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MARKET INTERACTIONS OF SELECT BAGGARA TRANSHUMANTS DURING DROUGHT AND POST DROUGHT PERIODS: THE CASE OF SOTH KORDOFAN, SUDAN IN 1985*

INTRODUCTION:

Location:

The Baggara (cattle owning people) transhumants (migratory along fixed routes) of Sudan, Africa migrate along routes crossing the Southern Kordofan Province and entering the Northern Kordofan Province of the country. Southern Kordofan Province is located between 9 degrees and 13 degrees North Latitude and 27 degrees and 33 degrees East Longitude. Figure 1 presents a map showing political boundaries and locations of major towns, some of which are referred to in the report.

A research program was undertaken during the late dry season and late rainy season of 1985 by the Western Sudan Agricultural Research Project (WSARP) using the Kadugli Research Station of the WSARP as headquarters for the study. Kadugli, Sudan is the provincial capital of Southern Kordofan and is located at 11 degrees 0 minutes North latitude between 29 and 30 degrees East longitude. The program area extends from approximately 35 kilometers NW of Kadugli to 180 kilometer NE of Kadugli; an area which follows routes normally used by the transhumants.

Environment:

Southern Kordofan Province of Sudan encompasses several climatically different environments associated with differences in latitude, longitude and elevation. The peoples described in this report traverse the entirety of Southern Kordofan Province and therefore move through many different ecological zones.

The province is located within the Sudan-Sahelian savanna zone. Altitude varies from over 1000 meters in the Nuba Mountains, located in the central and Southern area of the province, to less than 500 meters above sea level in the plains areas. The Southern part of the province is characterized by undulating plains broken by the Nuba Mountains which outcrop across the area. As one moves North the plains become more prevalent and the topography more homogenous as a result.

Due to rainfall patterns the vegetation of the southern part of the province is quite different from that of the North as is the ecology of the mountains. Moving from South to North the transhumant would traverse areas characterized by woodland savanna at the intensive margin followed by semi-desert areas at the extensive margin for cattle, sheep and goat production.

The Baggara transhumants begin their migration at the intensive margin for livestock production in the South and move toward the extensive margin in the North during the rainy season. At the end of the rainy season they retrace their initial routes to an area twenty to thirty-five kilometers South of the point where they will eventually stay during the dry season.

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Temperature:

Long term temperatures for the Southern part of the province vary from a minimum of about 18 degrees centigrade in January to over 40 degrees centigrade in March and April. Mean temperatures range from a low of 27 degrees to a high of around 31 degrees centigrade. In the Northern areas the temperature is somewhat higher with the mean temperature ranging from a low of 18 degrees to a high of 33 degrees centigrade.

Precipitation:

Rainfall, both effective and total, is highly variable across years and across space. The long term average rainfall for El Obeid, which boarders the Northern migratory return point, is 386.0 mm. compared with 732.0 mm. for Kadugli at the Southern fringe. Figure 2 presents long term mean annual rainfall for both Kadugli and El Obeid.

Soil:

Soil structures vary over the transhumant migratory routes. Dark brown, deep cracking clays are the most extensive soils in the the Southern Nuba Mountains area. These soils, also referred to as cotton soils, are similar in structure, texture and physical characteristics to vertisols which were classified by Buol, (1980). Hunting Technical Service (1976) refer to these soil as predominantly alluvial in origin and similar to alkaline vertisols.

A second major soil type in the area is the Gardud soil. This soil is a medium to heavy textured alluvial soil. Textures range from loam and clay loam in the top 50 cm. to sandy clay loam, sandy clay and clay in the subsoil (HTS, 1976).

The third major soil type of importance to the Baggara is the Qoz sandy soil. These soils are yellowish red sands, loamy sands, and sandy loams which are acid in reaction and low in all macro and micro nutrients (HTS, 1976). The Qoz soils, due to their rapid drainage, provide a suitable soil for the transhumants to camp upon during the rainy season. These soils are more prevalent in the Northern parts of Southern Kordofan Province.

Socioeconomic:

The Baggara transhumant production system of South Kordofan Province in Sudan has been a major source of livestock production for Sudan over the years. Many different groups may be aggregated under the heading "Baggara" including sub categories of peoples which might include the Humr, Messirriya, Fellata, and many individuals from Nuba tribes. Traditionally the word Baggara has been used to denote Arab cattle owning transhumant or nomadic individuals and groups. Baggara may also be used to denote Nuba or other peoples who have shifted from sedentary production activities to transhumance.

The Hawazma and Messiriya now occupy the central part of South Kordofan. These two gabily (tribes) are Arab transhumants while individuals from another group of people called the Nuba are non Arab.

The Nuba participants are dissimilar in cultural background and generally in religious beliefs. The Nuba people occupy the mountains and cultivate the surrounding plains areas. They live in the Nuba Mountains of South Kordofan Province. While transhumance is not the major lifestyle of the Nuba, many families participate when the size of their cattle, sheep and goat herds result in livestock enterprises becoming primary economic enterprises.

The Arab tribes are believed by some to have migrated to the Western Sudan after the Arab invasion of Egypt. Following the invasion the Arabs, which later became the Baggara, are thought to have continued their march across North Africa to what is present day Tunisia. From Tunisia they are said to have moved South into what is now considered their home territory in the Western Sudan. Others believe that the Baggara formed part of an invasion up the Nile valley at the end of the fourteenth century (Cunnison, 1966). They subsequently are believed to have migrated to areas which are now the provinces of North and South Kordofan and North and South Darfur.

The Nuba who participate in transhumance are only a small minority of the general Nuba population which is primarily involved with sedentary cultivation. The Nuba are generally considered autochthonous to the area and may have controlled larger areas of South Kordofan prior to the arrival of the Arabs (South Kordofan Planning Unit, 1978).

Cunnison (1966) provided anthropological information on one of the subgroups of the Arab Baggara known as the Humr. This study deals with economic and demographic information on another main gabily known as the Messiriya. As Cunnison (1976) points out, the Messiriya and the Humr are related closely and were once considered a single tribe. Other gabily and Nuba tribes are also represented in the work and will be distinguished when differences may create a degree of heterogeneity which requires explanation.

Nature of Production System:

Abu Sabah (1985) has characterized a Messiriya sub-tribe called the Inainat as a "bovine culture". This characterization may be equally applied across other transhumant tribes for the purposes of this paper. He goes on to say the following:

"Within this culture the general trend of accumulation of wealth through accumulating cattle, and with them, prestige, political, and social influence occurs. In addition to cattle, sheep and goats are also reared as are fewer numbers of chickens, donkey, and very occasionally camels, which are usually purchased as adults for beasts of burden. The primary

characteristics of this target group are: a) a primary production enterprise consisting of the rearing of cattle with average herds greater than 50 head; b) limited cropping activities; and c) seasonal migrations along relatively fixed routes between South and North Kordofan grazing areas."

The production cycle encompasses the birth, rearing, sale and consumption of livestock and livestock products supplemented by grains both produced by the household and purchased in the market. The Arab Baggara will generally depend upon livestock for food and income to purchase other staples to a greater extent than the Nuba Baggara. However, the designation of a Nuba household as a Baggara household implies that primary production activities are centered around the ownership of livestock rather than the production of grain commodities.

Baggara transhumants produce livestock, mainly cattle, sheep and goats, in an area of Sudan which encompasses potential for both intensive and extensive production characteristics. The Baggara migrate to provide a source of food and water, protection against disease, insects and mud and for marketing of livestock. A wide spectrum exists with respect to household cattle, sheep and goat holdings, with some households controlling in excess of several hundred cattle. The proportion of small ruminants to cattle in the system is approximately 2:3. Demographics of traditional herds show that a relatively high proportion of male to female animals exist within cattle herds at ages over thirty months, approximately a 3:1 ratio (1983). Bunderson (1983) has estimated a female to male ratio in sheep herds of 3.7:1 in a Baggara herd. No similar information is available for the ratio of female to male animals in goat herds among the Baggara although they are an important hedge against environmental risk.

RESEARCH PROGRAM OBJECTIVES AND DETAILS:

During 1983, the Socioeconomic section in conjunction with the Range/Livestock section of the Kadugli Research Station undertook a two phase survey to provide baseline economic and demographic information on the Baggara transhumants. A general objective of the program was the provision of marketing information for the WSARP technical assistance team. This report draws together part of the results of that study and integrates those with livestock and commodity price information which had been collected during the same periods in different markets.

The specific objectives of this paper are the following:

1. Document the trends in prices at the subregional and regional marketing levels to measure price differentials which existed across space for both livestock and non livestock staple food commodities;
2. Use the information developed in objective 1, in combination with other primary data, to describe the effects on nutritional levels in Baggara transhumant households resulting from loss of purchasing power; and
3. Identify a method of and time for intervention in the production system which would result in the maintenance of purchasing power without increasing market risk.

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EXPERIMENTAL DESIGN:

A two phase enumeration schedule was developed. The first phase of the enumeration took place in April and May of 1985. This represents the late dry season in South Kordofan Province. The site of the experiment during this phase was Demick, Sudan. Demick represents a subregional market town with a periodic market occurring on Saturday and Tuesday each week. A second important factor in site selection was the importance of conducting research in areas where the Range/Livestock section had ongoing experiments. A third factor entering the decision on choice of site was the homogeneity of market participants. Demick market was frequented by many different tribes of Nuba and Baggara Arabs. The predominant tribe was the Messiriya.

During 1985 a severe drought occurred and resulted in more pronounced market price movements which impacted upon the households ability to purchase staple foods. For the Baggara household this resulted in decreased capability to purchase basic food requirements. However, for the purposes of this paper, the drought can be seen as an extreme case of the seasonal impact of fluctuating prices which are the norm rather than the exception. In this context the drought provided opportunities for developing a data base which allows a more graphic picture of the predicaments facing the transhumant household on a yearly basis.

Enumeration of all individuals in the market who were selling or purchasing livestock was attempted. The first enumeration took place on Saturday, March 20, 1985 and was continued, on a weekly basis, through May 12, 1985. During that time eighty-eight interviews took place. The number of enumerations was a function of activity in the market and the problems encountered defining a sample frame and subsequent inability to sample the population in a structured manner. It was and is logistically impossible to identify all individuals who might participate in marketing or the purchase of livestock in Demick on any given day or over any given period. The author estimates that enumerations as a ratio to actual transactions in the market was approximately .85:1. This was based upon observation of market activities and consultation with staff familiar with livestock marketing in the area.

The survey questionnaire consisted of twenty-five questions with multiple parts. Questions included in the phase one questionnaire were directed primarily toward the market activity which had occurred just prior to enumeration and the most recent previous market activity.

The second phase of the survey was undertaken during the late rainy season when the transhumants were at or near their Northern most point of the migratory route. Thirty-five producers were interviewed during this phase of the survey. Every attempt was made to identify and enumerate producers who had been enumerated during phase one of the survey. However, this turned out to be impossible due to logistical considerations. Producers were located in areas which were inaccessible, could not be located due to remoteness of the area and were located in different fariques (camping groups) to numerous to track down with limited time and resources available to the enumeration team. The team was forced to

interview members of *fariques* which were accessible and came from the same general area around Demick. It is the position of the author that those enumerated during phase two were representative of the recommendation domain targeted in phase one of the enumeration program.

The second phase emphasized question pertaining to the marketing activities which occurred during the rainy season while the *Baggara* were on their annual trek. Strategies employed by producers to maintain herd size and the composition of herds were identified as well as the demographic composition of family. Births, deaths and losses from theft or other management problems which occurred during the trek were enumerated. A section of the survey questionnaire dealt specifically with general market characteristics which were encountered by the transhumants in their marketing activities. A section was also devoted to the identification of production costs associated with each major species of livestock owned by the producer household. A final section of the survey instrument was designed to collect information on the actual transportation activity which is entailed in migration.

Market Structure:

Along the transhumant migratory routes there are villages and towns where they market livestock and livestock products and purchase commodities for household consumption. Movements on a yearly basis are defined by the onset of rains in the South and lack of water sources or graze in the North. The information on the left of the Figure 3 represents a typical migratory route.

The body of Figure 3 presents the flow of commodities in the livestock market. The market structure within which the transhumants operate is such that poor flow of information may restrict their ability to take advantage of financial opportunities which arise at different levels of the market. (All communication outside the major villages and towns is done by word of mouth or carried note.) At the lowest level of the market are the producers who rear livestock for sale, consumption and as a store of value. These animals are sold when a need arises with the money income generated used for a variety of purposes. At the next level, the subregional level, periodic markets operate weekly or more often but not daily. Most transhumant marketing occurs at this level. The regional level is characterized by permanent markets such as that which exists in Kadugli. Livestock purchased for resale in the Kadugli market may be transported to the national markets for consumption in urban centers or for export on the international market. Examples of these markets would be Khartoum, Kosti, and El Obeid.

A few large merchants will assemble herds at the regional level and transport the livestock overland, by rail or by truck to the national markets. In general the transhumants are not involved at this level. One result of this is that new innovations or technologies which are in use at higher level markets are not disseminated at regional or subregional levels. It probable that demand for goods and services with the resultant increase in off-take would be greater if the *Baggara* had direct access to these markets.

Market Conduct:

The market for both livestock and non livestock commodities at both subregional and regional levels is characterized by strong competition on the supply side and potential oligopsony during part of the year on the demand side. It is not clear whether the conduct in the livestock market on the buyers' behalf lead to price distortions. However, in the staple grain markets it appears that normal profits exist for the few merchants trading in the Kadugli market and in smaller sub regional markets. (Speece, 1985). Table 1 provides markups on the staple food, sorghum, in five different villages located in the area around Kadugli, Sudan.

Figure 4 provides maximum profit margins of channel participants in sorghum marketing with the Kadugli wholesaler as final demand. The markups and the profits margins support the conclusion about normal profits. This conclusion may be applied to other regional markets. Subregional markets may have a higher propensity toward oligopsony or monopsony due to fewer traders and seasonality of commodity transaction activity but show little inclination toward exorbitant markups.

Market Performance:

Based on the level of competition which appears to exist in both livestock and non livestock commodity markets which are frequented by Baggara transhumants, market performance is fairly efficient. The transhumants' tribe may in many cases have a permanent agent assigned to a livestock market. The agent would provide market information and act as a conduit for communication among potential buyers and sellers. While the agent is typically in business for himself (exclusively a male dominated activity) he will represent the interests of his tribe over those of others operating in the market. This tends to increase the efficiency of the market in that it provides a focal point and a degree of security for an individual entering the market to sell or purchase livestock.

This is not the case for the commodity markets. In these markets at a regional level a few sellers will be licensed to purchase and sell major staple grains in a central market area. In the Sudanese case this would generally be dura (sorghum). At certain times of the year maize and lubia (cowpeas) would also enter this market. These individuals are influenced in decisions about sales which they undertake by the price of similar products in the unlicensed market operating simultaneously. The unlicensed market is not a black market, rather it is a producers market which competes with the licensed merchants. Once again there is little opportunity for excessive profits due to competition from the producer market. During times of scarcity this competition will not exist and the environment for price fixing becomes more conducive to oligopolistic market activity. However, commodities will flow into an area from other regions during that period creating yet another buffer against price fixing. A large merchant in Kadugli felt that his net profits actually decreased during this period due to increase competition from outside (El Fhati, 1985, personal comm.) This also reflects the inelastic nature of the demand curve for certain commodities.

In both the livestock and non livestock markets at the subregional and regional level there appears to be two major impediments to increasing the efficiency within and thereby the performance of the market. These are poor transportation infrastructure and poor communications infrastructure. Other factors such as storage (very efficient at the farm level), standard grading practices and lack of an effective extension service exacerbate the problems but are not primary determinants of inefficiency in the market at the present time.

HOUSEHOLD CHARACTERISTICS:

The transhumant households enumerated during phase two of the survey consisted of husbands, wives, children, relatives and hired help referred to as cowboys. It is assumed that individuals enumerated during phase one of the survey were members of households homogenous in household characteristics with those of phase two. It is likely that the cowboy would not be part of the household during periods other than the treking months. Table 2 provides a breakdown of family composition by category and sex.

Male children reach adulthood around the time they are 16 years of age while female children are considered adults at around 14 years of age. Cowboys are adult males but not relatives of transhumants. The mean size of the transhumant household is ten with ages ranging from less than one year to 85 years. The mean age of household members is 16 years.

Ninety-four percent of the household members accompanied the farique on the migratory trek. The other 6% maintained a residence at some other location normally so they could participate in school.

Eighty-five percent of the household members had no previous education. Approximately 1% had participated in Kalwa (Islamic religious training). Primary school had been attended by 12% of the transhumants while less than 1% had attended either secondary or high secondary educational facilities. Of the 58 individuals who had the opportunity to go to school, the mean number of years attending was 4.4 years.

MARKET TRENDS:

Figure 5, 6, and 7 present trends for cattle, sheep and goat prices over the period August 1983 to August 1985. Figure 8 presents market trends for the retail sale of sorghum, cowpeas, and sesame during the dry season and rainy season for 1984 and 1985 on a monthly basis. Wholesale price trends are presented in Figure 9. It is important to remember that during certain periods commodities may have been unavailable in the market at which times higher priced substitutes had to be purchased. This is represented by broken lines in the graphs with the exception of November and December 1985 for non livestock commodities. These breaks are due to no price information being collected. For the analysis presented below, sorghum will be considered a proxy for other grain and legume commodities.

It is clearly shown that price differentials between livestock and non livestock commodities increase during years of normal precipitation and decrease during drought stress periods. Figure 10 presents this situation

graphically and dramatically. The wholesale price of sorghum is graphed against the market price for male cattle. It can be seen that during the most extreme period of the drought related food scarcities in 1985 the price of a sack of sorghum was equal to the average sale price of an ox. This has a tremendous impact on the purchasing power of the transhumant household.

Energy and Protein Differentials:

During these periods of drought Baggara transhumants were forced to reduce herd size to maintain household consumption levels of protein and calories. The question arises as to whether the Baggara are able to reduce both environmental and market risk associated with drought conditions. The answer to this question appears to be yes but not in the absence of educational programs designed to inform the Baggara of the benefits of adopting flexible livestock sale strategies. Surprisingly, the greatest benefits with respect to maintenance of household protein and calorie levels appear to exist during normal years or the year preceding the onset of a severe drought which may lead to malnourishment or malnutrition.

Calculations of energy and protein levels associated with deteriorating terms of trade faced by the Baggara are presented in Tables 3, 4, and 5. Sorghum is used as a proxy commodity for other grain and legume crops due to its preeminence as the staple food and to simplify the analysis. Similar trends exist with respect to other grain and legume commodities as well as to those non livestock commodities which are imported and available in regional markets such as rice and wheat flour.

Cattle meat (Zebu, the predominant breed of cattle owned by the Baggara) is used as a proxy for protein and calorie estimates lost in the sale transaction which must occur for the purchase of sorghum for household consumption. The Baggara producer has a choice as to whether the household will consume meat or sorghum or some combination. In this analysis it is assumed that the choice is mutually exclusive, the household consumes meat or sorghum. This is a plausible assumption in the real world context. The household gives up livestock to purchase sorghum, the staple commodity.

Table 3 provides information on the nominal wage price of sorghum and meat protein and calories during the 1985 pre drought and 1985/86 post drought period. Protein is given in grams of crude protein per Sudanese pound (GCP/LS) and calories are given in units of calories per Sudanese pounds (Cal./LS). The implicit assumption included here is that the Baggara prefer to maximize the availability of protein and calories during periods of drought while at the same time maintaining herd size. During the late dry season of 1985 the Baggara could purchase 67.8 GCP and 2302 Cal./LS. If they consumed male cattle meat during the same period they could purchase 88.5 GCP and 1125 Cal./LS. This period represents the pre famine period in South Kordofan province during 1985. Poor rainfall during 1984 had resulted in the narrowing of price differentials between livestock and sorghum which continued into the rainy season of 1985. By the time the rainy season of 1985 had begun late May, the Baggara's terms of trade had deteriorated to a point where the household could purchase sorghum which provided 61.6 GCP and 2091 Cal./LS or meat which provided only 63.0 GCP but

only 801 Cal./LS. In contrast, during what might be considered a normal year the Baggara household could purchase sorghum yielding 190.6 GCP and 6472 Cal./LS or meat which would yield 30.8 GCP and 391 Cal./LS as a result of decreased prices for sorghum and increasing prices for meat. This is represented by the Mid Dry Season data presented in Table 3.

This data provides a basis for the following contentions:

1. During normal years the sale of livestock during the mid dry season and the purchase of sorghum for consumption at a later date will provide more protein and calories than normal livestock sale patterns which exist among the Baggara.
2. A strategy designed to promote sales of livestock and purchase of staple commodities by the Baggara would provide opportunities to maintain household nutrient consumption levels and maintain higher disposable income levels for the Baggara. It would also decrease livestock and meat prices for urban consumers leading to increased effective demand for food at the most critical period of food shortages.
3. Educational programs designed to provide this information to Baggara households may prove more successful in promoting sales than would price incentives offered by government agencies.
4. The strategy would be effective during both normal and abnormal rainfall years but pay greatest dividends with respect to household productivity during drought or famine periods.
5. A strategy designed to promote livestock sales during the mid dry season and purchase of grains for household consumption at the same time or some later date would do little to disrupt the production system due to the sedentary nature of the transhumants during this period.

Table 4 supports the contentions laid out above. The loss of purchasing power in terms of ratios of sorghum price to that of cattle meat price for protein and calories is provided for different periods of 1985 and 1986. While the ratio of sorghum to meat provides only .8 the protein per LS during a late dry season sale and purchase it provides twice the calories. This is important in that the demand for calories is probably much higher in the short run than is the demand for protein. Over a long period of drought and famine it may prove to be more important to provide the greater amount of protein. However, the seed of a strategy designed to avoid this situation is available. It is represented in Table 5 by the Mid Dry Season ratios of 6.2 to 1 for protein supplied by sorghum over meat and 16.5 to 1 for calories supplied by sorghum over meat.

Table 5 provides information on the purchasing power losses and gains which occur throughout the year with respect to the amount of sorghum which could be purchased from the sale on one ox. Male cattle are used in the analysis as a proxy for other livestock species and sexes. The trends in market price for other species and sexes follows that of male cattle

closely and justifies this price for use as a proxy. It is assumed that the Baggara wait to sell livestock as a drought situation reaches crisis levels which appeared to have been the case in 1985.

During the dry season 1983-1984 the weighted average of male cattle prices in the Kadugli market was 261.59 LS/AU. At that time the sale of one animal could have been used to purchase 494 kilograms of sorghum. The downward trend in prices which lasted through the end of an extended drought in July of 1985 and the the upward trend in prices for sorghum during the same period resulted in loss of purchasing power. Using average price data for the dry season of 1984 1985, the sale of one male animal could have been used to purchase only 110 kg. of sorghum. Following the drought the amount of sorghum which could have been purchased again rose to 494 kg./AU. This translates directly into Table 5 figures for protein and calorie losses and gains through the consumption of meat or sorghum. Furthermore, the same analysis would hold true if an index of meat consumption were related to an index of grain and legume consumption during the same periods.

LIVESTOCK MARKETING STRATEGIES:

The Baggara transhumant households undertake a variety of livestock marketing activities which include various strategies designed to reduce market risk. However, they appear to be subject to varying degrees of environmental risk with which they have difficulty in dealing. The major environmentally related difficulties evolve from poor grazing and limited access to water during below normal rainfall years. This results in decreased mobility on their Northern trek and reduced marketing opportunities. Reduced marketing alternatives are a result of poor transportation infrastructure which precludes overland transport of livestock by hoof to national market centers such as Kosti and Omdurman in the North. During below normal rainfall years the graze and water sources are limited and result in fewer large merchants from the North purchasing, assembling and transporting herds to the national markets.

Most livestock sales occur during the late dry season and early rainy season when the animals can be transported easily and are coming into good condition. Many of the animals will have been transported North some 150 to 300 kilometers so that costs incurred by the assembler are reduced, part of which accrues to the producer selling livestock. The amount of this differential and that which is passed on to the producer in the form of higher prices for sales undertaken is not known.

The greatest volumes of livestock sold as single animals in the Kadugli market during the period 1983 through July of 1985 occurred during the dry season months of December through February. Most sales of animals in the Kadugli market are one animal sales. Differentiating prices in sales of more than one animal or more than one animal of different species or sex was beyond the resource capabilities of the Socioeconomic section given manpower constraints and other research activities.

During the rainy season months the most volume was moved during the months of May and August (Gillard-Byers and Azrag, WSARP No. 43). The sales of animals in the Kadugli market are composed of animals reared by transhumants as well as sedentarists. Seventy three percent of the transhumants interviewed maintained that most sales undertaken by their households occurred during the period March through May yearly. This coincides with late dry season and early rainy season, a period when the transhumant households are preparing to begin the trek and also the period of rising non livestock commodity prices. It also represents a period when large merchants assembling herds for transport to national markets can transport the animals over long distances as the rains move North.

Producers were asked whether at the time of livestock sales they were doing so to purchase food, livestock or both food and livestock. Forty-five percent said they sold livestock to purchase food while 53% responded that they purchased both food and livestock. Less than 2% of the respondents said they purchased livestock with cash generated directly from the sale of another animal. This provides evidence that the purchase of food is a main goal associated with the sale of livestock. It also suggests that income from sale of livestock and labor is kept in the form of cash in order to make purchases of livestock. During periods of drought or famine this goal is likely to become the single most important goal. Meeting this goal may require considerable time and effort on behalf of members of the household.

Transhumant producers identified thirty-six markets which are located along their migratory route. These markets act as centers for the potential sale of livestock and purchases of small amounts of grain and other goods as well as for the provision of services. Seven of these markets could be considered important markets for many of the transhumants migrating along routes to the North of Demick dry season grazing areas. The seven important market towns were Dilling, El Dushol, Kerkaria, Kurgol, Kweik, Fershaia and Samasim. All of these are located to the North of Kadugli and South of El Obeid.

The data provided here suggests that most of the marketing of transhumant livestock occurs during the late dry and rainy seasons in markets to the North of their dry season grazing areas. Furthermore, most sales are undertaken to provide cash for food or food and livestock purchases. Given these findings and data provided early in the paper a scenario for marketing strategies can be outlined.

MARKETING STRATEGY SCENARIOS:

Three different strategies will be discussed here. Two of these strategies should provide the transhumant household with more residual disposable income and greater food security. At the same time they should smooth market price fluctuations and reduce meat costs at the retail level for the consumer. The third strategy represents the typical marketing activity of the transhumants. The first is the optimal strategy relative to the second and third. Strategy one entails the sale of livestock and the purchase of sorghum during February. This represents the period when the transhumants have reached their dry season grazing areas located around

Damick. Strategy two proposes the sale of livestock during February with the purchase of sorghum during the rainy season. The third strategy, that which is employed by the transhumants, entails the sale of livestock and purchase of sorghum during the late dry season and early rainy season.

Market prices for livestock, Zebu meat and sorghum are presented in Table 6. During 1985 international food aid relief tended to depress the price of sorghum in the Kadugli market. In the absence of this food aid the purchasing power from livestock sales would have decreased further. It is clear from Table 6 that a strong downward trend existed with respect to the purchasing power from livestock sales for the purchase of sorghum. Strategy number 1 in both 1984 and 1985 would have provided the transhumant household with the greatest amounts of sorghum for consumption during the rainy season and "hunger" period in July and August. Strategy number three which represents the normal sales strategy results in the poorest purchasing power figures during both years. This information is necessary to determine how the strategies outlined above bear on the quantities of crude protein and calories which are available to the household for consumption. Due to lack of meat and sorghum prices during the early months of 1984 prices for 1985 have been used as proxies. It is assumed that male cattle are sold and meat or sorghum is purchased and consumed. Meat prices at the household level from slaughter of animals have not been derived but are expected to be lower than retail prices. How then does this relate to the protein and calorie nutrient levels in the household?

Table 7 provides insight as to the effect of these different strategies on the availability of protein and calories from the sale of livestock for the purchase of sorghum. It can be seen from the table that protein and calories from the consumption of both meat and sorghum decreased. This was associated with the declining price of livestock and the increasing price of sorghum. Again strategy one, sale livestock and purchase meat or sorghum for consumption later provides the greatest quantity of both protein and calories. However, the transhumant household cannot sell livestock and purchase meat for consumption at a later date due to spoilage. The options available for the sell of livestock and the purchase of meat to avoid decreasing nutritional levels within the household are strategies two and three. Given the results described in Tables 5, 6 and 7 an estimate of the protein and calorie balance which would exist at the household level can be made.

Table 8 gives a clear representation of the protein and caloric balance which results when comparing the possible marketing options outlined previously. Table 8 tells us how many additional days of food security exist within the transhumant household on a per capita basis from undertaking the strategies outlined. The transhumant household would be better off selling livestock and purchasing sorghum during February while livestock prices are relatively high and sorghum pric ~ low. If strategy number two were undertaken by the transhumant household with respect to meat purchases the household would be better off in terms of available crude protein. However, during periods of famine the additional days of caloric sufficiency would probably offset those days lost in terms of protein sufficiency from consumption of sorghum. An important point

represented in the table pertains to the timing of implementing a strategy. The Baggara transhumants do not know until June whether they face an abnormal rainfall year and associated price fluctuations in the livestock and non livestock commodity markets. This fact provides strong motivation for the Baggara to consider marketing strategies which differ from what they have traditionally followed. Benefits would accrue to the Baggara and other players during normal rainfall years and low rainfall years.

If benefits in terms of nutritional sufficiency, higher incomes, lower consumer prices for meat, reduced environmental risks and others would result from employing different strategies how could a research program be set up to effect the change?

PROGRAM REQUIREMENTS:

The WSARP did not and does not include an agricultural extension component and relied upon farmer managed trials and personal interaction for dissemination of research results at the farm level. The Extension Department in Kadugli, a branch of the Ministry of Agriculture, participated with the WSARP in many different ways. However, they were poorly supported in terms of basic inputs and were therefore ineffective in carrying out the extension mandate. Practically speaking, the program would have to be implemented on a small scale starting as a cooperative effort between the extension group and WSARP scientists.

Input Requirements

Staffing requirements for a program designed to educate the transhumants in fundamental marketing strategies which differed from the traditional practices would require a compliment from different groups. Collaboration among the WSARP, Extension Department and individuals from the transhumant community would be required. The target group would be the Messirriya Baggara located around Demick, Sudan. The transhumant staff would be chosen from this group due to good relationships having been developed and an obligation to provide them with results from research in which they participated.

Cooperative action on behalf of the WSARP and the extension service would be a prerequisite for an effective program. Individuals from the extension service would be seconded to the WSARP for a two year period. They would be educated in the results of previous work and trained in the analysis of data so that they could easily transfer the information to the Baggara.

The WSARP would hire Baggara transhumant women to participate in training activities focusing on nutrition and marketing of livestock. They would be used subsequently to develop linkages at the household level in target communities and subsequently carry out training activities within the household. This training would be done on site by Extension personnel. During the course of the experiment they would be required to document consumption habits within the household and identify the production and marketing management activities of the Messirriya women.

Technical staff would be provided through the WSARP. These individuals would include the senior scientists from the Socioeconomic and the Range/Livestock Sections as well as senior and junior technicians.

WSARP would provide transport, training, technical and maintenance inputs for the program to support field activities. Technical assistance from the WSARP would participate and supervise program design, implementation and evaluation of results.

Program Design and Implementation

The implementation program would cover a three year period. During year one educational activities would be undertaken with input from the WSARP, Extension and transhumant women. This educational activity would occur during the dry season when the transhumants were located at their Southern sedentary grazing areas. Training in the use of market information would be provided in the Kadugli, Sudan livestock market beginning in the early dry season and continuing through the late dry season. During the same period transhumant women would be undertaking the household consumption and marketing diagnostic survey. Producers would be queried to identify any perceived negative effects upon herd demographics. It is anticipated that any such negative effects could be minimized or avoided completely.

Explanation of market and environmental risk guarantees would be explained and household members would be questioned about the incidence of illness among members during the dry and rainy season.

Year two activities would focus program activities. In herd and in household researcher/producer managed marketing activities would be implemented. These would include the identification and documentation of the male/female management decision structure with respect to livestock sales. The first sales of cattle during February would be undertaken and the subsequent purchase of Sorghum during the same month. A follow-up survey detailing the qualitative perceptions of the transhumant household would be undertaken during March and again during August. This would be carried out for both male and female household members independently and would provide information on the probable success or failure of the program. Guarantees protecting the producer against market and environmental risk would be instituted during year two and family members would be questioned a second time about the incidence of illness among family members during the dry and rainy seasons.

Year three would consist of monitering producer managed in herd trials to physically validate results of year two researcher/producer trials. This would consist of documenting sales of livestock which occurred during the dry season in contrast with normal practice. Transhumant women and men would be interviewed to identify the products which they had purchased with receipts from the sale. They would be asked to provide information on the nutritional status of the household and incidence of illness among family members. The latter would be qualitative measurements providing circumstantial evidence to validate previous findings. During year three, guarantees protecting the household against market price risk and environmental risk would no longer exist.

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Producers would be asked during each of the three years to give detailed information on the number of individuals with whom they had discussed the experiment. During year three they would be asked to identify all individuals whom they new had implemented a similar strategy during years one, two or three. This would provide information on rates of dissemination of the marketing strategy.

In general terms, the program would be designed to educate producers. Three target groups would be identified. They would include male producers entering the Kadugli and Demick livestock markets and female producers located in the Demick area at the household level. For purposes of program implementation no more than forty households would be identified in the Demick area for participation in the program. The participating households would be guaranteed against market risk in a manner which would not affect their marketing activities. The manner in which this guarantee would be implemented would be determined by the WSARP technical staff and approved through WSARP management. Sale date of livestock and purchase date of sorghum would be determined by the WSARP technical assistance. Collection of price information in the Demick market would be undertaken weekly during the dry season and early rainy season.

Initial implementation activities would center on producers entering the regional livestock market in Kadugli for the purpose of selling livestock. The focus of the education program during this period would be on reading graphs dealing with market trends for both livestock and commodity prices. This would be accomplished through the posting of graphs in the market with an individual from extension explaining the relationships between trends. Activity of this sort would be done on a weekly basis during the late dry season.

Subsequently, after extension personnel felt comfortable with their job, the same activity would be undertaken in the periodic market of Demick, Sudan. This would be done on a weekly basis during which time technical assistance from the WSARP would be on hand to answer questions and provide any support necessary for the extension staff.

During the period spent educating the Baggara producers in Demick a second educational activity would be undertaken. This would target transhumant wives for education in nutrition and market trend analysis. They would be provided information on fluctuations in market prices for livestock and non livestock commodities using sorghum as a proxy. It would be imperative to provide them with basic nutrition information and how the purchasing power for basic nutrients decreases as livestock prices fall and other commodity prices increase.

Summary:

Research activities undertaken by the WSARP have focused on areas where adaptive research in livestock marketing has an opportunity of succeeding in both the short run and long run. Documentation of trends for livestock and non livestock commodity prices provided a basis for measuring price differentials which existed. The collection of baseline economic data at the household level provided information necessary to identify a

potentially successful marketing strategy. Price differentials provided the basis for estimating effects which different marketing strategies would have on nutritional levels maintained within households during drought and normal years. With anticipated collaborative efforts on behalf of the WSARP, Extension Department and Baggara transhumant producers, a program was outlined to design, implement and evaluate a strategy which would result in positive benefits accruing in both the short and long run.

Using household nutrition levels as a primary measurement it has been shown that a marketing strategy emphasizing the sale of livestock during the mid dry season and the subsequent purchase of non livestock food commodities during the same period will have several beneficial effects. These results would include higher nutritional levels, associated higher disposable income levels, reduced market and environmental risk, reduced meat prices for consumers, and reduced fluctuations in livestock and non livestock commodity prices. Furthermore, it was found that the strategy would be as effective during normal years as it would be during drought years.

Anticipated effects on the production system appear to be negligible for two reasons. First, the activities would occur during the mid dry season when the transhumants reside in the Southern grazing areas resulting in a potential to store grain for later consumption. Secondly, the required livest[illegible] sales during these periods would be minimal on a household basis, [illegible]sulting in disproportionate benefits accruing to family members.

Additional monitoring of the effects which the marketing strategy has upon herd demographics would be necessary. Follow-up on a periodic basis after completion of the program would be undertaken when technical assistance staff were in the area.

Dissemination rates would provide information on the potential impact at regional and national level for provision of economic policy options. At the household level, training in analysis of market trends and in nutrition education would provide new tools for transhumant producers to use in their best interest.

Program implementation would require collaboration between technical assistance from the WSARP, Extension Service and Baggara transhumants. The WSARP would provide logistical support and technical assistance while the Extension Department and Baggara transhumants would provide technical assistance.

The three year program would provide an adoptable technology within the reach of the Baggara transhumants. It would result in both direct and indirect benefits in both the short and long run at the micro and macro economic levels. The potential for sustainable integration of agricultural research, agricultural research delivery systems and producers at the household level would be increased.

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Table 1: Markups on A Malwa of Sorghum in Kadugli Area Villages

	Kathca	Kululu	Dobeibat	Abu Seifa	Damic
markup%	19.1	20.3	17.2	11.6	5.4
std.	15.3	9.5	6.9	0.8	1.7
n	12	16	14	3	8
range	5.0-42.9	11.1-37.5	7.5-33.3	11.1-12.5	3.4-9.1

Note: One malwa weighs approximately 2.83 kg by volume for sorghum. We distinguish markup, with the selling price as the base, from marken, where purchase price is the base. For example, a merchant who buys a malwa of sorghum for LS 3.00 and sells it for LS 4.00 has a markup of 25% but a marken of 33%. These terms are confused so often in practice that one can rarely be certain what the authors mean by the term "markup" unless the base is explicitly stated.

Source: Speece, M. WSARP Report No. 49, p. 9.

Table 2: Family Composition During Trek: Baggara Transhumant Households, 1985

Householder Members		%	n
Male:	1) Head of Household	9	32
	2) Child < 16 years	23	84
	3) Adult ≥ 16 years	11	39
	4) Cowboy	9	34
Female:	1) Spouse	11	39
	2) Child < 14 years	24	88
	3) Adult ≥	12	44

Source: Gillard-Byers, T.E. 1985 Phase II Marketing Survey

Table 3: Nominal Wage Price of Sorghum and Cattle Meat Crude Protein and Calories, Kadugli, Sudan Market - Pre Drought and Post Drought, 1985-1986

SEASON	LATE DRY SEASON		RAINY SEASON		LATE RAINY/ EARLY DRY SEASON		MID DRY	
	March-April, 1985		June-August, 1985		September-October, 1985		January-February, 1986	
	Sorghum	Meat	Sorghum	Meat	Sorghum	Meat	Sorghum	Meat
Protein (GCP/LS)	67.8	88.5	61.6	63.0	91.8	42.4	190.6	30.8
Calories (Cal./LS)	2302	1125	2091	801	3118	540	6472	391

Source: Gillard-Byers and Azrag, WSARP Reports No. 42 and 43.

Table 4: Nominal Wage Price of Sorghum and Cattle Meat Protein and Calories, Kadugli, Sudan Market, 1985-1986

	LATE DRY SEASON		RAINY SEASON		LATE RAINY/ EARLY DRY SEASON		MID DRY SEASON	
	(LS/kg Sorghum : LS/kg Meat)				(LS/kg Sorghum : LS/kg Meat)			
Protein	0.8 : 1		1 : 1		2.2 : 1		6.2 : 1	
Calories	2.0 : 1		2.6 : 1		5.8 : 1		16.5 : 1	
	Sorghum	Meat	Sorghum	Meat	Sorghum	Meat	Sorghum	Meat
Mean Retail Price (LS/kg)	1.49	2.00	1.64	2.81	1.10	4.17	.53	5.75

Source: Gillard-Byers and Azrag, WSARP Reports No. 42 and 43.

Table 5: Purchasing Power Losses and Gains Associated With Fluctuations in the Market Price for Male Cattle and Sorghum, Kadugli, Sudan Market, 1983-1986

	Sorghum		Male Cattle		Kilograms of Sorghum Purchased From Livestock Sale
	(LS/Malwa)[1]	(LS/Kg)	(LS/AU)	(Weighted LS/AU)	(Kg)
Dry Season - 1983-1984	1.50[2]	.53[2]	259.86	261.59	494
Rainy Season - 1984	3.77	1.33	211.43	223.80	168
Dry Season - 1984-1985	3.80	1.34	152.41	148.28	110
Rainy Season - 1985	4.51	1.59	168.61	173.73	109
Mid-Dry Season - 1986	1.50	.53	259.86[3]	261.59[3]	494

[1]One malwa averages 2.83 kg. A Malwa is a volume of measurement. Grain weight will vary between 2.6 and 3.0 kg/malwa for sorghum.

[2]Mid-Dry Season prices are used due to no available data.

[3]Dry Season Prices for 1983 are used due to no available data.

Source: Gillard-Byers and Azrag, WSARP Reports No. 42 and 43.

Table 6: Market Prices for Livestock, Zebu Meat and Sorghum Under Three Marketing Strategies, Kadugli, Sudan Market, 1984 and 1985

	Male Cattle[1] (LS/AU)		Zebu Meat[2] (LS/Kg)	Sorghum[2] (LS/Kg)
Strategy No.:				
1984: Month		1984: Month		
1. February	258.51	February	2.00[3]	.39[4]
2. February	258.51	June	2.50[3]	1.33[5]
3. June	210.17	June	2.50[3]	1.33[5]
1985: Month		1985: Month		
1. February	158.01	February	2.00	1.50
2. February	158.01	June	2.50	1.66
3. June	136.41	June	2.50	1.66

[1]Source: Gillard-Byers and Azrag, WSARP Reports #43 and 55 (LPIDB).

[2]Source: Gillard-Byers and Azrag, WSARP Reports #42 and 55 (CPIDB).

[3]1985 Prices - Price information had not been collected prior to September, 1984.

[4]February 1986 market prices used. Price information had not been collected prior to September 1984.

[5]September 1984 prices.

Table 7: Total Crude Protein and Calories Available Under Three Marketing Strategy Scenarios Kadugli, Sudan Market, 1984 and 1985

Sale: Livestock Purchase: Meat or Purchase: Sorghum Sale Month-Purchase Month	Purchase: Meat Consume: Meat[1] Crude Protein (,000 grams)	Calories (,000 kcal)	Purchase: Sorghum Consume: Sorghum[2] Crude Protein (,000 grams)	Calories (,000 kcal)
1984:				
1. February-February	----	----	66.9	227.4
2. February-June	18.3	18.9	19.6	66.7
3. June-June	14.9	18.9	16.0	54.2
1985:				
1. February-February	----	----	10.6	36.1
2. February-June	11.2	14.2	9.6	32.6
3. June-June	9.7	12.3	8.3	28.2

[1]Grams of crude protein/100 grams of zebu meat=17.7
Calories/100 grams of zebu meat=22.5

[2]Grams of crude protein/100 grams of sorghum=10.1
Calories/100 grams of sorghum=343

Sources: 1) FAO. 1970.
2) Schmitt. 1979.

Table 8: Protein and Calorie Balance Employing Strategy One for Purchase/Consumption of Sorghum Versus Strategies Two and Three for Purchase/Consumption of Meat

	Crude Protein (,000 grams)	Calories (,000 kcal)	Crude Protein (Days[1])	Calories (Days[1])
Sell: Livestock **Purchase:** Meat				
1984: Months				
Feb. - Feb.	--	--	--	--
Feb. - June	48.6	204.1	675	88
June - June	52.0	208.5	722	89
1985: Months				
Feb. - Feb.	--	--	--	--
Feb. - June	-0.6	21.9	-8	9
June - June	0.9	23.8	13	10

[1]Calculated using target figures for daily/capita crude protein and calorie requirements. Source: Third World Food Survey, FAO, PP. 96 and 97.

FIGURE 1: MAP OF SUDAN AND SURROUNDING AREAS

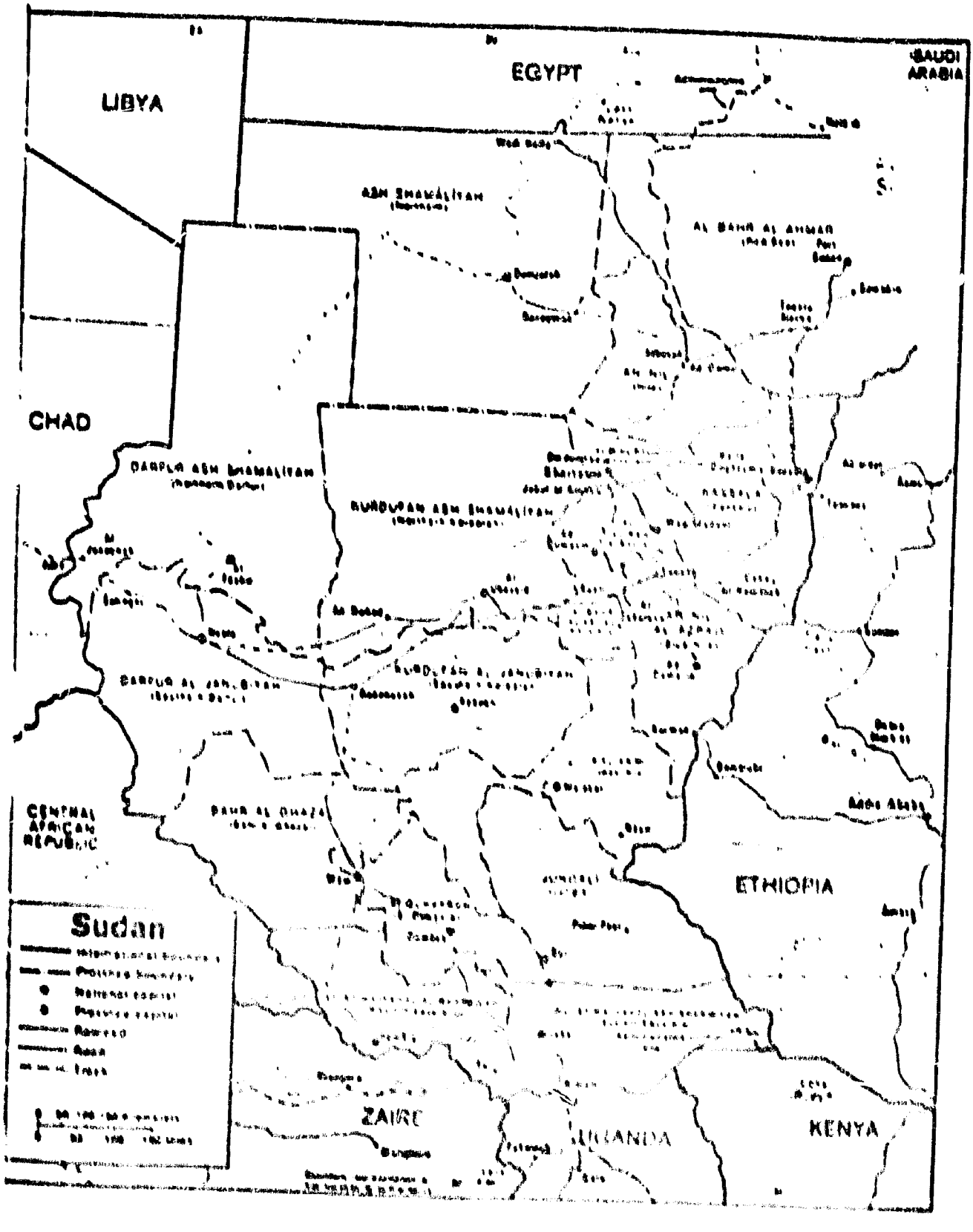
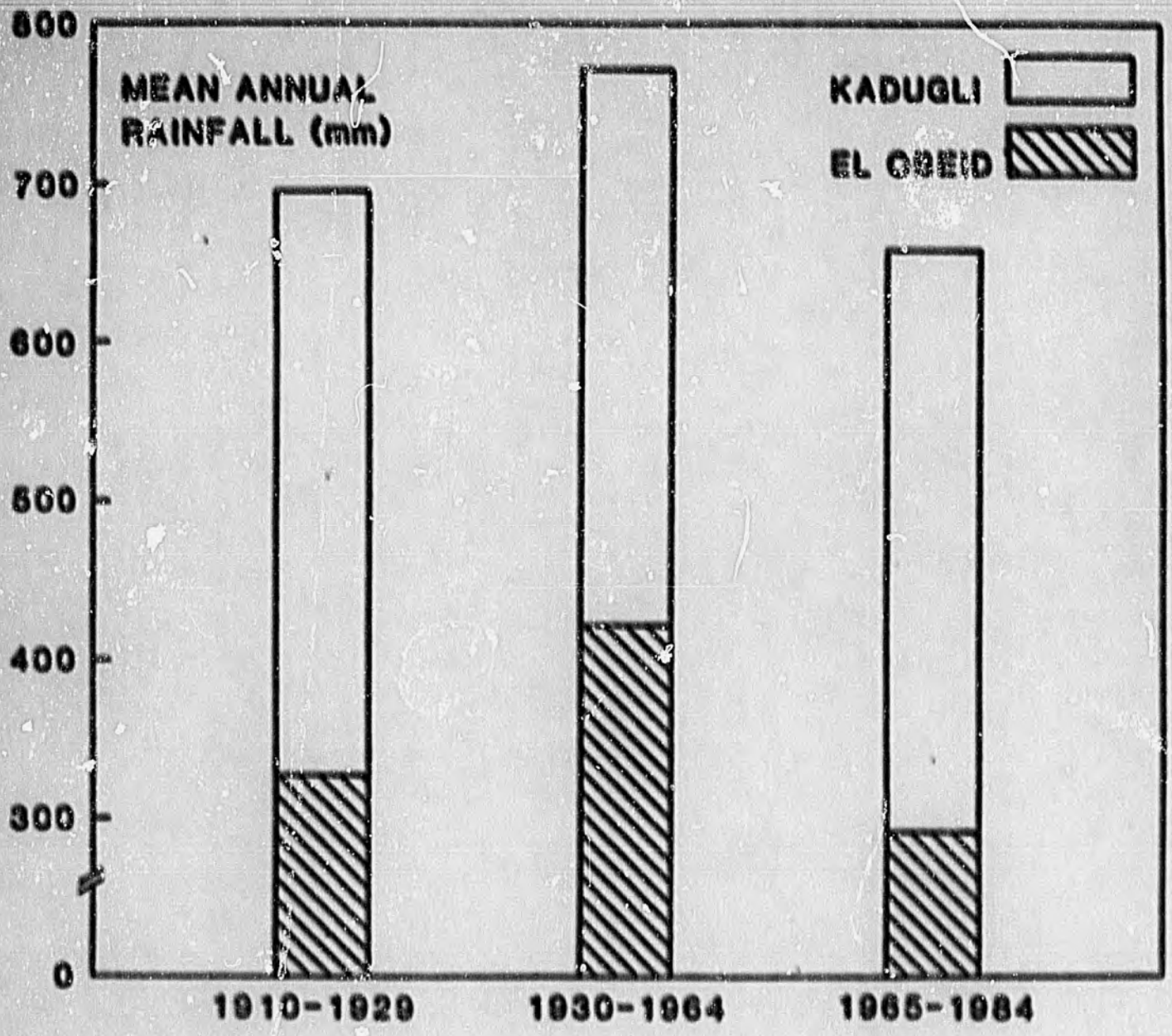
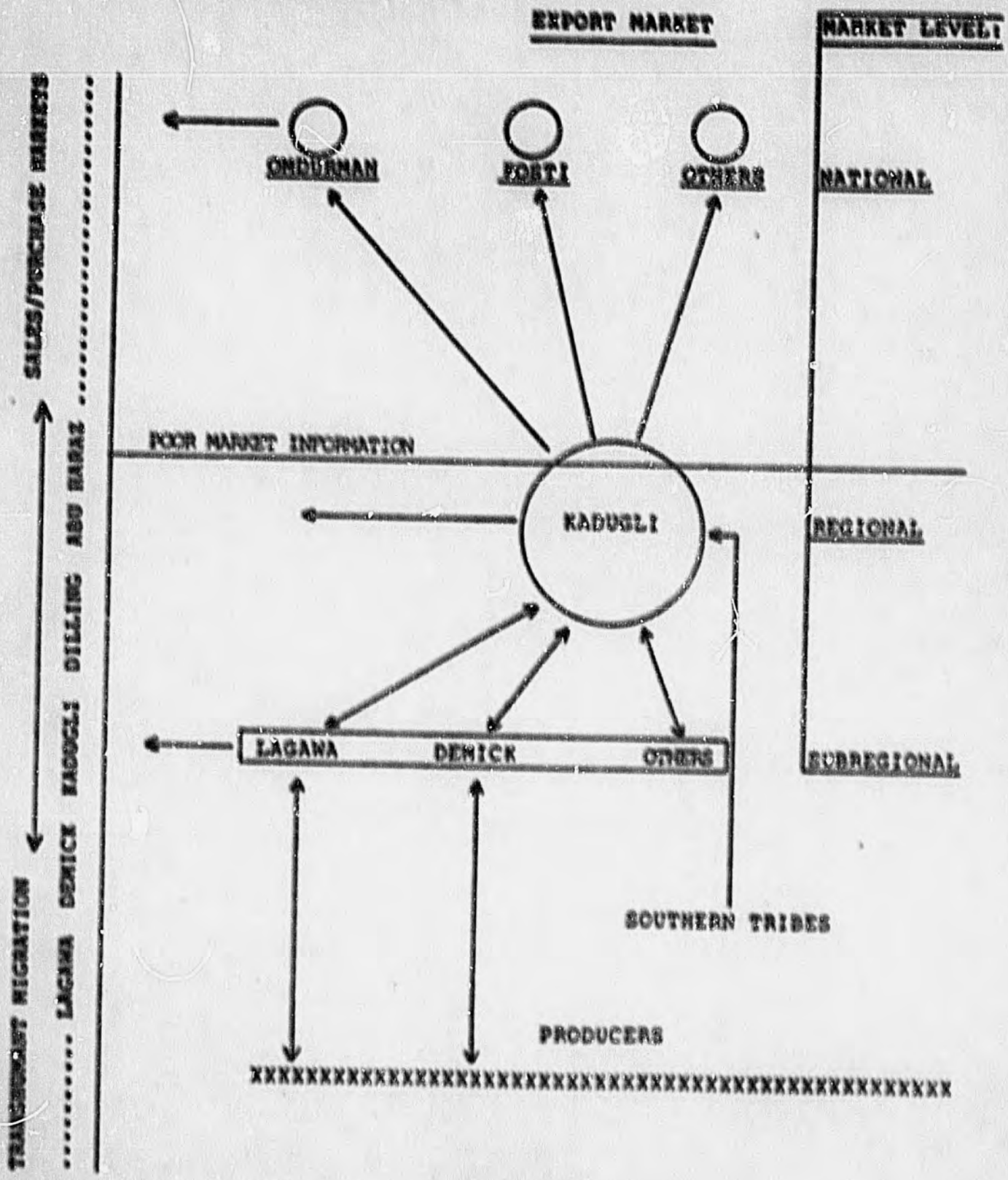


FIGURE 2: MEAN ANNUAL RAINFALL FOR SELECTED PERIOD AT KADUGLI AND EL OBEID, SOUTH AND NORTH KORDOFAN, SUDAN



Source: Riley, J., WEAMP No. 38.

FIGURE 3: SPATIAL MARKET STRUCTURE



Source: Gillard-Byers, Washington State University Seminar Series.

FIGURE 4: MAXIMUM PROFIT MARGINS OF CHANNEL PARTICIPANTS IN SORGHUM MARKETING

Katcha Producer Price Dec LS 2/Malwa (M)

Shopkeeper buys @ LS 2/M in Dec Katcha
sacking costs - .01/M

maximum profit margin
10.7 - 19.6%

Shopkeeper sells @ LS 2.25 - 2.50 in Dec in Katcha
Transport merchant buys @ LS 2.25 - 2.50 in Dec in Katcha
transport cost - .025/M

maximum profit margin
2.4 - 18.8%

Transport merchant sells @ LS 2.50 - 2.80 in Dec in Kadugli
Kadugli wholesaler buys @ LS 2.60 - 2.80 in Dec in Kadugli
average losses @ 15%
inflation @ 20% (40%/year)
storage cost .01/M

maximum profit margin
4.8 - 10.6%

Kadugli wholesaler sells @ 4.20 - 4.60 in May in Kadugli

Source: Speece, M., WSARP Report No. 49, page 21.

FIGURE 5: CATTLE PRICE TRENDS

KADUGLI, SUDAN MARKET, 1983–85

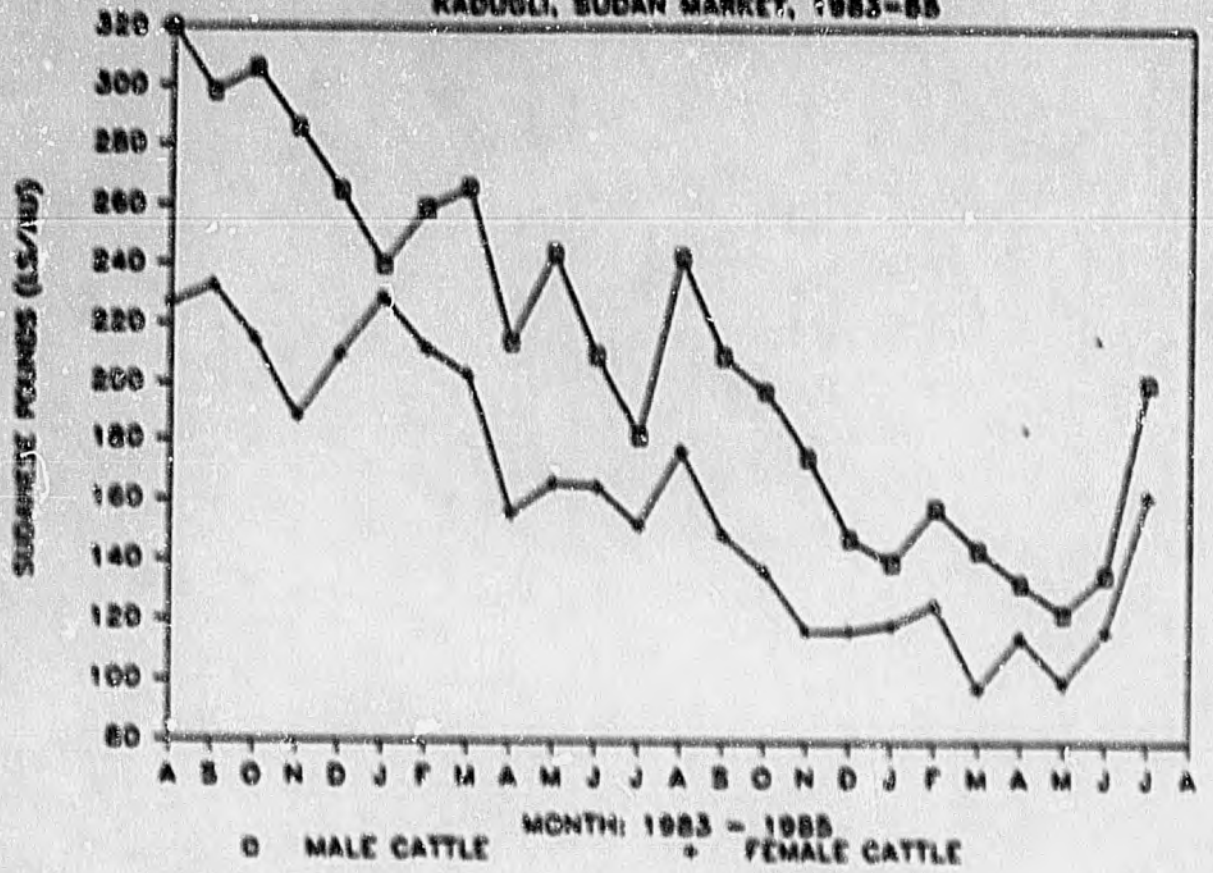


FIGURE 6: GOAT PRICE TRENDS

KADUGLI, SUDAN MARKET, 1983–85

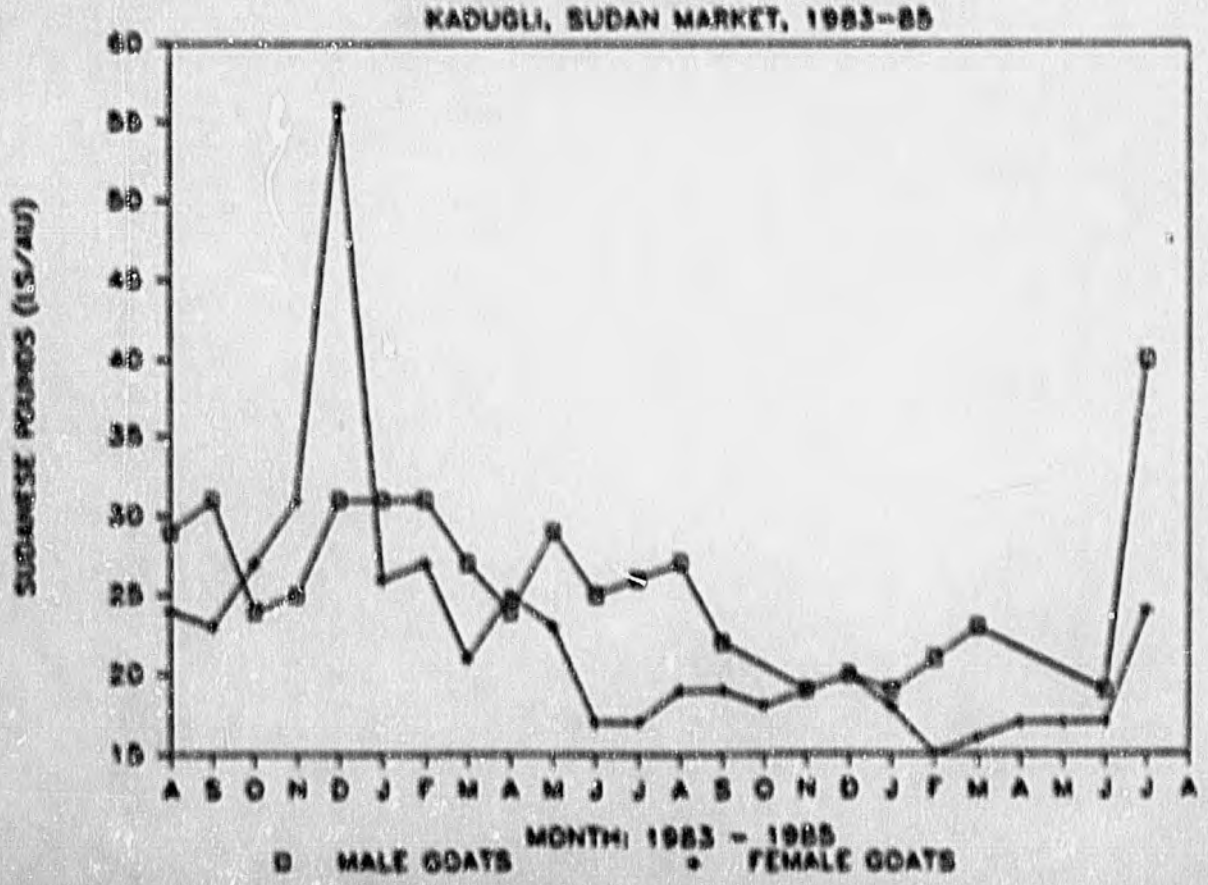


FIGURE 7:

SHEEP PRICE TRENDS

KADUGLI, SUDAN MARKET, 1983–85

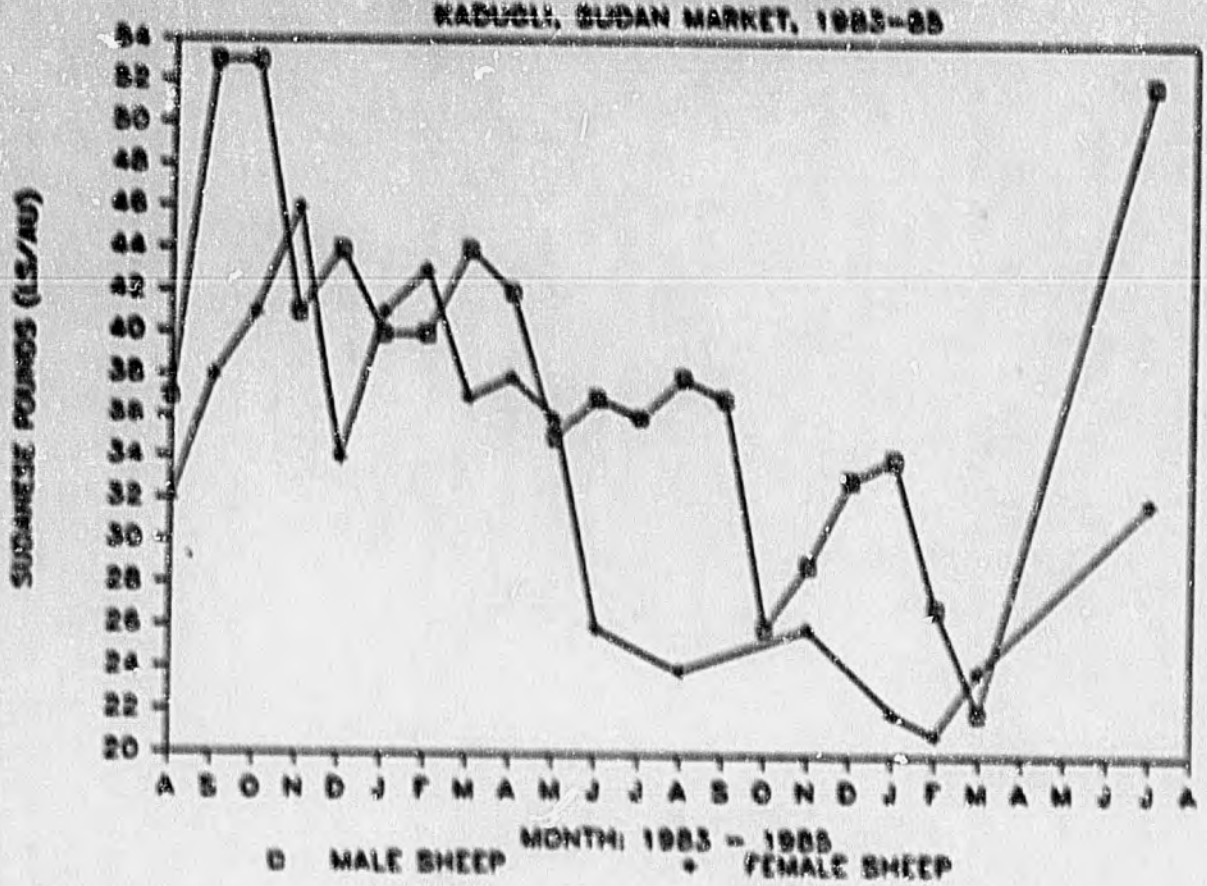


FIGURE 8:

RETAIL PRICE: SORGHUM, SESAME, COWPEA

KADUGLI, SUDAN MARKET, 1984–86

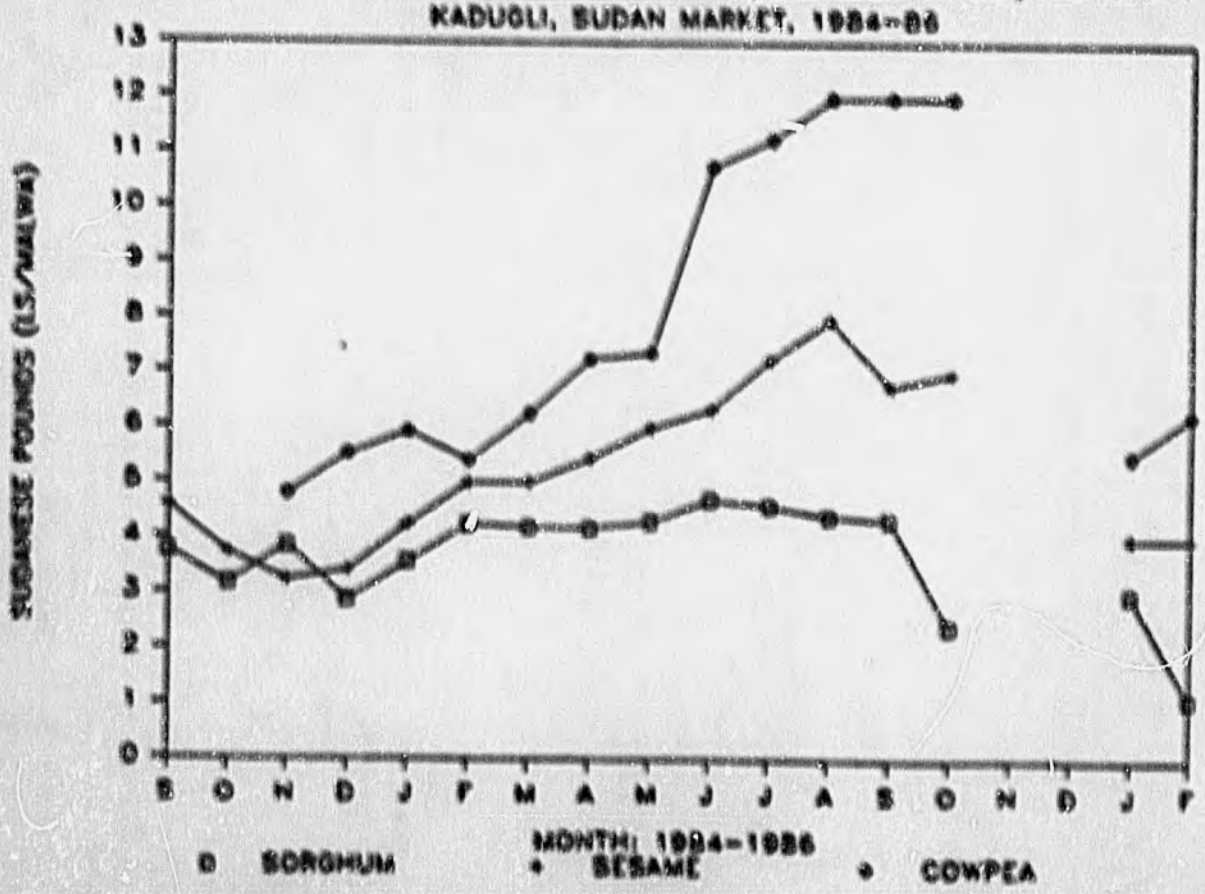


FIGURE 9:

WHOLESALE PRICE FOR SORGHUM, SESAME COWPEAS—KADUGLI, SUDAN MKT. 1984–86

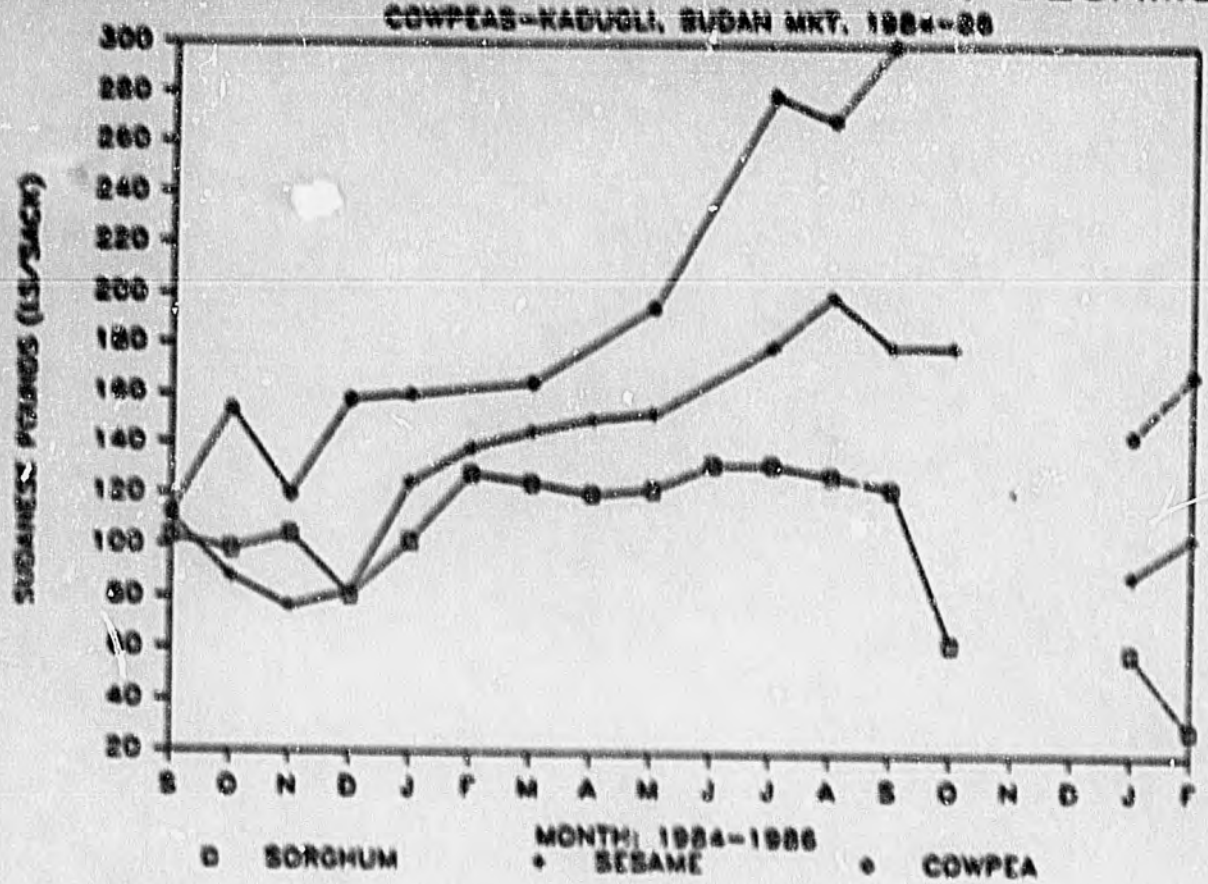
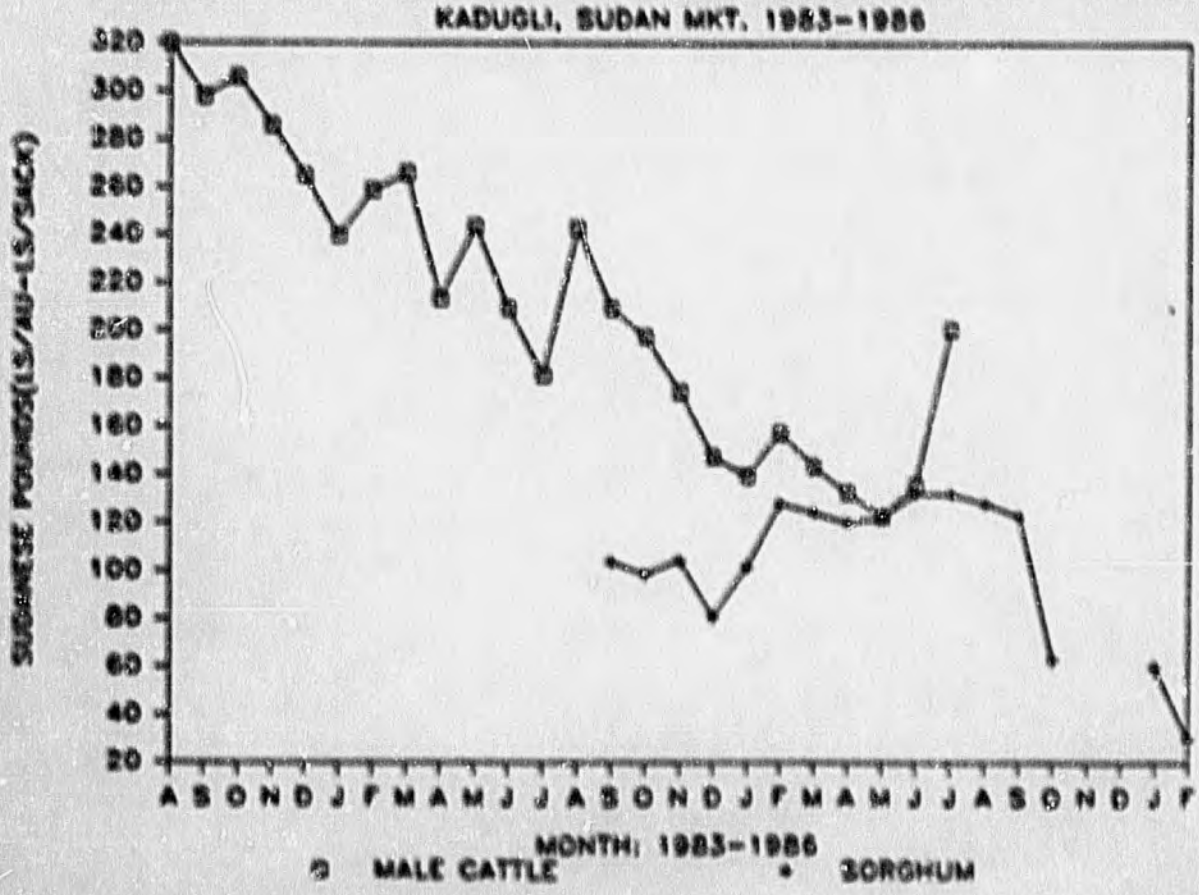


FIGURE 10:

MALE CATTLE AND SORGHUM UNIT PRICES

KADUGLI, SUDAN MKT. 1983–1986