100 (10 000)	50 (20 000)	100 (2 000)
Value of Animals	1 000.000	1 000.000	200.000
Gross Herd Increase			
Percent	7.5%	6.2%	20.0%
Value	75.000	62.000	40.000
Milk Production			
quantity (liters)	8.750	10.000	3.150
Value	43.750	50.000	15.750
Fair	-	2.700	3.600
Total Income	118.750	114.700	59.350
<u>Expenditures</u>			
Feed, Veterinary, etc.	6.200	2.300	1.780
Other and Miscellaneous (10%)	11.875	11.400	5.955
Sub-total	18.075	13.700	7.715
Herder Cost	21.000	21.000	21.000 ¹⁾
Total Cost	39.075	34.700	28.715
Net Return	100.675	101.000	51.635 ¹⁾
Labor Days	365	365	180 ¹⁾
Return per Labor Day	276	277	287
Investment Income (non-herder)	79.679	80.000	30.625
Return on Investment	8.0%	8.0%	15.3%

1) Assuming herd is on trek for 6 months. The remainder of the year herding is done part-time by children and other family members.

Source: RAMS.

Table III - 3

Percentage of Farmers by Size Group Who Also Own Livestock by Numbers of UBT¹

No of ha. cultivated	Percent of Farmers by Size Group Who Own Livestock by no. of UBT						Total
	5	5.1-10	10.1-20	20.1-35	35.1-50	55 +	
1	9%	9%	16%	4%	6%	-	44%
1.1-2	3	7	7	10	3	-	30 %
2.1-3	5	10	-	-	-	-	15 %
3.1-4	25	25	25	-	12	-	87 %
4.1-5	50	-	37	13	-	-	100 %
5.1-10	27	27	27	13	-	-	94 %
10.1-20	46	-	8	-	8	38	100 %
20.1-50	-	50	25	-	25	-	100 %
Total	14 %	11 %	24 %	5 %	4 %	4 %	52 %

¹This survey is limited to sedentary respondents who reported both land surface and numbers of animals by type.

Tables III-5 and III-6 also show the difficulty in attempting to institute programs to regulate herd growth; particularly the latter which cross-tabulates farms by size and livestock (measured in UBT) owned by farmers in each size category and which is indicative of the role of a livestock enterprise in farming operations. Each number in the Table is the percentage of responding farmers in each size of exploitation that also have the specified number of UBT of livestock. The right hand column shows the percentage of responding farmers in each size group who own livestock. The bottom row shows percentage of livestock by size of herd owned by responding farmers. It can be seen that over one half of the 167 responding farmers in our sample also owned livestock.

Supplementary livestock enterprises in farming operations have three functions: first, as a form of risk minimization through development of resources in alternative activities; second, livestock herds are means of non-monetary savings and capital formation, and third, consumption and/or sale of livestock are important additions to farmer's monetary and non-monetary income. Any programs or actions to regulate herd size must, therefore, consider both the profitability of livestock herding and the functional aspects of joint crop-livestock operations.

It will probably require some of governmental action if herd numbers are to be limited by any other means than "letting nature take its course". These could include such possibilities as: (1) forcibly limiting number; (2) providing emergency services during years of poor grazing conditions, such as stockpiling feed-stuffs for emergency use or constructing slaughter, transport and cold storage facilities that could be used either under regular or in emergency situations (the Kaedi plan for example);

or (3) providing alternative profitable investment opportunities particularly for the non-herder portion of livestock owners who often regard livestock only as a profitable investment. Each of these alternatives could be weighed against the private and social costs of animal mortality and rangeland degradation.

It is unlikely that any coercive limitations of animal numbers nor restriction of grazing areas would be successful. Furthermore, the cost of maintaining a rural guard force of the size required to police the range would be enormous. Similarly the second alternative of providing services either regularly or in emergencies would be very costly. The Kaedi plant has operated at a small fraction of capacity even during dry years.

A third alternative might be to increase the number of investment opportunities open to owners, many of whom own livestock purely as one of the most profitable investments in the rural sector. One suggestion has been the creation of a rural savings fund that would pay return equivalent to the return from herd investment (9-11%). If such a fund were to invest domestically with the low marginal efficiency of capital in Mauritania returns to savers would have to be subsidized. If however these funds could be invested in foreign money markets a rate of return exceeding the savings rate would be possible. The idea may sound far-fetched, but at least it would provide an alternative investment to rural people. In addition returnees from abroad would have an investment option not hitherto available to them. At present, they often invest in livestock or urban real estate and the reaction of this type of fund would provide an additional investment choice. Further, it might encourage herder owners to sell additional livestock in excess of their immediate cash needs investing the extra funds at high returns and one that is less risky than enterprises in the Sahel .

Chapter IV

Crop Agriculture

The estimate of crop production by various sources vary as widely as those for livestock. The estimates of millet and sorghum production, for example FAO and the Division de la Statistique agree in only two years in the Sice, and for date production the estimates are equal only in 1974. The estimates shown in Table IV - 1 are those of EAC, since they are more complete than the other estimates. For example, FAO estimates that about 3,500 tons of groundnuts were produced in Mauritania in 1979 on about 5,000 ha. The revised National Accounts do not mention groundnut production. The RANS Production Survey shows only a small surface in groundnuts mostly in association with other crops. Field observation by RANS and other agronomists tend to confirm the survey results. So, on the one hand there is no estimate at all. A reliable statistical service within the Ministry of Rural Development is badly needed. It is understood that a project to establish such a service is getting underway.

Production Trends

Table IV - 1 and IV - 2 show that the low level of productivity in the crop subsector is not only the result of the recent drought. In fact the production of all staples shown a declining trend at a rate of 4% per year since 1961 while cereal production has declined at an average rate exceeding 5% per year (Table IV - 2). Both rates of decline are the highest of any of the Sahelian countries. $(\frac{\Delta V}{V} = \frac{\Delta}{t})$ over the long term is higher for Mauritania than for any other country shown in the Table, reflecting the uncertainty of production due to wide year-to-year fluctuations in surface and yield.

Although the amount of irrigated land has increased gradually over the period, increased production from these perimeters has not been anywhere near sufficient to offset the decline in output from rainfed/recessional agriculture.

Farm Budgets

Table IV - 3 shows comparative farm budgets for major types of farming system. In each case no charge was made for labor and the resulting calculation is return per labor day, a crude measure of labor productivity in each type of farming. It can be seen that returns to labor are very low in rainfed/recessional agriculture (under 100 UM/day). Even at 4 tons/ha rice culture has a low return, but a part of this is a function of fixed price paid to growers by the agencies of the GINM. Prices of 11 UM and 12 UM/kg would yield the following results:

<u>Price</u>	<u>Net Return</u>	<u>Return per Labor Day</u>
11 UM/kg	20,520	137
12 UM/kg	24,570	164

Actually, the average yield at present on the small perimeters is estimated to be slightly less than 3 mt/ha/culture assuming double cropping, so that returns are only about 44 UM/day if all recommended practices are followed and the prescribed quantities of inputs are used.

Table IV - 1

FAO Estimates of Production of Major Crops in Mauritania
1961/65 and 1973/79

	1961-65 Average	1973	1974	1975	1976	1977	1978	1979
Millet/Worghal	33,200	35,000	50,000	45,000	36,000	21,000	17,200	35,000
Maize	3,620	1,500	3,000	4,000	4,500	4,000	4,800	5,000
Rice	500	3,000	3,000	3,240	3,960	3,600	3,500	4,000
Coconut	9,600	2,000	4,000	5,000	10,000	12,000	13,000	14,000
Potatoes	1,020	1,500	1,500	1,800	2,500	2,500	4,160	4,000
Sweet Potatoes	1,020	700	1,500	1,700	1,700	1,800	1,800	2,000
Wheat	97	150	150	170	250	200	180	200
Groundnuts	746	980	1,000	1,000	3,000	3,000	3,200	3,500
Yams	1,920	1,700	1,800	1,800	1,800	2,000	2,000	2,000
Barley	202	150	150	170	180	200	150	200
Other Pulses	8,500	5,000	6,500	3,000	10,000	10,500	11,500	12,000
Vegetables (net)	2,000	1,500	1,500	1,700	1,700	1,800	2,200	2,300
Watermelon	1,200	1,000	1,500	1,500	3,000	3,000	4,000	4,300
Dates	17,000	10,400	10,400	10,600	10,000	11,000	12,000	14,000
Other Fruit	2,000	1,500	1,600	1,500	1,700	1,500	1,800	2,000

Source : M.D. Computer Printout.

Table IV - 2

Food Production and Consumption Trend and Variation, 1961 - 1977

	<u>Consumption of Cereals</u>		<u>Production</u>		<u>Cereals</u>	
	Trend	Coefficient of Variation	Trend	Coefficient	Trend	Coefficient of Variation
Sta.	(% year)	(percent)	(% year)	(percent)	(% year)	(percent)
Ghana	-2.52	8.43	-2.72	8.41	-2.52	9.56
Gambia	1.78	8.63	1.23	8.23	-1.0	12.69
Ghana	3.72	9.12	-3.11	12.36	-0.71	13.45
Mauritania	1.22	8.18	-4.62	21.49	-5.22	22.91
Niger	3.04	14.33	-0.23	14.73	-0.43	16.19
Senegal	0.75	16.49	3.93	20.83	0.89	22.67
Upper Volta	1.52	9.80	1.34	15.56	1.25	11.79

Source . International Food Policy Research Institute 'IFPRI', Food Security Program, Washington, D.C., 1978

Table 10

Estimated Costs and Returns per Hectare Under Different Types of Cultures in Mauritania, 1979

(US\$)

<u>Types of Culture</u>	<u>Cost Per Hectare</u>			<u>Total Costs</u>	<u>Crop Grown^(S)</u>
	<u>Materials</u>	<u>Maintenance Depreciation of Equipment</u>	<u>Other Cost¹⁾</u>		
<u>Rainfed/Recessional</u>					
Diari (Senegal Valley)	103	100	1,250	1,453	Sorghum
Diari (South East)	162	100	405	673	Millet Niebe
Diari (Animal traction)	172	100	455	727	Sorghum Millet, Niebe
Recessional (in barrages)	172	2,950	1,020	4,152	Sorghum, Millet Niebe Beef
Recessional (in barrages)	133	100	623	856	Sorghum, Niebe
<u>Irrigation</u>					
Rice (1 culture)	12,390	4,500	9,550	23,430 ²⁾	Rice
Sorghum	5,600	4,500	8,772 ³⁾	18,872	Sorghum
Tomatoes	12,580	4,500	23,490 ³⁾	38,570	Tomatoes
<u>Oasis</u>					
Group 1	11,550	16,775	31,725 ⁵⁾	98,615	Dates Vegetables Palms
Group 2	1,760	7,315	19,100 ⁶⁾	28,175	Dates Vegetables Palms

Production	Price (UM/kg)	Total Return	Net Return	Labor Days	Return Per Labor day (UM)
430	14.5	6,235	6,134	85.5	72
45	30	1,350			
300	13.5	4,050	3,377	70.4	55
325	14	4,550	3,623	72	78
60	30	1,800			
370	14	5,250	5,298	55 ¹⁾	96
50	30	1,800			
0.33 yield	7.28	2,450			
430	14.5	6,235	7,179	89	81
60	30	1,800			
4,000	10	40,000	16,570	150	110
3,500	14.5	50,750	31,380	120 ⁴⁾	256
2,500	20	50,000	10,820	75 ⁴⁾	145
3,200	35	112,000	203,435		
6,000	25	150,000	153,775	174	1,169
502	2.5	1,480			
3,000	35	112,000			
300	25	20,000	105,305	117	900
502	2.5	1,480			

1) Includes explicit or implicit rent in Rainfed/Seasonal culture and annualized investment cost at 6% in irrigated and oasis culture as well as contingency and miscellaneous costs.

2) Annualized capital cost of 175,000 UM/ha at 6%

3) Assumes that harvest and transport costs 15% of the crop value

4) Uses family labor

5) Includes annualized investment cost of 500,000 UM at 6%

6) Includes annualized investment cost of 300,000 UM at 6%

The small perimeters have had problems with maintenance and repair of lift pumps. Often the fields are without water for several days, and since paddy is highly sensitive to drought, yields can be sharply reduced.

The budget estimates also show that sorghum is much more profitable per ha. than rice. Unfortunately, no Mauritanian experiments were available for analysis so results from one of the small irrigation perimeters in Senegal were used. The sorghum price is higher than the paddy rice and input levels are lower. Thus the returns to labor are more than double those of paddy.

Oasis culture is highly profitable, particularly when dates are grown in association with other culture. In the budget estimates we have used vegetables as the associated crop, although cereals and forage are also commonly found "sous-arbres". Date prices are favorable and labor requirements are not excessive.

The budget shows two types of oases:

An intensively cultivated oasis near a major center (Atar for example) where markets are readily available;

An oasis located some distance from a major center. Associated cultivation is not as intensive as in the above case. This type is often associated with a livestock enterprise.

The Oasis Culture report estimates that the total surface of date palms in Mauritania is about 4,500 ha. Expansion without new techniques of tapping subterranean water is probably limited to about 500 ha. Therefore, there is an element of monopoly rent in the return from oasis culture.

In rainfed/recessional agriculture the population practices subsistence farming, a system that provides very little capital formation and concentrates labor requirements at the beginning and end of the crop cycle. If there is a surplus it may be sold at farmgate or at the local market. If the crop is poor, as it has been in most recent years, there will be little involvement in the cash economy. The RMC Production Survey reveals the low level of financial flows into and out of agriculture. Few inputs are purchased and only a small portion of the output is sold.

In addition, rainfed/recessional farmers face the risks of low and variable rainfall, harmattan winds at critical stages of the plant growth cycle, predator and pest damage, and limited farm and village storage which is subject to product loss and deterioration.

Although money flows do exist in rural areas of Mauritania as shown in the RMS Consumption and Income Surveys, they appear to be largely external to the farming operations themselves. Nor does there appear to be any particular motivation to increase money flows. In fact, possibly the opposite is occurring and agriculture has been reduced to a secondary role in terms of income generation. The question is, has the sector stagnated to the point where without major structural changes it cannot even reproduce the conditions necessary to its functioning in other than a subsistence economy? No doubt both the drought and

GIRM price and import policies are at least partly responsible for this lack of a "production dynamic" since they both have inhibited possible supply responses even as demand for agriculture products has increased. However, the decline has taken place over a long time and probably a complex of interrelated causes is responsible for the secular decline in production and the current stagnation in the subsector. It is questionable whether rainfed/recessional agriculture can be expanded in anything like the amounts needed to even keep pace with the growing cereals.

Irrigated farming reduces the risks encountered in rainfed/recessional agriculture by reducing yield variations and increasing average yields, thereby increasing money incomes. However, other types of risk are encountered, notably management risk wherein the farmer is introduced to a new and more complex farming system. Purchased inputs are required, necessitating a credit system, with repayment expected at harvest. Also, timing is more important throughout the growing season and labor requirements more evenly distributed than under traditional rainfed/recessional farming.

Cereal Balances

Steadily declining production of cereals coupled with population growth has resulted in steadily increasing cereals imports. At present, domestic production of cereals accounts for less than 2% of domestic disappearance, while commercial imports of rice and other grains account for slightly more than one-third and foreign donations for about one-half of the supply available for domestic consumption. Imports from all sources

including donations have steadily risen, as follows.

<u>Year</u>	<u>Grain Imports¹⁾ (000 mt)</u>
1975	99
1976	139
1977	148
1978	150
1979	152

The average 1976-78 domestic production of 25,000 mt coupled with average grain imports of 145,000 mt gave a per capita consumption of about 127 kg/person/yr, a reasonably close approximation to the results of the Consumption Survey in which per capita consumption of rural sedentary dwellers was 134 kg while nomad consumption was somewhat less. The following tabulation shows potential consumption in 1990 and 2000 under three assumptions:

- 1) Population growth at 2.5% year with no growth in per capita income;
- 2) Population growth at 2.5% year, per capita income growth at 1% per year and an income elasticity of demand (E_p^V) cereals of 0.5 (a reasonable approximation of the results of the Consumption Survey in which income elasticity was estimated at 0.44 for the rural sedentary population);
- 3a) Population growth at 2.5% per year, per capita income growth of 2% year and E_p^V of 0.5.

1) Commercial and donated grain.

Cereal Requirements

(000 mt)

	(1)	(2)	(3)
1978	145	145	145
1985	172	178	184
1990	195	206	219
2000	221	239	260

It is obvious from the foregoing that a major effort to restructure Mauritanian grain production will be required. By the year 2000, import requirements could reach 250,000 mt or more. At current (1980) average value of imported grain of \$230/mt (midway between the maize/sorghum price of \$140/mt and rice at \$320/mt) the potential structural cost to the balance of payments from cereals imports could total US \$55.50 million. Even if half the shortage is made up of shipments from international donors, the actual foreign currency financial cost could be as high as US \$25.50 million at 1980 prices.

Irrigation

With the exception of small amounts of irrigation from ground water resources, notably for oasis culture and some small areas around wells, irrigation is limited to the Senegal River Valley and areas along tributary streams. In 1972, Mali, Senegal and Mauritania set up the Organization pour la mise en valeur du Nerve Senegal (OMVS) to develop the Senegal River Basin. Individual irrigation projects are to be controlled by member Governments, but the overall development of major infrastructure will be responsibility of OMVS.

OMVS plans two major dams, Manantali in Mali to create a large reservoir to control the flow of the river and Diama at the mouth of the river to prevent salt water intrusion. These dams would allow irrigation of about 125,000 ha. in Mauritania. However, the cost of the two basic dams alone would total more than \$600 million, and individual projects contemplated would require additional funding. So far, the amounts pledged by various donors total enough to begin construction of the upper dam (in Manantali) and construction is scheduled to begin in 1982/83. Allowing a four to five year construction period, some additional land should be available for irrigation development before 1990. In the interim, however, scope for additional irrigated development is limited.

In Mauritania, the Societe Nationale pour le Developpement Rural (SONADER) is charged with identifying, executing, supervising and managing irrigation and other rural development projects. To date, much of SONADER's work has been with small village irrigation perimeters (petits perimetres villageois). These are small perimeters averaging from 20-40 ha. in area and divided into plots averaging about 0.2 ha./family, although some holdings are as much as 0.5. Even at a paddy yield of 4 mt./ha./crop (which has not yet been attained) on the average these are much too small to support a farm family. SONADER, however, believes that most farm families in the small perimeters will also farm some rainfed/recessional land, and that the irrigated landholdings, no matter how small will lessen at least a portion of the production risk. The Production Survey shows that most farmers in the small perimeters also farm outside land. Capital costs of the small perimeters range from 150,000 - 2000,000 UM/ha. (\$3,300 - \$4,500/ha).

Recently, a group of international donors led by the IBRD has granted credits for construction of the Gorgol Irrigation Project, on the Gorogol Noir River, a tributary of the Senegal River. This project will irrigate about 3,600 ha. at a capital of approximately \$71 million and a total cost of \$93.2 million. Capital costs per ha. (including physical and price contingencies) are projected at nearly \$20,000/ha., including construction of the Foun Gleita Dam. An internal rate of return of about 7.4% is estimated. Partial justification for funding the project is contained in the following statements:

"Its rate of return is low -- but not lower than rates of return projected for other irrigation projects underway (Boghe) or planned (OLYS Studies), or in other sectors of the economy (GUMLES iron ore mining). This pattern suggests that the opportunity cost of capital in Mauritania is not higher than 7-8%, the main reasons being factors associated with the country's state of extreme underdevelopment and several immutable natural constraints."(1)

It is expected that the project will be completed in 1986/87. The IBRD also believes that it is probably unrealistic to assume that the process of irrigation development will exceed 1,000 to 1,200 ha/year, including the Gorgol Project for at least the next decade.⁽²⁾ This would mean that less than 20,000 ha. would be under full irrigation by 1980. This schedule would do no more than barely keep up with the increase in the cereals deficit.

(1) IBRD Staff Appraisal Report, Mauritania Gorgol Irrigation Project, 1980, processed, p. 9.

(2) Ibid, p. 7.

Price and Marketing of Cereals

The combination of low domestic cereals production, large scale commercial imports of rice and the increasing volume of donated cereals has led to a pricing system that segments the market and limits producer incentives. At present, domestic production provides less than 20% of the available supply of cereals, while rice imports account for about one-third and donations for over one-half of the total.

Traditional marketing channels have to a large extent been replaced by Governmental agencies that control the bulk of the supply fix prices and set patterns of distribution. The three agencies involved are

- SONNEX (Societe National d'Import Export) has a monopoly on imports of rice, sugar, tea and certain cloth. In addition, it exports gum arabic.
- The commissariat de l'Aide Alimentaire (CAA) controls all donations including cereals, fixes prices and is responsible for distribution.
- OMC (Office Mauritanie de Cereals) is charged with domestic price supports and with building reserve stocks from domestic cereals production. In recent years domestic production has been too low to provide any surplus to add to reserves, and its price support activities have been minimal. Grain purchases have totaled about 3,300 tons, and OMC's main function at present is to store donated grain in its warehouses.

Rice Imports

The volume of rice imports has steadily trended upwards, increasing from about 27,000 mt in 1971 to more than 50,000 mt in 1979. SONIMEX fixes wholesale and retail prices in Nouakchott and distributes rice throughout the country at a uniform price with the help of a transport equalization subsidy which enables SONIMEX to fix a flat transport charge of 3UM/kg, regardless of destination.

International rice prices, including those for Asian broken (type and grade usually imported by SONIMEX) show wide annual and seasonal price variations. During 1980, the CIF price for Asian broken increased from about \$240/mt to a level of about \$320/mt. Table IV-4 shows a "bareme" of the cost to SONIMEX at \$325/mt and \$400/mt.

Table IV-5 shows a second "bareme" of the cost of processing and marketing domestically produced paddy. At present, with the small production in Mauritania, most paddy is auto-consumed after hand threshing. However, a small volume is milled commercially but is almost all sold locally in the producing area. It can be seen that domestic rice is currently somewhat less costly to produce than imported rice delivered in the paddy-growing areas along the river. However, it cannot compete with imported rice in Nouakchott. Rice prices, however, are trending upward, and we have shown a second series priced at \$400/mt. The price differential narrows substantially, although imported rice would still serve the Nouakchott market.

Donation.

The Commissariat de l'Aide Alimentaire is responsible for securing and distributing donated food, principally cereals. Total donations have varied from 60,000 mt to 90,000 mt since 1976. A portion of the donated supply is distributed free to indigent families, and the balance is sold currently at prices of 10 UM/kg in Nouakchott and 8UM/kg in the interior to eligible low income recipients. Proceeds from these sales are used to cover transport and distribution costs. Donations include sorghum, wheat and flour, rice and maize.

Table IV - 4.

Cost of Importing Rice
(UM/mt except for CAF prices)

Price CAF (\$)	325 ¹	400
UM equivalent	14,625	18,000
Buying expenses	292	626
Harborage and transit	1,500	1,500
	<hr/>	<hr/>
Sub-total	16,417	20,146
General Expense	2,683	3,292
Taxes	493	604
Margin	294	352
Storage	320	320
	<hr/>	<hr/>
Cost Nouakchott	20,206	24,714
Transport to Interior	3,000 ²⁾	3,000 ²⁾
Cost Interior	23,206 ²⁾	27,714 ²⁾
	(25,206) ³⁾	(29,714) ³⁾

¹⁾ The price for Asian 5% broken is estimated at \$420/mt CAF. Using the formula $Z = 16.05 + 70 Y$ (Y = price of broken, Z = price of 5% broken) the price CAF Nouakchott. = about \$320/ton.¹ We have used a figure of \$325.

²⁾ This is a subsidized transport cost. The actual cost of transport is estimated at 5 UM/kg.

³⁾ Unsubsidized cost averaging 5 UM/kg.

Table IV - 5Cost of Processing Domestic Rice

	UM/mt
Producer Price of Paddy	11,000
Transport and Handling	2,000
Sacks and Labor	500
Milling (paddy)	1,800
Storage	500
	<hr/>
Sub total ex-mill	15,800
Conversion	0.60
Rice equivalent/ton	24,500
Less price of by-products	-1,800
	<hr/>
	22,700
Transport Nouakchott	3,000 ¹⁾
	<hr/>
Cost delivered	27,700 ²⁾

1) At subsidized charge (see Table IV-2)

2) Unsubsidized transport cost averaging 5 UM/kg.

Marketing of Domestically Produced Cereals

A network of private traders still exists to market millet and sorghum, the traditional Mauritanian cereal crops. These include primary grain buyers, transporters, wholesalers, caravan merchants, and retailers. Often a merchant carries out two or more functions.

The primary grain buyer resides in the production zone. He may own his own store, or he may merely serve as a local collection point for locally produced grain. Part of the collected grain is sold to rural non producers and another part may be sold to transporters, wholesalers or even urban retail merchants. In some cases he may be the agent of an urban wholesaler who supplies him with staples such as tea, sugar, condensed milk, etc. In some localities members of farm households, usually women, sell small quantities of cereals in local markets.

Transporters sometimes buy grain from farmers or local markets during trips. They employ the same cash and barter methods used by primary buyers and may supply urban wholesalers and/or retailers.

Wholesalers distribute a fairly wide range of products and consequently cereals are only a small fraction of gross sales. An individual may dispatch sugar and tea into rural areas to pay for his purchases and can obtain fairly large quantities of grain, up to 1,000 tons. The larger wholesalers have trucks and warehouses and sell to smaller wholesalers and retailers. Wholesalers also import millet and sorghum from neighboring countries, notably Mali.

Caravan merchants are sometimes owners of land cultivated by sedentary farmers also purchase grain from producers and primary buyers. These merchants also move grain from Mali and Senegal and sell to nomads, primary buyers and others.

No attempt has been made in this report to assess the efficiency of this traditional market. Table IV-6 shows estimated prices of millet and sorghum in various stages of the marketing chain in 1979-80. These prices should be viewed with caution since they were obtained from several different sources, who often provided conflicting information.

OMC is also charged with the dual function of building storage stocks from domestic production to supplement the private trade and to provide price guarantees to producers. The agency has been relatively unsuccessful in building stocks due to the low cereal production in Mauritania. Purchases have been limited to 1,500 mt of millet and sorghum in 1977/78 and 1,800 mt in 1978/79. At present, OMC warehouses are principally used to hold imported grain.

Cereals Price Comparisons

The rapid increase in rice imports and the volume of donated cereals have until recently effectively cut off domestic producers from the Nouakchott market. Since they receive imported cereals at relatively low or subsidized prices, urban dwellers tend to change consumption habits away from higher priced traditional cereals. Only in rural interior markets was there anything approaching price comparability during 1980, and even there, a substantial segment of the non-farm population receive donated

grain. Table IV 6 summarizes a rough comparison to cereal prices in various markets in September 1980. A cautionary note; these prices require much more research and verification.

On November 1, 1980, faced with huge and growing losses in its rice import program, SONITEX raised retail prices of brokens to 17 UM/kg and the price of whole grain to 30 UM/kg. RAB has monitored prices in the three main Nouakchott markets on a once weekly basis during December, 1980 and January, 1981. The results of this investigation are shown in the second half of Table IV 7, and confirm these higher prices. Current (1981) prices comparisons in rural markets are not available nor current farmgate prices in the spring of 1981. (1)

Potential Yields in Rainfed/Recessional Agriculture

Enough basic information exists on crop response to light applications of fertilizer (mainly nitrogen) in rainfed/recessional agriculture in Sahelian countries where rainfall is less than 600 mm. Table IV 8 shows the results of some of the available trials.

It should be remembered, however, that these are experiment station results, and yields are much higher than they would be on farms. A normal "rule of thumb" is that farm yields will be one half or slightly less of experiment station yields. Nevertheless, it should be possible to double yields of millet and sorghum (presently about 310 kg/ha.) in rainfed/recessional lands in Mauritania in areas where rainfall exceeds 450-500 mm without changing any basic technology.

(1) We have also monitored incoming and retail prices of vegetable in the Nouakchott markets. These data will be passed on to the USAID Vegetable Project.

Table IV -6

Comparative Prices for Domestically Produced
Cereals (Summer, 1980)
 (UM/kg)

	<u>Millet</u>	<u>Sorghum</u>
Producer Price ¹	13 - 15	14 - 16
Price at Local Market	19 - 22	18 - 20
Cost of Transport	5 - 6	5 - 6
Wholesale Price Nouakchott	28 - 30	24 - 26
Retail Price Nouakchott	32 - 34 ¹	25 - 28 ¹

Sources : RAKS Production Survey and interviews with buyers and sellers in local markets.

1)Note: These are prices in the dry season. Information on prices during the wet season is not available.

Table IV -- 7

Prices of Cereals in Nouakchott and Interior Markets
August 1980 (UM/kg)

	<u>Nouakchott</u>	<u>Interior</u>
Millet and Sorghum	30 - 35	18 - 21
Rice (SONIMEX)	14	18 - 20
Donate Cereals	10	8

December 1980 - February 1981

Millet and Sorghum	32 - 36	NA
Rice	17 - 30 ¹⁾	NA
Donated Cereals	10	8

¹⁾ 17 UM/kg for brokens and 30 UM/kg for whole grain rice.

Such an increase would add over 4,000 UM in value/ha. at a cost of about 400 UM/ha. (12 kg Urea and 6 kg of TSP.) The Kaedi Experiment Station could introduce station and field trials to determine optimum fertilizer applications as well as to test seed best adapted to fertilizer. At the same time a small group of extension agents could be trained and assigned to such a project.

During the first year, the project might encompass about 2,000 farms (3,000 ha.) in dieri and oualo lands, probably requiring inputs of about 20 extension agents and 50-100 tons of fertilizers. If satisfactory, the program could be expanded at a rate of 500-1000 farms per year (6-10 additional agents.) Farmers would be expected to pay for the fertilizer at harvest, either in cash or kind. Probably ONC should be the agency to distribute fertilizers and receive payment, at least until such time as village pre-cooperatives or cooperatives are formed.

The foregoing program could be accompanied by a simple crop insurance scheme, subsidized at first, but possibly made self-supporting later. It might work as follows

- Establish a base yield for the area.
- In case yields on the cooperating farms fall below that figure by some percentage, make up the difference in cash.
- If yields are above the standard by some fixed percentage, charge a small insurance premium, payable at harvest. Eventually, the program might become self supporting.

Table IV-8. Potential Yields in Rainfed/Recessional Agriculture

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Organization	Location	Type of Farming	Crop	Fertilizer	Yield/ha (kg)
IRAT	Senegal River Valley	Recessional	Sorghum	100 kg	1,600
IRAT	Senegal River Valley	Rainfed	Millet	100 kg	1,400
IRAT	Senegal River Valley	Rainfed	Cowpeas	100 kg	1,300
IRAT	Mali		Sorghum	100 kg	557 (net increase)
IRAT	Upper Volta		Millet	100 kg	596 (net increase)
IRAT	Niger		Millet	30 kg	1,700
			Cowpeas ¹⁾		576

1) Interplanting: CID: 1980. Annual Technical Report, Niger Cereals Project, A.C. Cunard.

Source: Monagomary The Economics of Fertilizer Use on Sahelian Cereals: The Experience in Mali and Upper Volta, REDSO/WA Processed.

IRAT Les Travaux l'IRAT en Mauritanie, Bref Apercu et Bilan, 1970.

The program outlined above would have three major benefits:

Together they would partially (but certainly not entirely) eliminate some of the risk inherent in rainfed, recessional culture in Mauritania.

Yields and production should be increased and farmers should be able to enter the market economy to a greater extent than at present.

By starting on a small scale lessons can be learned, administrative procedures developed and experimental and field data gathered and evaluated.

Chapter V

The Production Survey

This chapter summarizes the basic findings of the Production Survey, conducted in late 1973, and supplemented by a brief survey in October 1974. Portions of the data generated from this survey have been used elsewhere in this and other NARS reports. In particular, surrogate price information for both crops and live stock and farm wage rates have been used in the subsector reports, and in parts of the marketing analysis. Some additional production data have been useful (with appropriate interpretation) in the oasis and livestock subsector reports. Those data will not be repeated here.

The original questionnaire consisted of 43 pages with over 500 items for response. The responses and estimates shown in this chapter should be regarded as only indicative and conclusions drawn therefrom should be qualified appropriately.

Response to the Survey

Table 7-1 shows response to the Survey. Out of 277 questionnaires, 167 showed the surface farmed, while in only 104 responses could surface be related with production to obtain yields. Since the rate of valid responses is not proportionate to the sampled farms within the zones, the sample is automatically biased in favor of those zones where response is highest. Of

interest, however, is the degree of livestock ownership by sedentary farmers. More than 34% of the farmers who had crop land also had livestock, a risk prevention and capital formation measure (see Chapter 111).

Size of Farm and Type of Culture in the Agro Ecological Zones

Table V - 2 through V - 5 give basic characteristics of farming in the agro ecological zones. Principal types of farms and amounts of land cultivated in each type of farming are shown. In addition, a breakdown of numbers of farms and areas cultivated by size have been made. The tables are in percentage terms.

It is interesting to note the high percentage of multiple enterprise exploitation. Further analysis gives the following breakdown of the 31% of total farms in this category:

- 20% are combined irrigation rainfed/recessional farming
 - 41% are dieri recessional culture
 - 31% are oasis and other culture, including culture "sous arbres"
 - 8% are combined falo and oualo
-
- 100%

One	Total Questionnaire	Total Responses	Total With Crops	Total With Surface	Total Agriculture only	Total Livestock only	Total Agriculture & Livestock	Total Farms With Production ¹⁾
	57	53	48	36	36	5	12	25
	46	43	36	23	5	7	31	12
	41	41	33	32	19	8	14	9
	57	50	40	35	28	10	12	42
	76	74	42	41	23	32	19	15
Total	277	251	199	167	111	62	83	104

¹⁾ Where production can be related to surface on which it is produced.

Source: RAHS study on Production Survey, 1980.

In irrigated agriculture the very small size of the individual holdings in the small village perimeters makes it imperative to farm additional land to provide food for the farm family. The combined rainfed/recessional culture can be reviewed as an attempt to minimize risks in each type of culture, while the combination of crops in oasis culture provide additional income to an already profitable enterprise at low marginal cost. In chapter III the number of combined crop/livestock enterprise is discussed.

Tables V 6 and V 7 give a picture of the types of farming in each agro ecological zone, showing both percentage of farms and percentage of surface in each kind of exploitation, but related only to lands within the zones themselves.

Regional Summaries

Tables V 8 to V 10 give an estimated breakdown of the number of farms by types of farm and by size of farm. In addition, the percentage of total land in each region by type of farm is shown. Again, since the sample was not chosen to be representative regionally, the information in these tables should be regarded as only indicative. A more detailed breakdown of percentages of farms and land area by types of farming within each region is shown in Tables V 11 and V 12.

Table V-2. Estimated Percentage of Total Farms in Mauritania by Type of Farm and by Agro-Ecological Zones.

Zones	Dieri	Dualo	falo-Fonde	Recession	Irrigated	Oasis	Combined ¹⁾	Total
1	1.0	3.0	1.0	0.5	3.0	0.5	12.0	21.0
2	13.0	-	-	0.5	-	0.5	-	14.0
3	5.5	3.5	-	4.0	-	1.0	5.0	19.0
4	3.0	0.5	-	-	-	11.0	7.0	21.5
5	8.5	3.0	-	1.0	5.0	-	7.0	24.5
6	-	-	-	-	-	-	-	-
Total	31.0	10.0	1.0	6.0	8.0	13.0	31.0	100

1) Two or more types of farming practiced by one operator.

Source: Op. Cit.

Table V-3. Estimated Percentage of Total Cultivated Land in Mauritania by Type of Exploitation in the Agro-Ecological Zones

Zones	Dieri	Oualo	Falo-Fonde	Recession	Irrigated	Oasis	Combined ¹⁾	Total
1	1.0	2.0	2.0	0.5	<1.0	<1.0	11.0	16.5
2	11.0	-	-	<1.0	-	<1.0	-	11.0
3	2.0	17.0	-	0.5	-	<1.0	5.0	24.5
4	3.0	3.0	-	-	-	3.0	13.5	22.5
5	7.0	3.0	-	1.0	1.0	-	13.5	25.5
6	-	-	-	-	-	-	-	-
Total	24.0	25.0	2.0	2.0	1.0	3.0	43.0	100

1) Two or more types of farming practiced by one operator

Source: Op. Cit.

Table V-4. Estimated Percentage of Farms in Mauritania by Size and Type of Farm

²⁾ Size	Dieri	Qualo	Falo-Fonde	Recession	Irrigated	Oasis	Combined	Total
0 - 1	11.0	0.5	-	3.5	7.0	10.0	9.5	41.5
1.1-2	8.0	2.0	-	2.0	0.5	1.5	4.0	18.0
2.1-3	5.5	2.5	-	0.5	-	0.5	3.5	12.5
3.1-4	2.0	1	-	-	-	-	2.0	5.0
4.1-5	0.5	0.5	0.5	-	0.5	0.5	2.0	4.5
5.1-10	2.0	-	0.5	-	-	0.5	6.0	9.0
10.1-20	2.0	2.5	-	-	-	-	3.0	7.5
20.1-50	-	1.0	-	-	-	-	1.0	2.0
50.1 +	-	-	-	-	-	-	-	-
Total	31.0	10.0	1.0	6.0	8.0	13.0	31.0	100

Source: Op. Cit.

Table V-5. Estimated Percentage of Total Cultivated Land in Mauritania by Size and by Type of Farms

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Size	Dieri	Oualo	Falo-Fonde	Recession	Irrigated	Oasis	Combined	Total
0 - 1	1.5	<1.0	-	0.5	<1.0	1.0	1.0	4.0
1.1-2	4.0	1.0	-	1.0	<1.0	<1.0	2.0	8.0
2.1-3	4.0	2.0	-	0.5	-	<1.0	3.0	9.5
3.1-4	2.0	1.0	-	-	-	-	2.0	5.0
4.1-5	0.5	1.0	1.0	-	1.0	1.0	2.0	6.5
5.1-10	3.0	-	1.0	-	-	1.0	11.0	16.0
10.1-20	9.0	11.0	-	-	-	-	12.0	32.0
20.1-50	-	9.0	-	-	-	-	10.0	19.0
50.1 +	-	-	-	-	-	-	-	-
Total	24.0	25.0	2.0	2.0	1.0	3.0	43.0	100

Source: Op. Cit.

Table V-6. Estimated Percentage of Farms by Type in Agro-Ecological Zones

Zones	Dieri	Oualo	Falo-Fonde	Recession	Irrigated	Oasis	Combined	Total
1	5.5	14.0	5.5	3.0	14.0	3.0	55.0	100
2	91.0	-	-	4.5	-	4.5	-	100
3	26.0	19.0	-	19.0	-	6.0	28.0	100
4	14.0	3.0	-	-	-	51.5	31.5	100
5	34.0	12.0	-	5.0	20.0	-	29.0	100

Source: Op. Cit.

Table V-7. Estimated Percentage of Surface by Type of Farms in Agro-Ecological Zones

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Zones	Dieri	Oualo	Falo-Fonde	Recession	Irrigated	Oasis	Combined	Total
1	6	9	11	2	1	2	69	100
2	97	-	-	2	-	1	-	100
3	10	68	-	1	-	1	20	100
4	11	15	-	-	-	13	61	100
5	28	12	-	3	5	-	52	100

Source: Op. Cit.

Crop Production

Table V · 13 and V · 14 show production of selected crops by agro ecological zone and by Administrative Region. In effect Zones 1 and 2 are the major production areas of Mauritania. This should provide the CIRI with sectors in which to concentrate agricultural improvement programs. Likewise, Regions 4 and 6 should be the poles of agricultural development. Sorghum production in the sample exceeded millet production by a ratio of 2 to 1. Sorghum yields averaged about 304 kg/ha while millet yields averaged 330 kg/ha. A weighted yield for the two crops (usually reported jointly) averages about 313 kg/ha.

Expansion of the Sample

In an attempt to get a rough idea of the total cultivated land in Mauritania, the sample data were expanded using following factors:

- The median farm size is 1.5 ha.
- The rural sedentary population in the "fichiers village" formulated during the 1977 census is 713,520.
- The average rural household size, obtained during the initial production survey, is 3.1 persons/household.
- The percentage of the sampled population engaged in livestock rearing only is 24% leaving 76% of the population engaged in crop farming.
- The formula for expansion is therefore:
 $713,520 \times 0.76 \times 1.5 = 95,690$ ha. farmed by the rural sedentary population. In addition some land is farmed by nomads, but this information is not included in the sample.

Table V-8. Estimated Percentage of Total Farm in Mauritania by Regions and by Type of Farm

74 Region	Type of Farm	Pieri	Oualo	Falu-Fonde	Recession	Irrigated	Oasis	Combined	Total
1		2.0	0.5	-	-	-	-	-	2.5
2		1.0	3.0	-	-	-	4.0	-	8.0
3		1.0	-	-	1.0	-	0.5	1.0	3.5
4		7.0	3.0	-	-	2.0	-	11.0	23.0
5		-	-	-	4.0	-	-	6.5	10.5
6		10.0	3.5	1.0	0.5	2.0	0.5	5.0	22.5
7		1.0	-	-	-	-	7.0	5.0	13.0
9		-	-	-	-	-	1.0	2.0	3.0
10		9.0	-	-	0.5	-	-	-	9.5
12		-	-	-	-	4.0	-	0.5	4.5
Total		31.0	10.0	1.0	6.0	8.0	13.0	31.0	100

Source: Cp. C.A.

Table V-9. Estimated Percentage of Total Cultivated Land in Mauritania
by Region and by Type of Farm

75

Region	Type of Farm	Lieri	Oualo	Falo-Fonde	Recession	Irrigated	Oasis	Combined	Total
1		2.5	3.0	-	-	-	-	-	5.5
2		2.0	16.5	-	-	-	<1.0	-	18.5
3		<1.0	-	-	1.0	-	<1.0	6.0	7.0
4		3.5	2.0	-	-	<1.0	-	12.0	17.5
5		-	-	-	0.5	-	-	6.0	6.5
6		8.0	3.5	2.0	0.5	<1.0	<1.0	4.0	18.0
7		<1.0	-	-	-	-	3.0	11.0	14.0
9		-	-	-	-	-	<1.0	3.0	3.0
10		9.0	-	-	<1.0	-	-	-	8.0
12		-	-	-	-	1.0	-	1.0	2.0
Total		24.0	25.0	2.0	2.0	1.0	3.0	43.0	100

Source: Op. Cit.

Table V-10. Estimated Percentage of Total Farms in Mauritania by Region and by Size of Farm

76

Region	Size of Farm								
	0 - 1	1.1-2	2.1-3	3.1-4	4.1-5	5.1-10	10.1-20	20.1-50	Total
1	1.0	-	-	-	-	-	1.0	-	2.0
2	4.0	-	-	-	-	-	3.0	1.0	8.0
3	0.5	2.0	0.5	-	-	-	-	0.5	3.5
4	7.0	7.0	4.5	0.5	1.5	2.5	0.5	-	23.5
5	6.5	0.5	0.5	-	0.5	1.5	0.5	-	10.0
6	6.5	4.0	6.0	3.0	1.5	2.5	0.5	-	24.0
7	6.0	1.0	1.0	1.0	0.5	1.0	1.0	0.5	12.0
9	2.5	-	-	-	-	1.0	-	-	3.5
10	3.5	2.5	0.5	0.5	0.5	-	1.5	-	9.0
12	2.5	-	-	-	0.5	0.5	-	-	5.0
Total	41.0	17.0	13.0	5.0	5.0	9.0	8.0	2.0	100

Source: Op. Cit.

Table V-11. Estimated Percentage of Farms by Types in Administrative Regions in Mauritania

Region	Dieri	Gualo	Falo-Fonde	Recession	Irrigated	Oasis	Comoined	Total
1	75.0	25.0	-	-	-	-	-	100
2	15.5	38.5	-	-	-	46.0	-	100
3	17.0	-	-	33.0	-	17.0	33.0	100
4	32.0	13.0	-	-	8.0	-	47.0	100
5	-	-	-	35.0	-	-	65.0	100
6	44.0	16.0	5.0	3.0	8.0	3.0	21.0	100
7	9.0	-	-	-	-	55.0	36.0	100
9	-	-	-	-	-	33.0	67.0	100
10	95.0	-	-	5.0	-	-	-	100
12	-	-	-	-	87.5	-	12.5	100

Source: Cp. Cit.

Table V-12. Estimated Percentage of Surface by Type of Farms in Administrative Regions in Mauritania

78

Region	Dieri	Oualo	Falo-Fonde	Recession	Irrigated	Oasis	Combined	Total
1	43	57	-	-	-	-	-	100
2	11	87	-	-	-	2	-	100
3	4	-	-	10	-	3	83	100
4	19	10	-	-	2	-	69	100
5	-	-	-	5	-	-	95	100
6	47	19	10	2	1	<1	21	100
7	>1	-	-	-	-	21	79	100
9	-	-	-	-	-	<1	100	100
10	98	-	-	2	-	-	-	100
12	-	-	-	-	55	-	45	100

Source: Op. Cit.

Table V-13. Estimated Percentage of Total Mauritanian Production of Selected Crops by Agro-Ecological Zones

A-E Zones	Millet	Sorghum	Rice	Corn	Niebe	Groundnuts	Dates	Others
1	12	31	92	71	58	-	-	17
2	39	29	3	-	42	-	5	51
3	23	26	-	-	-	-	8	-
4	11	7	-	5	-	6	79	81 ¹⁾
5	15	7	5	24	-	94	8	2
Total	100	100	100	100	100	100	100	100

1) Most vegetables, forages and grains in association with date palm culture.

Source: Op. Cit.

Table V-14. Estimated Percentage of Total Mauritanian Production of Selected Crops by Administrative Regions

32

Regions	Millet	Sorghum	Rice	Corn	Niebe	Groundnuts	Dates	Others
1	11	-	-	-	-	6	-	13
2	<1	4	-	-	-	-	12	<1
3	-	-	-	-	-	-	12	-
4	34	30	93	<1	-	-	17	7
5	4	14	-	19	-	-	-	5
6	35	18	7	76	8	94	-	8
7	1	5	-	5	-	-	47	40
9	-	5	-	-	-	-	12	<1
10	15	24	-	-	92	-	-	-
12	-	-	-	-	-	-	-	27
Total	100	100	100	100	100	100	100	100

Source: Op. Cit.

This estimate probably overstates the amount of land in faras, since undoubtedly there are rural sedentary dwellers engaged in other activities than agriculture or livestock. To check on the above results the following data were used.

- There were 61,305 farm families reported in the 1977 census. If each family farmed a medium size of 1.5 ha., the land farmed would approximate 92,100 ha.
- Sedentary and nomadic employment in agriculture in 1977 was estimated at about 124,000. A technical "rule of thumb" is that one person can farm about 0.75 ha. by traditional methods. This estimate would give a total of about 93,000 ha.
- The 1979/80 field survey of the World Food Program arrived at the conclusion that slightly more than 100,000 ha were cultivated during that crop year.

Further examination of the sample data indicates that millet/sorghum yields averaged about 312.7 kg/ha. with sorghum production totalling about twice millet production. Approximately 32% of the total surface is devoted to sorghum/millet production, or about 74,000 ha. This would give an estimated production, after deduction for seed, of about 24,530 tons of millet and sorghum, an estimate in reasonable agreement with the estimates of the Division de la Statistique of 23,000 tons but well below the FAO estimate of 35,000 tons. (It should be remembered, however, that FAO has the habit of revising its estimates the year following their first publication.) The 1979 production estimates are the most recent available, and it is possible that FAO will later revise its estimates. Furthermore, IARS estimates do not include production by nomad agriculturists. Therefore, there is a possible understatement of total production. This may be partly offset due to IARS possible overestimate of the rural sedentary farming population.