

**THE IMPACT OF COMMERCIALISATION ON HOUSEHOLD
FOOD CROPS PRODUCTION IN WESTERN SUDAN DRY-
LAND AGRICULTURE**

BY

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TABLE OF CONTENTS

	PAGE
ACKNOWLEDGEMENT	I
TABLE OF CONTENTS	II
LIST OF TABLES	Vi
LIST OF FIGURES	VII
LIST OF APPENDICES	VIII
ABBREVIATIONS	IX
ABSTRACT	X

CHAPTER ONE: INTRODUCTION

1.1	Background	1
1.2	Statement of the Research Problem	4
1.3	Objectives of the Study	5
1.4	Study Hypothesis	6
1.5	Significance of the Study	6
1.6	Scope and Limitation of the Study	7
1.7	Layout of the study	7

CHAPTER TWO: AN OVERVIEW OF AGRICULTURE AND AGRICULTURAL POLICY, WITH PARTICULAR REFERENCE TO NORTH KORDOFAN STATE, SUDAN

2.1	Agriculture in North Kordofan	8
2.2	The Income Contribution of Cash Crops and Food Crops	10
2.3	The Production Constraints in North Kordofan	10
	2.3.1 Physical/Biological Constraints	10
	2.3.2 Technical and Management Constraints	12
2.4	Economic Status	13
2.5	The Agricultural policy under Changing Macro-economic Policy Environment	14
	2.5.1 ECRP Policies and Performance (1978-985)	14
	2.5.2 NESP Policies and Performance (1990-1993)	16
	2.5.3 Crop Price Trends in North Kordofan	17
2.6	Implications for Smallholder Farmers	20

CHAPTER THREE: LITERATURE REVIEW

3.1	The Concept of Commercialisation	23
3.2	The Trade-offs between Cash Crop and Food Crop Production	26
3.2	Empirical Studies	29

CHAPTER FOUR: DATA COLLECTION AND ANALYSIS

4.1 The Study Area, Sampling Technique and Data Sources	31
4.1.1 The Study Area	31
4.1.2 Sampling Technique	32
4.1.3 Data Sources	32
4.2 Descriptive Statistical Analysis	33
4.2.1 Social Characteristics of Household	33
4.2.2 Household Education and Institutional Services	34
4.2.3 Labour Contribution of Household	35
4.2.4 Land Ownership and Accessibility	36
4.2.5 Livestock Ownership	38
4.2.6 Key Characteristics of Sheikan Province Farming System	39
4.2.7 Significance of Cereal and Cash Crops	40
4.2.8 Crop Marketing	43
4.2.9 Farm Production and Marketing Relative to Consumption	43
4.3 Characteristics of Commercialised Household	45

CHAPTER FIVE: ECONOMETRIC MODELS, RESULTS AND DISCUSSION

5.1 Econometric Models	49
5.2 Determinants of Commercialisation	54

5.3	Impact of Commercialisation on Household	
	Food Crop Production	58
CHAPTER SIX:	CONCLUSION AND IMPLICATIONS	61
Bibliography		64

LIST OF TABLES

Table 4.1	Page
Sample Distribution	33
Table 4.2	
Age Distribution of Sample Population	34
Table 4.3	
Age Distribution of Household Head	35
Table 4.4	
Distribution of Sample Population and Household Heads by Level of Education	36
Table 4.5	
Access to Credit and Extension Services	35
Table 4.6	
Contribution of Household Members to Cropping and Livestock Herding	37
Table 4.7	
Labour Supplied by Farm Households	37

Table 4.8

Distribution of Households by Type of Access to Land	38
--	----

Table 4.9

Land Distribution in Hectares.	38
--------------------------------	----

Table 4.10

Ownership of Animal Heads by Rural Council	39
--	----

Table 4.11

Household Crop Production by Rural Council in Sheikan Province: 2001/02	43
---	----

Table 4.12

Percentage of Households Involved in Crop Marketing by Rural Council in Sheikan Province: 2001/02	45
--	----

Table 4.13

Characteristics of Commercialised farm Households	49
---	----

Table 5.1

The Anticipated Signs and Measures of the Variables Included in the Models	55
--	----

Table 5.2

Empirical Results of Commercialisation and Food Crop Production Models, Sheikan Province, North Kordofan State, Sudan	57
--	----

LIST OF FIGURES

Figure 2.1	Page
Millet Deflated Farm Gate Price: 1970-1997	18
Figure 2.2	
Sorghum Deflated Farm Gate Price: 1970-1997	19
Figure 2.3	
Groundnut Deflated Farm Gate Price: 1970-1997	19
Figure 2.4	
Sesame Deflated Farm Gate Price: 1970-1997	20

LIST OF APPENDICES

	Page
<u>Appendix I</u>	
Figure 4.1	
Map of the Sudan	71
Figure 4.2	
Map of North Kordofan State	72

Appendix II

<u>The Household questionnaire form</u>	73
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ABBREVIATION AND ACRONYMS

ABS	Agricultural Bank of Sudan
AERC	African Economic Research consortium
ARC	Agricultural Research Corporation
CBC	Commercial Banks Consortium
ECRP	Economic Recovery Programme
HCI	Household Commercialisation Index
IV	Instrumental Variable
MoA	Ministry of Agriculture
NESP	National Economic Salvation Program
RC	Rural council
SD	Sudanese Dinar (1 US\$ = 250 SD)

Abstract

The promotion of cash crop commercialisation and its effects on smallholder welfare have been debated for decades. This study uses cross-sectional data to examine the impact of cash cropping on food crop production at farm household level in Sheikan province in North Kordofan State, in Sudan. In addition to descriptive analysis, the study specifies and estimated models of groundnut commercialisation index and food crop production. The survey shows that the degree of agricultural commercialisation varied significantly across the entire sample, but still the semi-subsistent production features the production pattern in the area of study. Also, The empirical results show that groundnut commercialisation significantly and positively affected food crop production at household level. Commercialisation was significantly and negatively affected households' investment in livestock, but positively by family size. The study concludes that agricultural commercialisation has a positive and significant impact on household food crop production. Even when the households allocate more resources to cash crops, the earned income and access to food markets appears to justify their resource allocation.

CHAPTER ONE

INTRODUCTION

1.1 Background

It is commonly argued that productivity growth in African agriculture will require a transformation out of the semi-subsistence, low-input, low-productivity agriculture that characterises most of rural Africa. Given population growth and the limits of area expansion as a means to increase crop production, productivity growth will increasingly entail yield growth and/or shifts to higher-return activities, involving more intensive use of productivity enhancing inputs and more market oriented patterns of crop production (Strasberg et. al., 1999).

In some areas of Africa, input intensification was formerly promoted on food crops in the 1970s and 1980s through state-led programmes featuring subsidised and inter-linked credit-input-output marketing arrangements implemented by state marketing boards (Byerlee and Eicher 1997). However, these state-led approach eventually accumulated large budget deficits and become financially unsustainable, leading to partial state withdrawal from food crop and input marketing and an associated stagnation or decline in the use of farm credit and cash inputs on food crops (Jane and Jones 1997). Moreover, there has decreased the profitability of using trade-able inputs such as fertiliser on non-trade-able crops (which include the major grain crops in most years and most areas of Africa) (Govere et. al., 1999). The limited successes in stimulating food crop intensification in the post-liberalisation environment can

also be partly attributed to the evolving system's continued difficulties in delivering and reliably recovering credit to finance the intensification of smallholder food crop production (Mosley 1994; Dorward, Kydd, and Poulton 1998).

Modernisation of the Sudanese agriculture - application of new technology, commercialisation and irrigation – goes back to colonial time (Suliman, 2000). Since those days, broad wave of agrarian change took place by introduction of large-scale agricultural activities, which was a reorientation of the predominantly traditional subsistence agriculture and animal husbandry to produce for the market.

The agricultural sector plays a pivotal role in Sudan's economy. It contributes, on average, about 49.8% of the country's GDP, over 48% of export proceeds and 75% of the productive sectors' value added, and employs 75% of the labour force (Bank of Sudan, 1999). In addition, it produces over 90% of the national food requirements (Hag Elamin and El Mak, 1997). It comprises five main sub-sectors: irrigated, mechanised rain-fed, traditional dry land, livestock, and forestry.

The dry-land agriculture, a vast semi-arid region, is the largest economic sector in Sudan. It represents 63 percent by area of annual cultivated land and support over 70 per cent of the population - which estimated at about 35 millions. It also contributes significantly to the export crop portfolio netting nearly 60 per cent of the country's foreign exchange earnings (Bank of Sudan, 1998). Western Sudan is a typical dry-land agricultural sector. The important crops grown in this dry land agricultural sector are millet, sorghum, groundnut, sesame, and gum Arabic.

A chronological survey of the farming system and conditions of the region better portrays the vulnerable economic situation of diminishing growth of farm income and declining productivity of all crops in western Sudan. The agricultural policies which have been followed, in the dry-land of western Sudan, since the mid-1960s are favouring the expansion of cash crops, in particular the oil seeds (groundnut & sesame) which are mainly grown in this part of the country. These policies are also favouring the large-scale mechanised farms (> 400 ha per unit) in terms of credit allocation, where the large farmers access to institutional credit is significantly higher than that of the small farmers, even when small farmers are organised in co-operatives or trust groups.

Since the mid-1960s a gradual transformation of the production pattern of the dry land of western Sudan from subsistence to commercial cropping, producing increasing amounts of cash crops has taken place. The small farmers without reducing their normal cultivation of food crops were encouraged to increase cultivation of cash crops. This government-activated policy was mainly motivated by the high export value of these cash crops.

The agricultural policy favouring cash cropping has been pursued in different forms. One form is exhibited in the loan conditions of the Agricultural Bank of Sudan (ABS), the major agency lending the dry-land agriculture in the Sudan. The ABS has conditioned its loans to individual small farmers by that at least 80 percent of the 21 hectares¹, maximum permitted area for credit finance, must be grown with cash crops. Millet, sorghum and/or other food crops could be grown on the remainder 20 percent of financed area (Elamin, 1998).

The regional Ministry of Agriculture (MoA) has also followed a similar policy parallel to that of the bank as it extensively is engaged in providing improved seeds of cash crops, especially groundnut, on credit basis. Moreover, the commercial banks have also played a major role in promoting cash crop production by adopting marketing rather than production-led strategy of agricultural finance.

Therefore, three highly interrelated factors have major influence in shaping the socio-economic activities of the dry-land agricultural sector, in Sudan. These are the recurrent drought, the agricultural policies, specifically cash crop intensification, and the food grain markets. The next section portrays the research problem.

¹ The small farmers organise themselves in co-operatives or trust groups in order to be able to get credit from government or private institutions, by that the area could reach 21 hectares.

1.2 Statement of the Research Problem

Most local and internationally based agricultural research programmes designed to promote food crop productivity growth in Africa are based on the allocation of scarce resources to primary food crops. Although, high-valued cash crops represent one potential avenue of crop intensification, the promotion of cash crop commercialisation and its impacts on farm household welfare have been debated for decades. Commercialisation policy featuring non-food cash crops have frequently been criticised in African contexts as having a negative effect on food production and food security of farm households.

From the background we presented above and the underlying linkages involved in this development strategy based on cash crop intensification in the Sudanese context, it emerges that not much attention has been paid to what is working at the micro-level of the development problems facing the subsistence household.

One logical conclusion to that chronological survey is that small farmers are caught in a double threat of low grain production and farm income. Grain production has been low and unstable and farm income from cash crops is declining in real terms, which represents a real threat to farm households' ability to secure their food needs.

While productivity growth of staple food crops is indeed essential to overall rural productivity growth due to the large proportion of cropped area under food crops, the

potential impacts of higher-valued cash crops can have on farm household food crop production has often been neglected. Whether it positively or negatively affected food production in the Sudanese context, is still a question open for discussion and empirical investigation.

This research study attempts to investigate the effects of groundnut commercialisation on food crop production at the household level in Sheikan province of North Kordofan State. Accordingly, the research question to be addressed in this study is that: *what are these indirect effects that cash cropping can have on household food crops production in Sheikan province of North Kordofan State?* This question, however, falls into a broader policy issue relating to sectoral agricultural policy and to what should be the role of government in getting various economic sectors and sub-sectors into process of development.

This research study intends to contribute to resolving this policy paradox for the government of the North Kordofan State (which is one of six states composing the dry-land agricultural sector in western Sudan) by initiating policy reforms to revive the dry land agricultural system in North Kordofan State.

1.3 Objective of the Study

The overall objective of this research is to analyse the impact of commercialisation on household food crops production, in Sheikan province of North Kordofan State in the Sudan. Specifically, the study aims:

1. To identify factors those influence the commercialisation decision of farm households.
2. To examine the impact of commercialisation on the farm households' food crops production.

3. To discuss the policy implications for improving the contribution of cash cropping to rural food production of the households.

1.4 Study Hypothesis

In order to achieve the second objective, the study will test the following hypothesis:

Commercialisation (cash cropping) is expected to have a positive impact on food crops production of farm households.

1.5 Significance of the Study

A number of studies have been done on the area of agricultural commercialisation policy in Sudan. Most of these studies however have been indicative and either descriptive or have tended to limit themselves to the national/sectoral policies, neglecting the direct and indirect impacts of cash crop intensification on farm household food crop production in dry-land agriculture.

This study highlights the indirect effects of cash cropping on food crop production at farm household level in Sheikan province of Northern Kordofan State. In addition to contributing to knowledge, based on the results of the descriptive and analytical work, the study will provide a set of recommendations to the decision-maker, regarding farm households in north Kordofan.

1.6 Scope and Limitations of the Study

The study will focus on traditional area (areas where the farming system is traditional in terms of technology and input use) of Northern Kordofan in Western Sudan. Traditional agriculture of the area is often described as subsistence dry-land agriculture combined with limited amount of pesticides and high-yield varieties. However, the results of the study may be generalised to other areas of Western Sudan with similar environment.

This research study is limited to examine the consequences of commercialisation on food crop production of the farm households in dry-land agriculture in Sheikan province of North Kordofan State. Therefore, the central theme to be addressed by the present research study is that of commercialisation impact on food crop production at farm household level.

1.7 Layout of the Study

The remainder of the dissertation is organised as follow chapter two reviews agriculture and agricultural policy with particular reference to North Kordofan State in Sudan. Chapter three presents literature review on the concept of commercialisation and empirical studies in African context. Chapter four presents data collection and the descriptive analysis. Chapter five presents the econometric models and discusses the empirical findings of the study. Finally, chapter six includes the conclusion and implications of the findings.

CHAPTER TWO

AN OVERVIEW OF AGRICULTURE AND AGRICULTURAL POLICY, WITH PARTICULAR REFERENCE TO NORTH KORDOFAN STATE, SUDAN

2.1 Agriculture in North Kordofan

According to the present Federal governing system in the Sudan, Kordofan region consists of three States North, South and West Kordofan State. Geographically, Kordofan region lies between latitudes 9° 30' and 16° 30' N and longitudes 27° and 32° 25' E. it encompassing a total area of 380,000 km² (37,800,000 hectares), (Figure 1, Appendix I). The region has low population density. The total population of North Kordofan State, according to year 2000

estimation is 1,438,000 persons (205,428 households). Out of the total population, the urban communities account for 13%, the nomads 24% and the rural-settled 63% (State Statistics Bureau, 2001).

The economy of Kordofan region is predominantly dependent on agricultural production, the leading form of agriculture is rain-fed crop farming, with traditional livestock raising practised through nomadic systems or as a village based activity coming next in importance. There are two types of production systems under which staple food crops such as sorghum and millet and cash crops including groundnut, sesame, gum Arabic and watermelon are produced. These include traditional and mechanised farming. But traditional farming is widely practised across the region. It is dependent on family labour cultivating relatively small plot including staple food and cash crops. The use of inputs is limited to small amounts of pesticide and fungicides.

Another characteristic of the region is low and fluctuating rainfall. The average annual rainfall is 317 mm/annum (Eldukheiry, 1997). This rainfall is highly variable, and hence this variation combined with the available soils in the region limit the types of crops that can be cultivated. Moreover, the socio-economic environment also influences the characteristics of agriculture in this region.

Millet is principal subsistence crop grown in North Kordofan region. About 55% of the cultivated area are cultivated with several types of millet (Eldukheri, 1987). Despite the high share of area only limited quantities of millet is marketed as most of the production is retained for home consumption. The major market for millet is El-Obeid, the capital of North Kordofan State. Usually farmers sell their marketable surplus of millet to an assembler-wholesale merchant who in turn sells the commodity either directly to consumers or to a retailer (Hashim, 1994).

Sorghum is the second important staple grown in the region. Although it is not extensively grown as millet, only 4% of the total cultivated area are cultivated with sorghum (Eldukheri, 1987). There are many different ways of sorghum marketing, but the most relevant one to traditional farmers is through private bargaining with a merchant. In this case, the merchant usually provides the farmer with credit during the production season. In response the farmer sells his crop to the merchant at discount sale prices. Local merchants can next sell to wholesalers from other parts of the country, directly or through their representative.

The two main cash crops in the region are groundnuts and sesame. The region cultivated and produces one-third of the total groundnuts and sesame in the country (Eissa, 2000). Marketing of groundnuts in traditional rain-fed cultivation is characterised by hierarchy of markets and institutions. To obtain the urgently needed cash to pay back informal credits; farmers are usually compelled to sell their crop at low price during the harvest time to local merchants. Similarly, the marketing system of sesame is essentially identical to that of groundnuts (Hashim, 1994).

2.2 The Income Contribution of Cash Crops and Food Crops

The extent of food and cash crop production varies by season. According to Dunston et. al., (1996), even in a better-than-average good year, food from households' own farms is inadequate for family consumption. Therefore, sale of surplus food crops is not expected. But one alternative to obtaining cash income to secure household access to food is exchange of a high value cash crop (groundnut, sesame and gum Arabic) with food staples, which is an important mechanism applied by farm households. Thus, production of cash crops is more preferred than staple crops. Dunston et. al. (1996) found that the conversion of cash crop into a staple crop equivalent has a comparative advantage by taking the terms of trade between the

two types of crops at a given time of the year. Therefore, cash crops income contribution is significant in farm household food security.

2.3 The Production Constraints in North Kordofan

The effects of desertification and drought are major constraints to development in Kordofan region common to all production systems. Other constraints can be broadly classified into physical/biological, socio-economic, technical and institutional constraints. These constraints will be briefly summarised in this section.

2.3.1 Physical/Biological Constraints

2.3.1.1 Soil

Under this group of constraints the soil types and suitability for different forms of agricultural production emerge, as an important determinant of future development and possibilities of expansion of production. The arid and semi-arid zones of the Kordofan region face pressure from three main sources: cultivation, pastoral activity, and wood requirements – all exacerbated by a growing population.

In the northern half of the region fragile sandy soils predominate, which characterised by low fertility and low water holding capacity. Such soils are vulnerable to soil hazards and require special treatments if it is to be made productive. In the central part of the region poor soils with hardpan extensively prevail. These soils require reclamation efforts, which are beyond the abilities and technical know-how of the traditional cultivator. In the southern areas, rocky surfaces, which are unproductive, are found over many locales an obstacle to crop farming.

Soil fertility decline has made agriculture in Northern Kordofan increasingly risky as source of income (SCF, 1998).

2.3.1.2 Rainfall

Inadequacy of rainfall coupled with annual fluctuations render the Northern half of Kordofan region unfavourable for crop farming (Eissa, 2000). Equally, and because of the drop in rainfall averages during the last decade, this same area has lost most of its forage potential of the past, resulting in an observed decline of its livestock economy. Also, the unpredictable rainfall coupled with pest infection constitute the two major constraints to farming in Northern Kordofan (SCF, 1998). It is interesting to note a number of local adaptations intended to reduce the economic risk of crop failure due to rainfall failure. For example, allocation of land to millet which is a hardly drought resistance crop. When the early rains continue without a prolonged break, this strategy works to the advantage of farmers, resulting in higher yields. Occasionally however, the early rains followed by a significant break and in the event, replanting several times may be necessary (IFAD, 1987).

2.3.1.3 Inferior Genetic Types and General Environmental Degradation

Seed quality is an important determinant of crop yields. With few exceptions, all the crops cultivated species raised are of genetically poor, pest susceptible and low yielding varieties and breeds (Eissa, 2000). Many farmers who save their own seed actively select for desirable qualities. Seeds brought from the market are often of low or unobservable quality. Infestation and viability, for instance, are quality characteristics that are difficult to observe. The more distant the origin of the seeds, the less likely they are to be appropriate. For these reasons, farmers perceive buying seeds from the market as a bad practice.

2.3.2 Technical and Management Constraints

2.3.2.1 Improper Crop Rotation

Production in the traditional rain-fed sub-sector depends mainly on the amount of rainfall and its distribution. The main traditional means of production are seeds, hand tools and manual labour. However, rotation patterns have a direct effect on crop production and soil quality. Crops grown there are sorghum, millets, groundnuts, sesame, watermelon and gum Arabic, often in mixed form.

Shifting cultivation is practised which includes clearing a plot of land to grow crops for three to four years, then allowing the land to rest for 10-12 years to restore its fertility. In recent years, farmers deviate from the optimal practice they articulated and due to the tendency of nomads to settle, land may be cropped more and allowed less time to recover. They tend to fallow a mono-cropping pattern, inorganic fertiliser were not applied for various reasons. Also, agriculture is encroaching on low rainfall areas below 300 mm. of rain. All these have led to low yields, overgrazing at water points and encroachment of the desert. The low yield is mainly due to the continuous cropping of land, little or no use of improved inputs, poor infrastructure and services and the subsistence pattern of production.

2.3.2.2 Uncertainty of Production

The environment imposes severe constraints on cropping, in the rain-fed sub-sector of Kordofan region. The main determinants of the area cultivated and yields realised are conditions of the soils and climatic factors mainly quantity and quality of precipitation. It is generally agreed that rainfall distribution in these areas is poor. There is a great variation between and within seasons. The relatively high temperatures, low humidity and high rate of evaporation cause water stresses for the plants, hence causing low yields.

According to A. E. Kambal (undated) “The high year to year variation in production levels of more than 20% is attributed mainly to the pattern of rain distribution rather than to the total rainfall”. Within the year variation in rain correlated positively with yield. Also, El Adeemy (1995) has stated some of environmental constraints to production in Northern Kordofan. These include the following: 1) adverse affect of natural conditions; wind erosion; 2) irregular rainfall; 3) diseases; shortage of fertilisers and pesticides; 4) lack of improved seeds; 5) absence or inadequate credit facilities farmers; 6) high production costs and high labour cost; 8) losses at various stages of crops production and pre and post harvest losses.

2.4 Economic Status

Consonant with African production systems, land ownership is not a good measure by which to satisfy households. There are few households that do not own land. Except for occasional sales of fields, land is not generally sold. Instead, assets such as livestock holdings, electric generators, tractors, lorries and trading capital, remittances from relative’s abroad or in urban centres, and occupational categories such as participation in the agricultural labour market, are the keys to household stratification into economic status groups.

2.5 The Agricultural Policy under a Changing Macro-Economic Policy Environment

During the late 1970s Sudan’s economy began to experience sever interdependent structural problems that inhibited economic growth (World Bank, 1985). The internal sectors, in particular the agricultural sector, have suffered from excess aggregate demand resulting in inflationary pressures in the economy (Hag Elamin and El Mak, 1997). To address these issues, the government has lunched a series of development plans and programmes. These

were the Economic Recovery Programme (ECRP – 1978-1985) and National Economic Salvation Programme (NESP – 1990-1993).

2.5.1 ECRP Policies and Performance (1978-1985)

During the ECRP a series of sector-specific policies were implemented in agriculture, the most important of which were the, reduction of export taxes for agricultural exports, dismantling of the monopoly power of the Oilseeds Company in oilseeds exports and Islamisation¹ of the financial system, which implemented since 1985.

Despite the government effort of introducing changes in the area of exchange rate, pricing policies, export taxes, production relations and public investment, a host of other policy variables were left untouched. Marketing of principal exports like cotton, gum Arabic and oilseeds (groundnut and sesame) was monopolised by the government through its parastatals. Although these export marketing parastatals were described by various government reports as less than efficient, little was done to change their marketing policy. Their parastatals failed to stabilise producers' prices and reduce seasonal price variations. Furthermore, they constrained incentives for producers by keeping agricultural prices at very low levels compared to international prices (Hag Elamin and El Mak, 1997).

Formal credit to agriculture was confined principally to the Agricultural Bank of Sudan (ABS), and rural financial market in Sudan were dominated by informal lenders. The ABS

credit was channelled mainly to large-scale farmers who could provide guarantees. The other source of formal credit to agriculture was the Bank of Sudan. It provided loans to the irrigated sector. The commercial banks' credit to agriculture was negligible since they concentrated on financing industry and foreign trade.

Agricultural loans are generally viewed by the commercial banks' as risky, costly to administer and less rewarding as they do not allow quick circulation of funds. In searches for financial instruments that are consistent with both the Islamic principles of finance and the nature of agricultural production system, which is subject to environmental hazard, yield and price uncertainties. Formal lending in general and commercial banks lending in particular has been confined to the mechanism of "purchase with deferred delivery", which is locally known as *elsalam*. Through *elsalam* farmers obtain cash advances on the promise of selling or delivering a certain amount of their future crop to banks at the time of harvest. In other words, in typical *elsalam* agreement, the borrower receives a money loan by undertaking to deliver to the lender a certain amount of the future crop at agreed (contract or *elsalam*) price. This determined by the commercial banks consortium and may be significantly different from the harvest or spot price. According to Elhirika et. al. (1997), *elsalam* credit is not risk-free.

In keeping with the principle of Islamic finance, lenders are not allowed to take collateral to secure debt services when project returns are insufficient. But they insist on providing some sort of warranty to secure that the person taking *elsalam* is genuine farmer, and they also seek to reduce the cost of administering *elsalam* transactions.

¹ Islam categorically prohibits receipt or payment of predetermined rates of interest. For a detailed discussion of the Islamic principles of finance see Khan (1986).

2.5.2 NESP Policies and Performance (1990-1993)

With economic liberalisation as an overall objective of NESP, the programme sought to reallocate resources to enhance production particularly in agriculture in order to achieve food security and to generate export surplus. Also, to boost the role of the private sector; to remove price and exchange rate controls; to privatise public entities; and to achieve financial stability.

The agricultural policy reforms assigned agriculture its leading role as the engine of economic growth. These policy changes were taken as an active initiative towards a change in strategy rather than a temporary adjustment to internal and external shocks. Substantial improvements were achieved in the area of products pricing, where the role of the Ministry of Commerce in controlling prices was frozen and ministerial committees were set up to oversee a set of flexible induced prices.

To reinforce the role of the private sector the government launched a phased programme for privatisation and liquidation of public sector enterprises. Staffing of parastatals was reduced by 30%-40% following restructuring so to emphasise commercialisation.

As a result of NESP initiatives to activate agriculture and to achieve food security, the number of banks branches in rural areas was more than doubled, and the ratio of farm credit rose from less than 1% to an average of 18% during the period 1990-1993. Moreover, the Central Bank of Sudan raised the commercial banks' ceiling for operation and non-operation credit to agriculture to 40% of their total advances. But most importantly, the role of Agricultural Bank of Sudan (ABS) has been considerably expanded; its branches increased from 15 in 1990 to

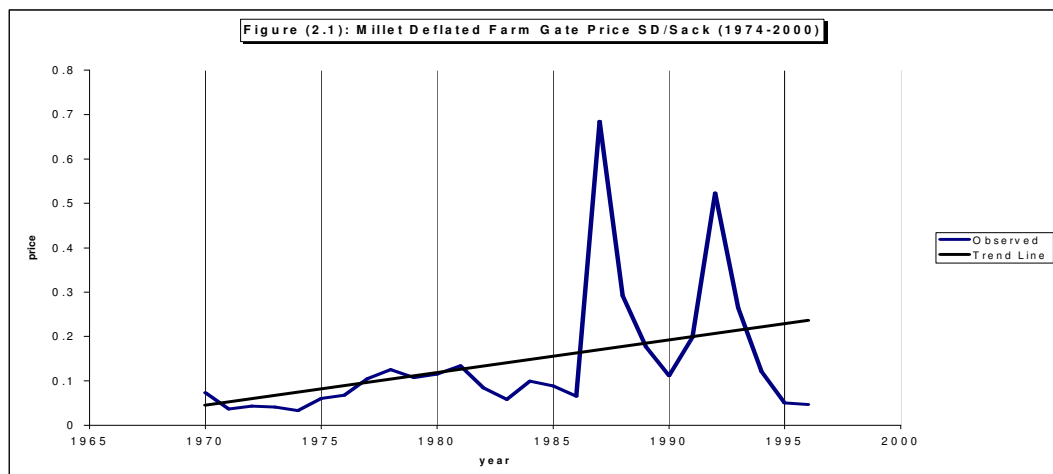
118 in 1994 and two other specialised banks, the Farmers Bank and the Animal Resources Bank have recently been established. Also, a commercial banks consortium (CBC) was set up in order to raise credit availability and lower individual bank exposure by means of risk pooling. Moreover, agricultural insurance was introduced for the first time in 1994 (Elhiraika *et. al.*, 1997).

Recently, liberalisation and Islamisation are characterised the Sudanese economy. By and large, the most important implication of the recent financial policy is that formal agricultural credit, which between 1970 and 1989 depended almost exclusively on government sources, has since 1990 up today been assigned to private sources.

2.5.3 Crop Price Trends in North Kordofan

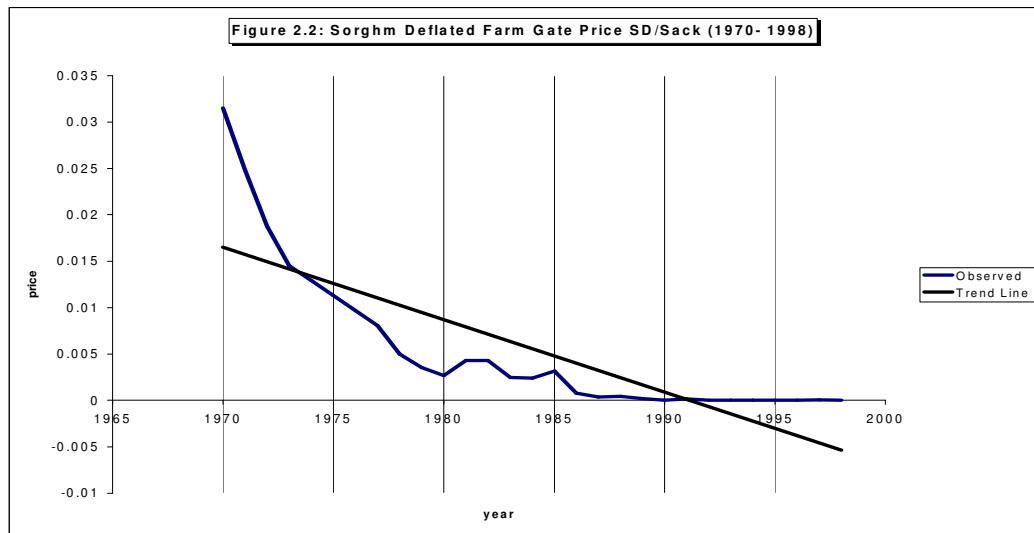
As has been mentioned earlier in another situation, that the two main food crops grown in North Kordofan region, are millet and sorghum, groundnut and sesame are the two main cash crops. Of course, such macro policy environment changes will have impacts on farm gate price. Figures 2.1 to 2.4 show the real farm gate prices of food crops and cash crops for period started at 1970 to 1997.

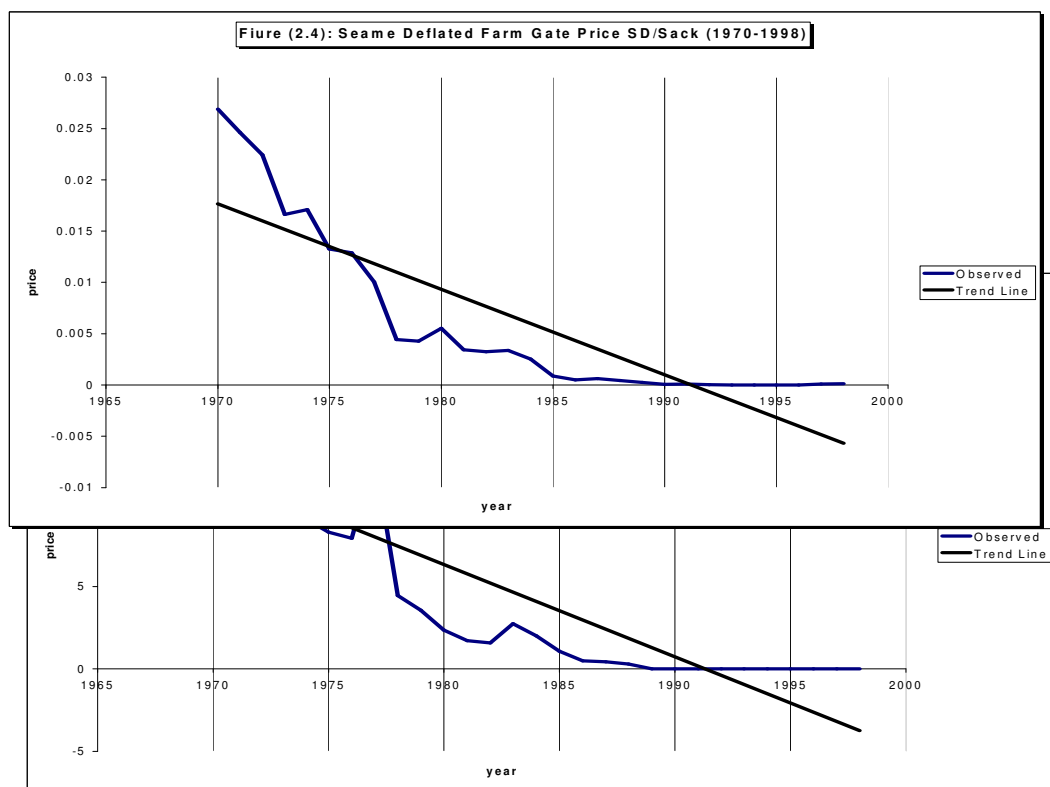
Figure 2.1, shows millet's farm gate price, which is upward trend. Millet is staple food for majority of Western Sudan (Kordofan & Dar Fur regions) population. However, farmers experienced millet yield declining due to rainfall fluctuation along the period 1983-1993, which led to famine in 1983-84. As a result amount supplied declined in the face of high demand, which led to high price of millet



during that period.

Generally, downward trends in prices received by farmers at that period of time could be observed in figures 2.2, 2.3 and 2.4. Serious price declining was in period 1985-1997. This is attributable to the agricultural pricing policy, which was resulted from unsuitability of macro policy environment at that period of time. Also, it is observable that farmers received fixed prices along the same period for the three crops, which can be linked to the monopoly power of the Agricultural Bank of Sudan (ABS) and the Consortium of Commercial Banks (CBC), the major financial institutions provide credit to agricultural sector. The practising of the monopoly power was through determination of prices, in each season by these banks, at which farmers agreed to deliver or sale their crops to the bank in order to repay the money that they borrowed. Usually, price significantly different from harvest or spot price.





2.6 Implications for Small-holder Farmers

The agricultural policies in 1990s were meant to promote production and transforming the smallholder subsistence farmers into commercial agriculture. The changes in the policies are

leaving the smallholder farmers in a free market situation. There are potential benefits and losses for the smallholder farmer. On the positive side, one can expect improvements in market efficiency as result of competition among providers of services. The farmers also now have a wide choice of who to deal with.

Potential negative effects on smallholder farmers include failure to get food at cheap prices, and failure to meet the stringent conditions of some new players like the consortium of commercial banks. Also, lack of full information on the market and the risk of falling prey to middlemen. Phased out subsidies results in reduction in the agriculture developmental services previously provided free by the state enterprises; leads to loss of the guaranteed producer prices; and forces farmers to plan production decision in the absence of indicative pre-planting prices. The actual outcome in the short-run is the net of composite effect of changes in real farm prices and the consequent change in the provision of development services in the agriculture emanating from changes in real farm price.

Under conditions of recent economic liberalisation and Islamisation, institutional credit availability to smallholder farmers is likely to be constrained, which will make farmers subject to the exploitation of the informal lenders in terms of exorbitant interest rates and lenders' monopoly power. The agrarian credit market in Sudan has a dual character in the sense that formal and informal lending and borrowing are carried out simultaneously where the formal sector exists.

In the absence of institutional loans, farmers re-sort either to sharecropping or *shail* credit to meet their financial needs. The *shail* system is essentially a system of crop mortgage under

which the borrower sells in advance a certain part of the future crop in exchange for a loan from a village trader, a landlord, a relative or a friend. Sufficient knowledge about the borrower is prerequisite and hence there is no collateral.

Informal loans could be in cash or kind but repayment is usually in kind at lender-set prices that are significantly lower than harvest prices. In other words, although subject to negotiation, the lender has the upper hand in determining the amount of cash to be received by the borrower and the amount of future crop to be delivered. In this process the present (contract) price of the future crop is also specified. According to Saleem (1987), informal lenders enjoy monopoly power, and there is not risk sharing, as the borrower is obligated under all circumstances to honour the commitments. But it is not unusual for contract terms to be regenerated to allow cash or delayed repayment in which case additional interest may be charged (Elhirika *et. al.*, 1997).

Empirical research on informal borrowing has focused on its prevalence and exploitative nature in terms of exorbitant interest rates. For example, a study of 96 tenants in the Gezira scheme found that 80% having 2-8 hectares borrowed for sorghum, 45% for wheat and about 35% for groundnuts (Adam and Apaya, 1973). Saleem (1987) used quantitative information to calculate interest rate, found that the compounded monthly interest rate ranged from 172% to 201%. These studies argued that the absence of formal credit made it possible for village merchants and other money lenders to charge such high implicit rates of interest.

In sum, although there were many empirical studies have investigated the effects policy changes promoting commercialisation on crops production at both sectoral and economy-wide

levels, still there remains much room for empirical investigation of commercialisation impact on farm household food crop production, which has been neglected in previous research studies. Thus, whether commercialisation succeeds to promote food crop production at the farm household level, in the Sudanese context, still question open for discussion and empirical investigation. The critical consideration in assessing its impact on food crop production is its effectiveness in improving incentives for farm households.

CHAPTER THREE

LITERATURE REVIEW

3.1 The Concept of Commercialisation

Agricultural commercialisation may be defined as the proportion of agricultural production that is marketed. As such, commercialisation can be measured along a continuum from zero (total subsistence-oriented production) to unity (100% of production is sold). Commercialisation of agriculture involves a transition from subsistence-oriented to increasingly market-oriented patterns of production and input use. Economists have long advocated cash crop production as part of a broader strategy of comparative advantage. The underlying premise is that markets allow households to increase their incomes by producing that which provides the highest returns to land and labour. Then, use the cash to buy

household consumption items rather than be constrained to produce all the various goods that in the household needs to consume (Timmer 1997, Pingali 1997). While this concept of comparative advantage is well accepted under the assumption of well-functioning markets, the process of commercialisation involving non-food cash crops, risks and high costs will be impeded in the food marketing system. Food market failures give rise to the well-known, non-separability of household production and consumption decisions, which account for the potential breakdown of agricultural commercialisation strategies based on comparative advantage (Govere et. al., 1999).

The involvement of marketing firms in cash cropping programmes may be measured along a risk-support continuum. On one end of the continuum are firms that attempt to develop profitable opportunities with smallholder farmers while limiting their exposure to risks. These firms encourage delivery of smallholder products to the extent possible without incurring major expenditures in service support or credit that may not be recovered. Govere et. al. (1999), argue that while risks minimised, this approach generally generates small surpluses from participating farmers and hence has less potential to catalyse farm productivity growth. On the other side of the continuum are firms that pro-actively support input intensification of smallholder production in order to generate greater surpluses and throughput. Again they argue that this is often important to the firm in the presence of scale economies in processing (e. g., cotton ginning, sugarcane processing) and where fixed costs can be spread out over a greater volume of products handled. The most common approaches to pro-actively generate greater supply from farmers involve the distribution of credit, inputs, management and extension training. These up-front costs are recouped in principle by the firm at the time that farmers sell their product. In some cases, marketing firms explicitly try to also promote food

crop productivity even if they do not purchase these crops (e. g., in the case of Lonhro in Northern Mozambique), (Govere et. al., 1999). The firms' rationale for supporting food crops is based on the belief that their cash crop operations will be more sustainable and profitable over the long run if their participating farmers are more productive in their food crop enterprises. For example, if households are able to increase their food production per unit of land, they may devote a greater proportion of their land-holding to the cash crop required by the firm for the purpose of providing services, credit, ... etc.

A key common feature of the more sustainable (but not necessarily equitable) private-sector cash cropping schemes has been "interlocked transactions," or the tying of credit (usually in-kind) to the delivery of product at harvest (Strasberg 1998, Dorward, Kydd, and Poulton 1998). Provided that institutional arrangements are successfully designed to limit the incentives for farmers "side-market" to other buyers, marketing firms may find it possible to profitably extend credit, inputs, and other services to support food crop production as well as cash crop production, and recover the credit and associated costs upon the farmer's delivery of the crop. By contrast, in situation where the institutional arrangements between the farmer and buyer are not successful in limiting incentives for diversionary sales of the cash crop, the potential synergies or trade-off between cash crop cultivation and food crop productivity may breakdown (Govere et. al., 1999).

The key feature determining the ability to limit diversionary sales are both institutional and crop-specific. Food crops suffer some key disadvantages in this regard. Crops that smallholder farmers can process or store on the farm for long periods pose greater difficulties

and costs for firms to ensure delivery than perishable and industrially processed crops. Market structure (e. g., the number of potential buyers operating in the market) also influences the ability of marketing firms to ensure recovery of loans and services support, but these problems can be mitigated by co-operation and co-ordination between buyers. For example, sharing lists of farmers receiving loans from each firm, and agreeing not to buy products from farmers, who have received loans from other marketing firms. However, when the number of potential buyers becomes very large, as it does with staple commodities (as many households themselves are in the market to purchase these crops as well as traders), the potential of co-ordination among buyers breaks down, and credit recovery for up-front support services becomes extremely problematic. This may partially explain why staple food crops have seldom been featured in commercialisation programmes involving private marketing firms operating at the support end of the *risk/support continuum*.

While some crops are sold for cash, there is typically weak support from private marketing sectors to actively promote the productivity of these crops through credit, input, management advice, forward markets for sale of output, etc. In Kenya, for example, nation-wide households survey in eight diverse zones in 1997 and 1998 reveals that agricultural credit were almost exclusively allocated by cash crop marketing firms. Credit for food grain crops was only supplied by parastatal (Agricultural Finance Corporation) and even in this case eligibility is extremely restricted. Moreover, farmers' access to credit differed across regions even when they grew the same cash crop, reflecting differences in the marketing firms' ability to recover the credit through interlocking arrangements (Nyoro, Yamano, and Jayne, forthcoming). These observations underscores that certain types of commodity/market structure combinations are more likely than others to attract private investment of the type

that can catalyse smallholder crop productivity and in some cases the productivity of other farm activities.

3.2 The Trade-offs between Cash Crop and Food Crop Productivity

The case for cash cropping has generally been based on the direct contribution that these crops can have on farm incomes. A relatively neglected avenue of research concerns the effects that cash cropping can have on the productivity of other household activities. The following sections examine one of the potential pathways by which cash cropping may affect the productivity of other crops

Household level trade-offs between food and cash crops production occur when the household's participation in a commercialised crop scheme enables it to acquire resources not otherwise available for use on other enterprises in the crop mix (Govere et. al., 1999). There are several pathways of this type. First, under conditions of constrained access to farm credit, households' ability to intensify food crop production may depend on their participation in cash crop programmes. Credit market failures are commonly cited as a feature of rural agricultural economies (Binswanger and McIntire 1987; Adams 1988; Platteau 1991; Bolnick 1992; Goetz 1993; Dorward, Kydd, and Poulton 1998).

Scarcity of credit for food crop production has especially dried up after the demise of the state-led interlocked credit-input-output marketing systems. Credit market failures may create non-separabilities between input use decisions on food crops and participation in commercialisation programmes (Govere et. al., 1999). Strasberg (1998), for example, found

that under credit and input market failures in Northern Mozambique, participation in cotton out-grower schemes was the primary means of acquiring cash inputs for use on food crop production. In parts of Western Kenya, smallholders engaged in sugarcane out-grower schemes to obtain access to credit, input, extension services, and equipment for use not only on sugarcane but also on food crops.

Some cash crop marketing companies have stated an objective of explicit support of out-grower farmers' food production, based on the premise that this would raise smallholders' ability to participate in the scheme in a sustainable way, which would in turn provide longer term benefits to the company (Strasberg, 1998).

In Zimbabwe, in the wake of the state credit systems' demise, private cotton marketing firms began administering in areas suitable for cotton a credit line for inputs and equipment for cotton producers perceived as having low risk of credit default. The equipment package includes ploughs, which also can be used in maize production. While the inputs are obtained through a cotton-based credit line, farmers' use of the equipment is spread out to food crops in order to improve profitability. Without cotton production, these farmers would not have access to the credit that assists in capitalising the farm. These examples underscore the potential non-separability between production technologies used in food crop production and the decision to grow selected cash crop and participate in associated marketing schemes.

Investment by marketing firms to promote cash crop production may also raise the productivity of existing household resource devoted to food crop productivity. Private sector marketing firms have found it in their interests to contribute to training of farmers who grow

cash crops. In Zimbabwe, the Department of Agricultural and Technical Services (AGRITEX) co-operates with private fertiliser and pesticide manufacturing firms in training farmers at the Cotton Training Institute (Mariga, 1994). One important part of the training programme focuses on pest scouting. Farmers get extensive training in determining the critical stages of economic injury to a cotton stand. Margia (1994) argues that cotton instils discipline in farmers because of its stringent husbandry requirements. Such knowledge improves not only cotton management skills but improves the overall quality of farm husbandry. Farmers trained in cotton pest scouting are likely to be in a better position to determine the stage at which a maize stalk-borer or grain weevil causes economic injury. Hence, investments in human capital represent another household-level pathway by which participation in a cash crop programme may promote food crop productivity.

Thirdly, the promotion of high-return enterprises may improve households' ability to invest in lumpy assets such as livestock. In Malawi, 70% of the farmers surveyed by Dione (1989) perceived cotton production and usage of fertiliser as the two most important conditions determining the profitability of animal traction adoption. According to Barret et. al. (1982) market conditions for cash crops affect farmers' capacity and decision to invest in draft animals and equipment. By contrast, the commonly witnessed volatility of domestic staple food markets makes investment in animal traction and fertiliser risky unless these inputs are also targeted for use on other crops that raise the expected returns and stability of returns of the overall farm activity. For example, in some areas food crops may be cash crops and play a dynamic role in agricultural commercialisation.

3.3 Empirical Studies

Studies from a range of African countries also demonstrate potential synergies or trade-offs between cash crop investment and food crop production. These studies found that the presence of commercially viable cash crops such as cotton and groundnuts had positive spillover benefits for smallholder food production in selected regions. These spillover benefits include increased adoption of fertiliser on food crops made possible by cash crop input delivery channels. And increased availability of farm credit through cash crop schemes with which to hire additional labour and finance investments in productive assets such as draft oxen and traction equipment. These studies raise the possibility that the promotion of cash crop production may, if suitably implemented, have important positive spillover effects on food crop intensification and productivity (Strasberg et. al., 1999).

Strasberg et. al. (1999), found crop commercialisation is not uniformly correlated with land-holding or .area cultivated among the households surveyed on some Kenyan regions. Also they find that household agricultural commercialisation, generally has a significant and positive effects on fertiliser use and productivity of food crop. Their results indicate that a 10 percent increase in the household commercialisation index (HCI) from the mean level of 39 percent would, on average, result in an additional 8 kg/acre of fertiliser used on food crops and an additional 670 Ksh/acre boost in food crop productivity (a 7 percent increase at the mean). A finding by Strasberg et. al., (1999), is that the meaningful payoff to formal education in terms of food crop productivity, fertiliser use was also found to be positively associated with education.

In Mozambique, farmers engaging in high-input cotton schemes had higher levels of food productivity (more inputs available for food production) than households who were on low-input cotton schemes (Strasberg et. al., 1998). This is due to application of herbicides and fertilisers in Montepuez in addition to using improved seeds and insecticides, which was common in all schemes.

In Zimbabwe, Govereh et. al., (1999) find that the relationship between commercialisation and grain crop productivity was both direct and indirect, as commercialisation was found to also contribute to farm capitalisation which in turn contributed to both absolute grain production and grain crop yields.

Govereh et. al. (1999), in cross-country study also found that the intensity of commercialisation among the Zimbabwe sample was significantly affected by the number of years the household head had spent in school. Education, however, only weakly related to food crop productivity in Mozambique and Zimbabwe. In Zimbabwe, the evidence indicated weak support for the hypothesis that investment in human capital emerging from cotton training programmes had a positive spillover effect on food crop productivity.

It is well known that high-value cash crops represent one potential avenue of crop intensification. Evidence from other parts of Africa shows that processes of agricultural intensification and productivity growth are often driven by cash crops with reliable markets and predictable returns (von Braun and Kennedy 1994; Kelly et al, 1995).

In brief, all the literature we reviewed here supported that intensification of cash cropping promotes food crop production, under suitable implementation, at the farm household level providing that many evidence from different African countries were mentioned above.

However, whether commercialisation through cash crop intensification has positive impact on food crop production at the household level, considering the Sudan case, it is a research area to be investigated.

CHAPTER FOUR

DATA COLLECTION AND ANALYSIS

4.1 The Study Area, Sampling Technique, and Data Sources

4.1.3 The Study Area

North Kordofan State is administratively divided into five provinces; those are Sodari, Jabrat El-Sheik, Bara, Sheikan and Um Rawaba (Figures 4.1 & 4.2 in Appendix I). Each province is divided into local councils, each local council is divided into village councils and each village council has satellite villages. The total population of the state according to the 1993 census is

1,327,066 of which 76% (1,011,292) are rural. The population is ethnically diverse, including Arab and Arabised tribes in the northern part and Nuba tribes with a mixture of Arab tribes in the Southern part. ((Elamin, 1998). Sheikan province's total population according to the 1993 census is 546 826, or about 40% of the total State population. Sheikan province is located within a climatic zone that allows rain-fed agriculture (both cash and subsistence cropping), and is ecologically was uniform (homogenous), (Dunston et. al. 1997, Eldukheri, 1997 and Elfeil, 1993).

4.1.1 Sampling Technique

Multistage random sampling technique was employed for the study. Sheikan province has got four rural councils (see Figure 2 in Appendix I) namely are Kazgel (RC₁), Abu Haraz (RC₂), Um Asheira (RC₃), and Khor Tagat (RC₄). These four RCs are geographically located in the south, west, north, and east, of the Capital of Northern Kordofan State. These four rural councils (RCs) were selected for the household survey. Within each of the four rural councils, 10% of the villages were selected randomly. And from each selected village, 5% of household members were selected randomly. The total sample size of the surveyed farm household is thus 100. Table (4.1) shows the distribution of the surveyed sample households.

4.1.2 Data Sources

For this study a cross-sectional primary data collected using a structural questionnaire administrated to the farm households, and secondary data were used. The data collected included socio-economic parameters such as age, family size, family expenditure, farm size, education, off-farm and farm income, and livestock ownership. Crop output for millet, sorghum, cowpea, sesame, groundnut, and crop areas and sold amounts of each crop as well as purchased amounts of food crops were collected. Also data on labour, pesticides inputs were collected. In addition to primary and secondary data collection direct observations were also conducted by the observing the conditions in the study area.

Table (4.1): Sample Distribution.

	Rural Council	No. Of Village	Surveyed Village	Total Number of Households	Sample Size
Sheikan Province	Kazgel	30	Um Katera	300	15
			El Numeir	200	10
			El Shegla	200	10
	Abu Haraz	25	Um Ramad	250	13
			Abu Haraz	300	15
	Um Aheira	10	Um Asheira	340	17
	Khor Tagat	20	Banat	200	10
			Zngaha	200	10
Total	4	75	8	1990	100

4.2 Descriptive Statistics Analysis

4.2.1 Social Characteristics of Households

Production, consumption pattern and decision-making are partially affected by size, sex and age of household members. The social structure of household is regarded as an important factor that influences the household's contribution to farming activities. Regarding the farm household characteristics in this study, the average household was found to be 7.3 persons. This number typically included a husband, a wife, four children, and one relative. More than half of the households (57%) has a medium size of 6-10 members.

Of the 740 people included in the study households, 51.2% are male and 48.8 percent are females. Also, of the 100 household covered by the sample, 71 per cent were male-headed, and 29 per cent were female-headed households. Household members age distribution is summarised in Table 4.2. The majority of the sample members are young to middle-aged (15-45 years), 58% of the sample are middle-aged who are usually active labour force in farming. Considering household head age distribution, household age averaged 48.94 years. Again, most of the household heads (85%) are within the productive age (20-60 years) and only 15% of household heads are above 60 years (Table 4.3).

Table (4.2): Age Distribution of Sample Population

Age Category	No. of Observations	% of Distribution
No age reported	08.00	1.10
<5	88.00	11.9
5-10	109.00	14.7
11-15	197.00	26.60

16-45	232.00	31.40
46-60	65.00	8.8
>61	41.00	5.5
Total	740.00	100

Source: Field survey, 2001/02

Table (4.3): Age Distribution of Household Head

Age Category	No. of Households
20-30	11
31-40	16
41-50	22
51-60	36
>60	15
Total	100

Source: Field survey, 2001/02

4.2.2 Households Education and Institutional Services

In fact one of the major production constraints in the developing countries was found to be lack of knowledge about the importance of certain modern inputs which was assumed to be due to lack of extension services and farmer education programmes in general (Ruttan, 1988). Table 4.4 summarises levels and types of education in the sample and of household heads. Illiteracy rate is higher among household members than household heads. Half of household members (50%) in the entire sample did not get any type of education, whereas 48% of household heads were illiterate. In the entire sample population only 5% were educated until intermediate level, and the level of education accounted at 11% for household heads.

Table (4.4): Distribution of Sample Population and Household Heads by Level and Type of Education

Type Of Education	Sample		Household Heads
	Number Of Observations	% of Distribution	Number of Household
Intermediate (secondary)	37	05.00	11
Primary	178	24.10	23
Informal	155	20.90	18
No-education	370	50.00	48
Total	740	100.0	100

Source: Field survey, 2001/02

Also, credit and extension services are considered to have an important role to play in rural development. Binswanger (1989), as many researchers, argue, depends among other things on the availability of funds to make new production inputs and technology accessible to farmers.

Data on credit accessibility and extension services collected in a yes/no format. Of the 100 households covered by the survey, only 21 percent got credit from the Agricultural Bank of Sudan, which is too small percentage (Table 4.5). With respect to extension services, 11.7 percent of households received extension services; again it is also very small percentage (Table 4.5).

Table (4.5): Access to Credit and Extension Services

RURAL COUNCIL	SERVICES			
	Credit		Extension	
	Number of Household	% of Household	Number of Household	% of Household
Kazgel (RC ₁)	13	37.1	8	24.2
Abu Haraz (RC ₂)	6	21.4	0	0
Um Asheira (RC ₃)	1	5.9	3	17.6
Khor Tagat (RC ₄)	4	20	1	1
TOTAL	24	24	12	12

Source: Field survey, 2001/02

4.2.3 Labour Contribution of Household

Contributions of household members to crop and activities are summarised in Table (4.6). Labour contribution data were collected in a yes/no format, which indicates labour division within the household. In crop production, 80 percent of husbands and 82 percent of wives contribute to ‘crop activities’. Only seventeen percent of husbands and 16 percent of wives contributed to neither agricultural nor animal herding work. Children also contribute labour to agricultural production, 37 percent of households reported that (at least some of) their

children performed ‘crop activities’. With respect to hired labour, 74 percent of households reported that most hired labour needed for animal herding and 26 percent for crop activities.

Table (4.6): Contribution of Household Members to Cropping and Livestock Herding.

Household members	% CONTRIBUTING TO		No Participation
	Crop Activities	Stock Herding	
Husband	80	3	17
Wife	82	2	16
Child	37	3.5	59.6
Relative	48	4	48
HH Employee	26	74	-

Source: Field survey, 2001/02

Farmer family is the main source of labour supply for various farm operations. Hired labour, if needed, is used in cases of seasonal bottleneck. Labour supplied by household averaged 5.0 adult persons. More than half of households (76%) provided 3 to 5 adult equivalent of labour force (Table 4.7).

Table (4.7): Labour Supplied by Farm Households.

No. of Adult Equivalent	Number of households
1-2	22
3-5	76
>5	2.0
Total	100

Source: Field survey, 2001/02

4.2.4. Land Ownership and Accessibility

There are five principal means of ownership rights in land: inheritance, *Zakat* (Islamic Social Welfare), grants (allocated by the village leaders), land renting, and land purchases. As Table 4.8 shows, the most important way is through inheritance, reported by 56% households. This followed by land grants (12%), rent (10%), *Zakat* (6%) and purchase (2%). Average land ownership of surveyed households is 11.1 hectares (Table 4.9 and Figure 4.7). The average size of land holdings varies from rural council to another. For example, a household in RC₁ (Kazgel) owns, on average, 16.7 hectares, RC₂ (Abu Haraz) owns 13.6 hectares, RC₃ (Um

Asheira) owns 10.3hectares, and in RC₄ (Khor Tagat) 7.3 hectares. The variation in land size among the rural councils is due to variability in population density. Land-less households usually include war displaced, drought displaced, migrant, and resettled nomads.

Table (4.8): Distribution of Households by Type of Access to Land

Primary Means of Land Acquiring Access	No. of Households
Inheritance	56
Grants	12
Zakat	06
Rent	10
Purchase	02
Others + Land-less	14
Total	100

Source: Field survey, 2001/02

Households typically own land for many years. Some 36% have had their land for less than 10 years and more than 50% of households have owned their land for more than 10 years. There are many ways to establish access to land. In addition to farmland, households also have access to use communal land for various purposes. The most common uses of community land are collection of firewood, burning charcoal and animal grazing. Communal land use is reported by 35% of the surveyed households.

Table (4.9): Land Distribution in Hectares

Land size (ha.)	No. of Households
2.1-6.7	33
6.8-11.4	28
11.5-16.1	17
16.2-20.8	07
>20.8	15
Total	100

Source: Field Survey, 2001/02

4.2.4 Livestock Ownership

Livestock serves as a means of “savings” for households throughout Northern Kordofan State, more specifically for farm households of the present study. This consistent with newly acquired animals, especially goats and sheep. During hard times, goats will be the last assets to be sold off, sheep are more likely to be fattened and sold at market earlier. As a result, most families seemed to prefer animals as investments improving chances for economic security that had the additional advantage of providing nutritional benefits (milk and meat) while held.

Table (4.10): Ownership of Animal Heads per Household.

Type of Animal	Number of Animal	The Average	Number of Household
Camel	7	1.4 (0.548)	5
Sheep	254	13.4 (7.033)	19
Goat	233	4.2 (3.085)	55
Cattle	38	9.5 (6.351)	4

Source: Field survey, 2001/02

Note: (.) Standard Deviation in parentheses

Table 4.10 summarises ownership of livestock per household. Fifty-five percent of the entire sample reported own goats, 19 percent sheep, 5 percent camel and 4 percent cattle. The average household owns 13 heads of sheep, 9 heads of cattle, 4 heads of goats and only one camel. This shows the relative importance of goats and sheep to the farm households in the area of study. The distribution of sheep and cattle is deviated from the mean by 7.033 and 6.351, respectively. The minimum number of sheep and cattle heads owned by a household is

4 and the maximum number of sheep is 25 heads, whereas the maximum number of cattle owned by a household is 15 heads.

4.2.5 Key Characteristics of Sheikan Province Farming System

The province's farming system provide the context for analysing production key characteristics:

- All households in the sample use hoe cultivation. No animal traction or other form of cultivation is reported among the sample population. Hoe cultivation has implications for family labour requirement and total area that could be put under cultivation. This could be attributed to the sandy nature of the soil in Sheikan province.
- Crop rotation is practised by 62% of sample households; an important way to improve yields and controls pests. 40% of those who rotate alternate crops every two years; 13% every three years and 9% alternate crops in more than three years.
- More than 57% of respondents make extensive use of inter-cropping. According to the respondents, reasons are to increase soil fertility, to increase crop production, and to diversify risk.
- 27% of survey respondents reported hiring seasonal farm labour. This is particularly true with farm household own large plots of land. Farm labourers do land clearing, planting, weeding and harvesting. Farm labour is hired either on a daily rate or on a piecework basis. Payments vary according to type of work performed and are made in either cash or kind.
- No one in the sample reported using fertiliser, because of the soil texture – sand soil –, as fertiliser use is not recommended on sandy soil. However, 58% of the respondents reported purchasing seeds during the planting season. The sources of seed included

households' own stock; Ministry of Agriculture (MoA), NGOs (CARE and Save the Children Fund USA); Agricultural Bank of Sudan (ABS) and markets.

- Use of pesticides was reported by 52% of respondents. The main sources of pesticides (DDT & UL.V) are markets and MoA.

4.2.6 Significance of Cereal and Cash Crops

Four key factors determine the significance of agricultural production in surveyed area to household livelihood. These are 1) the number of households involved in crop production, 2) types of crops grown, 3) area cultivated, and 4) quantity produced. Food crops such as millet and sorghum are the main staple food crops widely grown in the area of the study. For example, 96% of households produce millet and 90% of households in the area of the study grow sorghum. Cash crops such as groundnut and sesame are important to household economies. For example, 96% of households in surveyed sample grow groundnut and 93% grow sesame. The extent of food and cash crop production varies by season.

As table 4.11 shows, millet and sorghum are the two most widely grown food crops in all the four rural councils in Sheikan province. 88.6% of the households in RC₁, and all households in RC₂, RC₃, and RC₄ cultivate millet. Significant proportion of households in the four rural councils also grew sorghum. Groundnut, the main cash crop, is grown by 82.2% of sample households in RC₁, all households in RC₂, 94.1% in RC₃, and 95% in RC₄. Similarly, cultivation of sesame is reported by 96.8% of sample households in RC₁, all households in RC₂, 94.1% in RC₃, and 95% in RC₄.

In general, sorghum cultivation commands the largest land, on average, 4.1 hectares per household. The rationale to putting a major proportion of land resources under sorghum cultivation is to diversify risk, also sorghum is one of the major staple food crops, and because millet productivity declined in the last ten years (Dunston et. al., 1997). The second largest land area, in the surveyed household sample is used for groundnut cultivation. The economic benefits of putting such proportion of land resource under groundnut cultivation are good; groundnut is one of the highest value cash crops for the area. Millet also occupies an important land area among the surveyed respondents in all rural councils, on average, 2.3 hectares per household. Another cash crop, sesame, cultivated on an average area of 1.5 hectare. This shows that the households attempt to balance food crops and cash crops production. In the all surveyed area, groundnut has the highest yield of 188 kg/hectare (=4.2 sacks)¹, (Table 4.11). A large amount of sorghum yield is also reported for all rural councils, 117.3 kg/hectare (= 1.3 sack). Millet also reported to have a yield of about 94.2 kg/hectare, on average, over all the rural councils. Other cash crop, sesame, was reported to have lowest yield compared to groundnut, which was around 88.4 kg/hectare, on average, in the surveyed rural councils.

All four rural councils had different levels of millet productivity, which ranged from 50.5 kg/hectare to 104.1 kg/hectare per household. For groundnut, the level of productivity ranged from 100.4 kg/hectare to 313.4 kg/hectare. Productivity of crops depends on several factors including moisture distribution, pests and farm management practices. The average household produces 1560.6 kg of all cereal. However, low yields of different crops in surveyed area could be attributed to that farmers tend to fallow a mono-cropping pattern; inorganic fertiliser

¹ 1 sack of groundnut or sesame = 45 kg and 1 sack of sorghum or millet = 90 kg

was not applied for various reasons. Also, agriculture is practised on low rainfall areas below 300 mm. of rain. All these have led to low yields.

Table 4.11

4.2.8 Crop Marketing

Market centres at which farmers sell their produce determine competitive product price and thus the income derived from crop sales. Many farmers (38%) reported selling their produce at village markets; 20% at RC markets, and 19% at town market such as provincial centres. Table 4.12 summarises the sold crops in different rural councils. On average the sold amount of groundnut was 616.2 kgs (= 13.7 sacks), 64.5 kgs (= 1.4 sacks) of sesame, 23.6 kgs (= 0.3 sack) of sorghum and 8 kgs (= 0.09) of millet. Thus, to generate crop income, households mostly depend on groundnut sales. The cash value gained from crop marketing varies from rural council to other. Generally, households' revenue from crop sales ranged from 2,267.08 SDD (US\$ 8.90) to 4,689.73 SDD (US\$ 18.30).

4.2.9 Farm Production and Marketing Relative to Consumption

To analysis household consumption it is necessary to consider three major factors: 1) farm production, 2) market purchases, and 3) the over-all ability of households to satisfy consumption needs. It is also worthwhile to consider households' comparative advantages gained by exchanging value cash crops for the cheapest grain staples.

Table 4.12

The survey examined staple grain purchases for household consumption. Households in RC₃, purchased an average of 382.4 kg per household. RC₄, household purchases averaged at 368.0 kg. RC₁, household purchased an average of 285.0 kg. And RC₂, households purchased an average of 250.0 kg. As a result, households fill the food gap by purchasing grains from market. Household capacity to meet consumption needs from their own grain stocks, even after following a good year, declines sharply between January and June (Dunston et. al., 1997).

4.3 Characteristics of Commercialised Households

Groundnut commercialisation index is defined as the value of groundnut sales divided by value of total crop production. Table 4.13 shows the farm household's characteristics categorised by groundnut commercialisation index. On average, the groundnut

commercialisation index is about 18.08% for the entire sample, with standard deviation of 18.29, minimum value of 0.88% and maximum value of 84.45%.

The first group of farm households with commercialisation index of (1%-30%) has smallest crop income (11,428.25 SD/ha.), and produced highest total grain output (37,560.36 kg), compared to other two groups. This group appears to be more subsistent than the other two groups. In contrast, this first group's total revenue derived from livestock is closed to the total average (31,240.26 SD), higher than of the third group (5,250 SD) and smaller than of the second group (74,342.11 SD). The percentage of female-headed households is the highest in the first group (20%), i. e., it is related with subsistence production rather than commercialised one.

The statistics results in Table 4.13 indicate that the relationship between cash crop and food crop production is neither competitive nor complementary. In the first group, which has got about 77% of the entire sample of households, farmers devoted greater proportion of land for groundnut cultivation, but also achieve higher grain output. This is resulted from the positive relationship between food crops production and land holding size. Considering that per capita cereal consumption requirements are approximately 20 kg of cereal equivalence per month, households the commercialisation index range of (1%-30%) secured about 48.8% (37,560.36 kg) of their grain consumption needs although they sold about 22.1% of their grain production. The households in the second range of commercialisation produced on average only about 19.9% (18,665.08 kg) of their cereal consumption needs and they sold about 10% of their grain output. Households in the third group of commercialisation secured only about 9.5% (12,432.30 kg) of their cereal consumption needs. Although the third group has the smallest grain self-sufficiency ratio, it produced on average 978.8 kg of groundnut therefore has received the highest total crop revenue (520,850.0 SD) and the lowest total livestock revenue (5,250.0 SD).

Household heads in the first and second group had, on average, more than two years in school; whereas household heads in the third group (the most commercialised group) have only one year. Table 4.13 also indicate that household's groundnut commercialisation index is related with the use of improved seeds. Farmers in the first group of commercialisation index range of (1%-30%), used the lowest value of improved seed or 2,626.20 SD/ha, compared to 6,898.93 SD/ha and 4,388.99 SD/ha for the second and third groups, respectively.

Land allocation appears positively related to food crop production and negatively to the commercialisation index. On average, 6.4 hectares were allocated for food crop production whereas only 2.0 hectares for groundnut cultivation. The higher the commercialisation index is the less land is allocated for cash crop cultivation. Again the more commercialised farmer considers the productivity of production input. In the entire sample, no farm household tended to have relatively large part of his land under fallow.

Credit accessibility percentage was highest for the more commercialised group, namely the third group with 50% credit accessibility percentage, compared to 34% and 32% for the first and second group, respectively. Credit accessibility is not significant in the case of more commercialised farmers food crop production, because of their small size, but is significant in case of less commercialised farmers food crop production and had a positive relationship.

Table 4.13 indicates that household groundnut commercialisation index appears to be associated with accessibility to all weather roads and shorter distance to markets. The more subsistent group, (1%-30%), had a lowest percentage of accessibility to all weather roads, whereas the other two groups had 53% and 50%, respectively. The more commercialised farmers in the third group have slightly shortest distance (49.25 km) compared to the second group (54.86 km), and the first group (68.00km).

Table (4.13): Characteristics of commercialised farm households

Characteristics	Groundnut Commercialisation Index (%) ⁶			
	(1%-30%)	(31%-60%)	(>60%)	Total
	77	19	4	Average
% of the Household				
Grain Output (kg)	37560.36	18665.08	12432.30	22885.91
Grain Yield (kg/hectare)	5443.53	3393.65	1828.28	3555.15
Grain Output (kg/capita)	116.97	47.82	22.78	62.52
Groundnut Output (kg)	149.50	367.90	978.80	498.73
Groundnut Yield (kg/hectare)	52.46	217.69	699.14	323.10
Average Crop Revenue per hectare	11428.25	13572.22	47350.00	24116.82
Per Capita crop Revenue	6196.25	361.21	4804.55	3787.34
Grain self-sufficiency (%)	48.80	19.90	9.50	26.07
Grain selling household (%)	22.00	10.00	0.00	10.70
Value of Household groundnut sales (SD)	4371.10	19873.68	30375.00	18206.60
Land size (ha.)	11.41	8.73	12.60	10.90
Fallow area (ha.)	0.40	0.10	0.30	0.30
Cereal area (ha.)	6.90	5.50	6.80	6.40
Groundnut area (ha.)	2.85	1.69	1.40	2.00
Family size (No.)	7.20	7.11	11.00	8.4
Total crop income (SD)	44613.00	2568.21	520850.0	189343.73
Total livestock income (SD)	31240.26	74342.11	5250.00	36944.12
Total off-farm work income (SD)	13555.32	126.32	22500.00	12060.55
Improved seed used (SD/ha)	2636.02	6898.93	4388.99	4641.31
Pesticides used (SD/ha)	380.58	662.63	34.84	359.35
Adult labour per hectare (No.)	0.60	0.90	0.80	0.80

⁶ Groundnut commercialisation defined as value of groundnut sales divided by value of total crop production.

Credit accessibility (%)	34.00	32.00	50.00	38.67
% of Female headed Households	20.00	2.33	0.00	7.44
Household head years in school (No)	2.60	2.70	1.00	2.10
Distance to nearest market (km)	68.00	54.86	49.25	57.40
Accessibility to all weather roads (%)	39.00	53.00	50.00	47.30

CHAPTER FIVE

ECONOMETRIC MODELS, RESULTS AND DISCUSSION

5.1 Econometric Models

The conceptual framework in chapter four argues that the intensity of cash crop production may influence the productivity of other crops in a farmer's activities. This chapter develops a model for measuring (1) the impact of factors influencing the commercialisation decision of the farm households, and (2) the impact of commercialisation on the farm households' food crop production.

Given our hypothesis that farm household's grain crop production may be promoted by its involvement in groundnut production. We developed an indicator of groundnut commercialisation to measure this relationship. We define the index of household groundnut commercialisation as the value of groundnut sales over total value of crop production for household i , this index is neutral with respect to farm production and measures the household's involvement in groundnut relative to its total farm output.

OLS estimation was used to identify factors those influence the commercialisation decision of the farm households. We then used two-stage least square estimation (2SLS) to determine the effects of groundnut commercialisation on farm household's food crops production.

The two equations below represent the theoretical framework of the determinants of commercialisation decision and their effects on food crops productivity. The farm household groundnut commercialisation index function is given by;

$$1. C_i = \alpha_0 + \alpha_1 X_i + \alpha_2 A_i + e_i \quad (i = 1, \dots, 100 \text{ households})$$

and the conditional productivity function is:

$$2. Y_i = \beta_0 + \beta_1 X_i + \beta C_i + v_i$$

Where,

Y_i is the gross value of food output in Sudanese Dinar.

X_i is a vector of exogenous household variables;

C_i is the groundnut commercialisation index, an endogenous variable;

A_i is a vector of instrumental variables used to predict C_i ; and

e_i and v_i are residual terms.

The choice of the exogenous variables in equation (1) and (2) was driven by hypothesis that these variables are strongly related to both farm household groundnut commercialisation decision and food crop production. All variables were used in both equations and the gender and distance to market were only used in equation (1) as exogenous and as instrumental variables in equation (2).

Two variables were chosen as instrumental variables: distance to nearest market, and a categorical variable specifies the gender of the household. The distance to the nearest market, which measured in kilometres, determines the level of transaction costs farmers may incur when marketing the surplus or purchasing inputs. In Kenya, Omano (1998) observed the effect of transport costs on cotton production to be enormous. Due to the labour-intensive nature of groundnut production, we expected female-headed households to participate less in groundnut production given more severe time pressures than male-headed households with at least two adults. Evidence from other countries presented by von Braun (1994) also indicated that female managers are less involved in cash crop production but play a more significant role in food crop production. We expected the gender (= 1 if female) effect to be significant in food crop productivity.

Factors like family size (number of adult equivalent) and land holding sizes (measured in hectares) are considered having influence on farm household production decisions. Family size, as one of the important factors provided mainly by the farmer's family in the area of study, is expected to have positive effect on farm household groundnut commercialisation but it is an ambiguous with respect to food crop production. Land holding size, which is considered as one of the vital factors in the production process, is expected to have positive relation with both groundnut commercialisation and food crop production.

Also, education is considered as one of the important aspects in human resource development. Schooling helps farmers to use production information efficiently, as a more educated person acquires more production action and so it is a better producer. Therefore, this study using number of years invested by farm household in schooling as an indication of education and is expected to have positively relationship with groundnut commercialisation, but it is an ambiguous in case of food crop production.

Proportion of total crop income was used to show the dependency ratio of farm households on income derived from crop sales. It expected to be positively correlated to both groundnut commercialisation and food crop production. With respect to farm household income that generated from livestock sales, is expected to contribute positively to commercialisation of groundnut as well as to food crop production.

Institutional services like credit and extension are expected to play a role in farmer's crop pattern decision. Credit accessibility (= 1 if credit accessed by a farmer), credit is a major

production factor of production. Hag Elamin (1997) suggested that without the provision of adequate credit agricultural supply response to increased price incentives will be minimal. It is expected to positively associate with both groundnut commercialisation and food crop production at the farm household level, as long as farmer can get access to credit only through involving in groundnut cultivation. Extension training is a good way to educate farmers in how to use their resources efficiently and to make effective transfer of production technology to farmers. Extension service (= 1 if provided to a farmer) is expected to have positive effect on both groundnut commercialisation and food crop production at the household level.

The other important inputs are improved seeds and pesticides. Improved seeds variable measured as total value of the total used amount in Sudanese Dinars (1 US \$ = 250 SD), is expected to have positive relation with groundnut commercialisation but it is unknown with respect to food crop production. That is because usually farmers use their own seed actively selecting for desirable qualities. Regarding pesticides factor, also it measured as total value of the total used amount in Sudanese Dinars. It is expected to have a direct relation with groundnut commercialisation, and negatively related to food crop production because of its insignificant amount that farmers used in food crop production.

In terms of technology use, we considered crop rotation practice effect (= 1 if a farmer adopted crop rotation). Rotation patterns have a direct effect on crop production and soil quality (Kevane, 1993). It is expected positively related to both farm household groundnut commercialisation and food crop production.

The computer packages that area used to enter and estimate the data are the Statistical Packages for Social Sciences (SPSS) and STATA. Definition of the specific exogenous, endogenous and instrumental variables and their expected signs are given in the Table (5.1), below:

Table (5.1): The Anticipated Signs and Measures of the Variables Included in Models.

	Groundnut Commercialisation Index (C_i)	Food crop productivity (Y_i)

Exogenous Variables (X_i)

Adult equivalents (number)	+	±
Land holding (hectare)	+	+
Proportion of crop income	+	+
Total livestock income (SD)	+	+
Total groundnut improved seed value (SD)	+	±
Total pesticides value (SD)	+	–
Credit accessibility (= 1 if received)	+	+
Extension service (= 1 if received)	+	+
Crop rotation (= 1 if practised)	+	+
Household head years in school (yrs)	+	±
<i>Endogenous Variables (C_i)</i>		
Groundnut Commercialisation		+
Index (%)		
<i>Instrumental variables (A_i)</i>		
Distance of market (km.)	–	
Gender (= 1 if female)	–	

5.2 Determinants of commercialisation

The empirical results of commercialisation model in Table 5.2 show that there demographic, household and technological factors were important determinants of household-level groundnut commercialisation. Livestock is an important source of household income to meet food and other household necessities. The household revenue from livestock sales had significant but negative influence on the commercialisation index ($p=0.01$). An additional Sudanese Dinar in income derived from livestock was associated with 0.41% decrease in the groundnut commercialisation index, at the mean value. It appears that household with higher livestock income, rely more on livestock as a source of investment and cash income than on groundnut production.

Extension training had a positive and significant impact on farm household's groundnut commercialisation index at 0.01 level of significance. An additional percentage in extension training was related with 0.33% increase in the household groundnut commercialisation index, on the mean. Extension training seeks to be successful in educating farmers about how to use their resources efficiently and to make effective transfer of production technology. Hence, the policy implication is that as there remain a room for improvement on both, much more emphasis must be placed on the development of stronger research-extension linkages and more direct participation of extension staff in the technology generating process.

As expected the effect of distance to market was significant at the 0.05 level. Groundnut commercialisation increased by 2.1% for every 10-kilometre reduction in the distance between the farm and the city centre market. In Kenya, Omano (1998) observed the

Table 5.2

effect of transport costs on cotton production to be enormous. Distance to market is a good indicator of transaction costs. This implies that policy to reduce transaction costs such as market development promote commercialisation and construction of roads to increase the accessibility of smallholder producers to markets during hard environment conditions.

Rotation patterns have a direct effect on crop production. Empirically, the results show that there was positive and significant relationship between crop rotation and household groundnut commercialisation index at 0.05 level of significance. An additional percentage increase in rotation practice associated with 0.22% increase in groundnut commercialisation index, on average.

The empirical results also show that improved seed use was positively related to household commercialisation index and it was significant at 5% level. An additional 10 Sudanese Dinars spent on improved seed use in a hectare of land were associated with 1.9% increase in household groundnut commercialisation index. The use of improved seed reduces the unit cost of production by increasing the productivity of land, and increases returns to labour (the major production input provided by a farm household).

The econometric results suggest that the number of years of schooling of the household head be negatively related to groundnut commercialisation index. Controlling for the effects of other factors an additional year invested in education was associated with 0.22% decrease in the household groundnut commercialisation index. Most fundamentally, development requires change in the attitudes and action of individuals. This suggests that the more educated heads of household are utilising other opportunities such as investment in livestock.

Gender variable was also found to be important. This appears from the negative association of female-headed household and groundnut commercialisation. Female-headed households pay less attention to groundnut (commercialisation) production. The policy implication here that policy to consider female-headed to promote commercialisation.

Family size (adult equivalence) had a positive and significant impact on commercialisation index at 10% level. An additional adult equivalence was related with (approximately) 0.2% increase in groundnut commercialisation index. This reflects labour intensity in groundnut production.

Although the relationship between farm size and household groundnut commercialisation index was insignificant, but farm size has got a negative impact on commercialisation of groundnut at the household-level, which was not expected. The insignificant impact of farm size supports other findings from cross-countries study by Govereh, Jayne and Nyoro (1999) in Eastern and Southern Africa.

The results show some other variables were not significant. Although credit accessibility had the expected impact on household commercialisation index, was not significant in the present case of study. Pesticides use was expected to have a significant impact on household commercialisation index, in spite of positive direction of the relationship, but was not significant. The ratio of total income derived from crop sales was positively related to household commercialisation index. These results may show the traditional pattern of production in the area of the study. The adjusted R-square for the commercialisation model was about 25.7% indicating a good fit given the cross-sectional nature of data used here.

5.3 Impact of Commercialisation on Household Food Crop Production

Results in Table 5.2 highlight the complementary relationship between groundnut commercialisation index and food production at the household level. Each additional percentage increase in the commercialisation index was associated with 0.38 Sudanese Dinar (1\$US = 250 SD) increase in the mean value of grain crop production. This relationship is significant at 0.05 level. This result corroborates similar findings from Zimbabwe, Kenya and Mozambique highlighting the complementary relationship between food crops and cash crops (Govere et. al. 1999, Strasberg et. al. 1999).

The result indicates that discussions of agricultural commercialisation and its effects, specifically in area of study case were positive. Also, the strength of this finding is consistent with empirical findings from Mali, Senegal and Mozambique where robust complementary relationships were found between household-level cash cropping and food crop performance (Dione 1989, Kelly et. al. 1995). But, this conclusion should not be over-generalised. What matters is what kind of commercialisation, how particular schemes or programmes organised, and their effects on smallholder access to inputs, management advice, market outlets, price levels and price risks, etc.

Investment in animal had a positive and significant impact on food crop production. This finding supports other findings from Mali, Ghana, and Zimbabwe (Dione 1989, Panin 1989, and Govere 1999). Controlling for the effects of other factors, one Sudanese Dinar increase in the household income derived from livestock tended to increase the food crop production

by 0.56 Sudanese Dinar in value. This reflects the strong complementarity between crop and livestock production in this mixed, crop-livestock system. Income from livestock has larger effect on household food crop output than on groundnut commercialisation index had. Although commercialisation has a positive impact on the food crop output of farm household, but still most farmers preferred to invest on livestock. The policy design should consider other activities besides cash cropping intensification to support small farm household food crop production through encouraging livestock production. Livestock investment represents a basic form of household savings and had additional advantage of providing nutritional benefits like milk and meat as it has been mentioned before.

Credit accessibility variable is significant at 1% level and had a positive impact on farm household food crop output. An increase of 1% in credit accessibility was related with 0.713 Sudanese Dinar increases in farm household food crop output at the mean value. Better credit access is one of the advantages of cash cropping. The importance of this result lies in its potential use in policy to promote household food production via commercialisation by improving household access to credit.

The empirical findings in Table 5.2 show that farm size had a positive and significant effect on farm household crop output. Other factors held constant, an additional hectare in land holding size was associated with 0.53 Sudanese Dinar increase in farm household food crop output value, on the average. However, this small effect of increase in farm size on grain production is expected given evidence elsewhere that farm size does not limit participation in commercialisation (von Braun, 1994). Therefore, farmers can expand production, vertically by using improved seeds or horizontally by increasing land use.

In the present study family size, education level, farm inputs (like improved seeds and pesticides), crop rotation and extension service, do not have statistically significant impact on farm food crop production. For the farm inputs like improved seeds, mainly used in cash crops (groundnut and sesame) production. But, for food crop production many farmers use what saved from their own seed production, which they believe is good quality of seeds.

CHAPTER SIX

CONCLUSION AND IMPLICATIONS

The present empirical model in chapter five, indicates the positive impact of commercialisation agriculture, featuring high-valued cash crops, on farm household food crop production which can under certain conditions provide a strong stimulus to smallholder agriculture and have major indirect benefits for food crop production. Most local and internationally based agricultural research programmes designed to promote food crop productivity growth in Africa are based on the allocation of scarce resources to primary food crops. To large extent, agricultural and nutrition policies in Sudan have formulated rural development strategies on this conventional wisdom and have implicitly or sometimes explicitly regarded diversification into non-food cash crops as detrimental to household food security objectives.

In the Sudan, the government has in the past decade gradually privatised its services and allowed free entry of private firms into most segments of cash crops (groundnut and gum arabic) marketing. Agricultural chemical companies are opening up distribution outlets in most provinces of Northern Kordofan State. While productivity growth of staple food

crops is indeed essential to overall rural productivity growth due to the large proportion of cropped area under food crops, the potential of higher-valued cash crops to promote food crop productivity has often been neglected.

This research study investigated the effects of groundnut commercialisation on food crop production in Sheikan province in Northern Kordofan State. The main findings of this investigation include:

- The degree of agricultural commercialisation varied significantly across the entire sample. But still the semi-subsistent production features the production pattern in the area of study;
- Commercialisation was significantly and negatively affected by households' investment in livestock but positively affected by family size;
- Groundnut commercialisation at the household level significantly and positively affected food crop production;
- The level of education of the household head and the household's investment in livestock significantly and positively affected food production; and
- Participation in a cash crop (e.g., groundnut) improves the household's access to inputs (e.g., credit and improved seeds) distributed through the government or private

institutions, which may result in the household using some of that input on food crop production.

Two key pathways can be identified by which crop commercialisation may improve food crop production. *First*, in constrained credit markets and unattractive domestic grain prices, crop commercialisation is the main avenues by which smallholders can overcome the capital constraints on making investments in key productivity-enhancing inputs and livestock. *Second*, once these investments and commercialised cropping patterns become initiated and incorporated into the households' farm activities, this appears to support a dynamic process of human and physical capital accumulation and further intensification of input use, thereby enabling further gains in food crop production. The challenge for government policy is to identify and facilitated strategic pathways to crate positive interactions between food and cash crops.

This study suggests that, despite frequent criticisms stressing the trade-offs between agricultural commercialisation and food crop production, agricultural commercialisation have a positive and significant impact on household food production. Even when the household allocates more resources to cash crops, the earned income and access to food market appears to justify these resource allocations.

In general, the results indicate that discussion of agricultural commercialisation and its effects were positive in the area of study. The strength of these findings is consistent with

empirical findings from Mali, Senegal and Mozambique where robust complementary relationships were found between household-level cash cropping and food crop performance. But this conclusion should not be over-generalised. What matters is what kind of commercialisation, how particular policies are organised, and their effects on smallholder access to inputs, price levels and price risks, etc.

A major task for future research is to understand better how successful commercialisation arrangements linking smallholders and marketing or processing firms has been structured so that their successful ingredients can be replicated and incorporated more broadly into commercialisation strategies in other regions. This is likely to yield high payoffs in terms of increasing agricultural productivity and food security.

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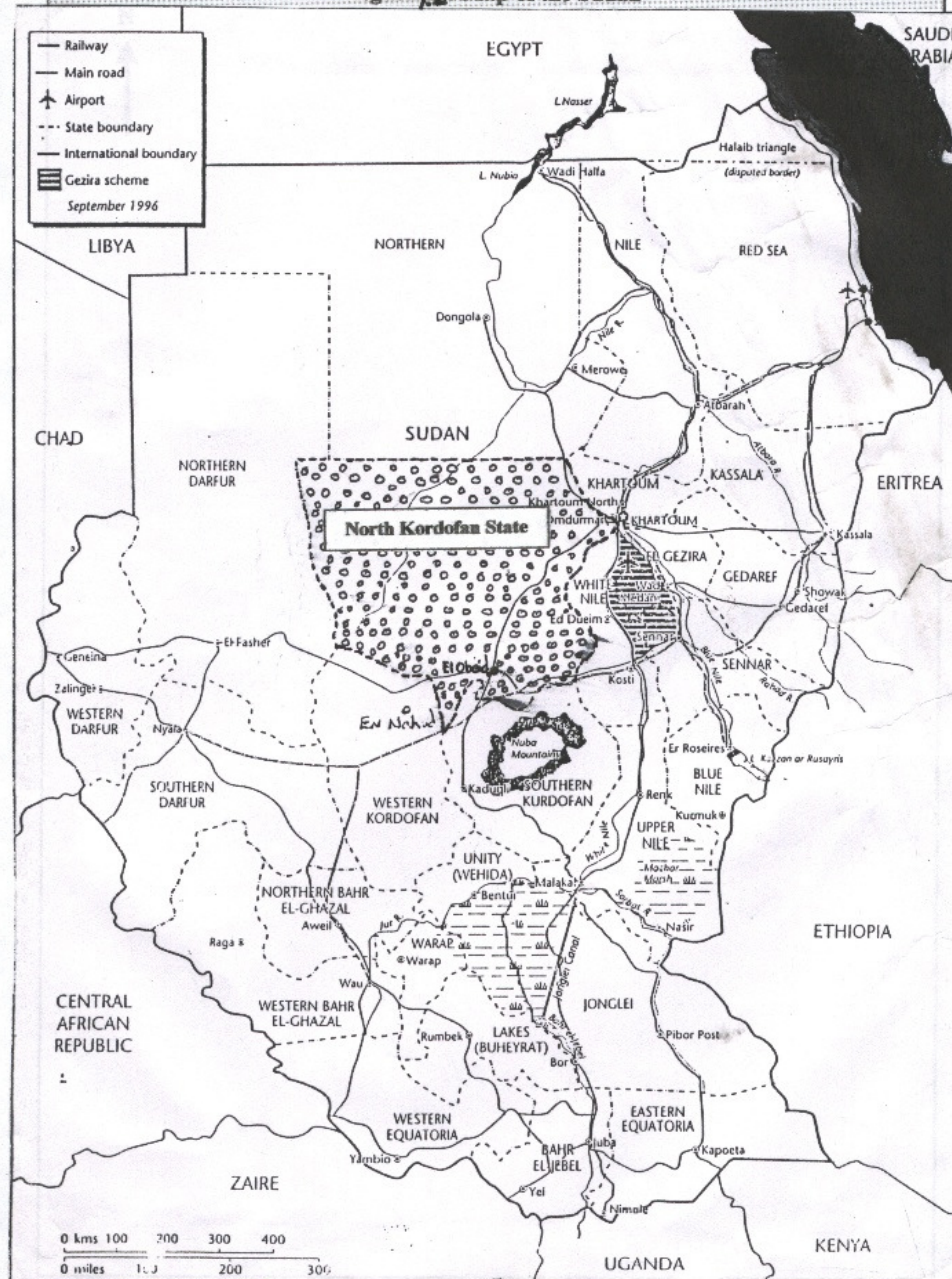
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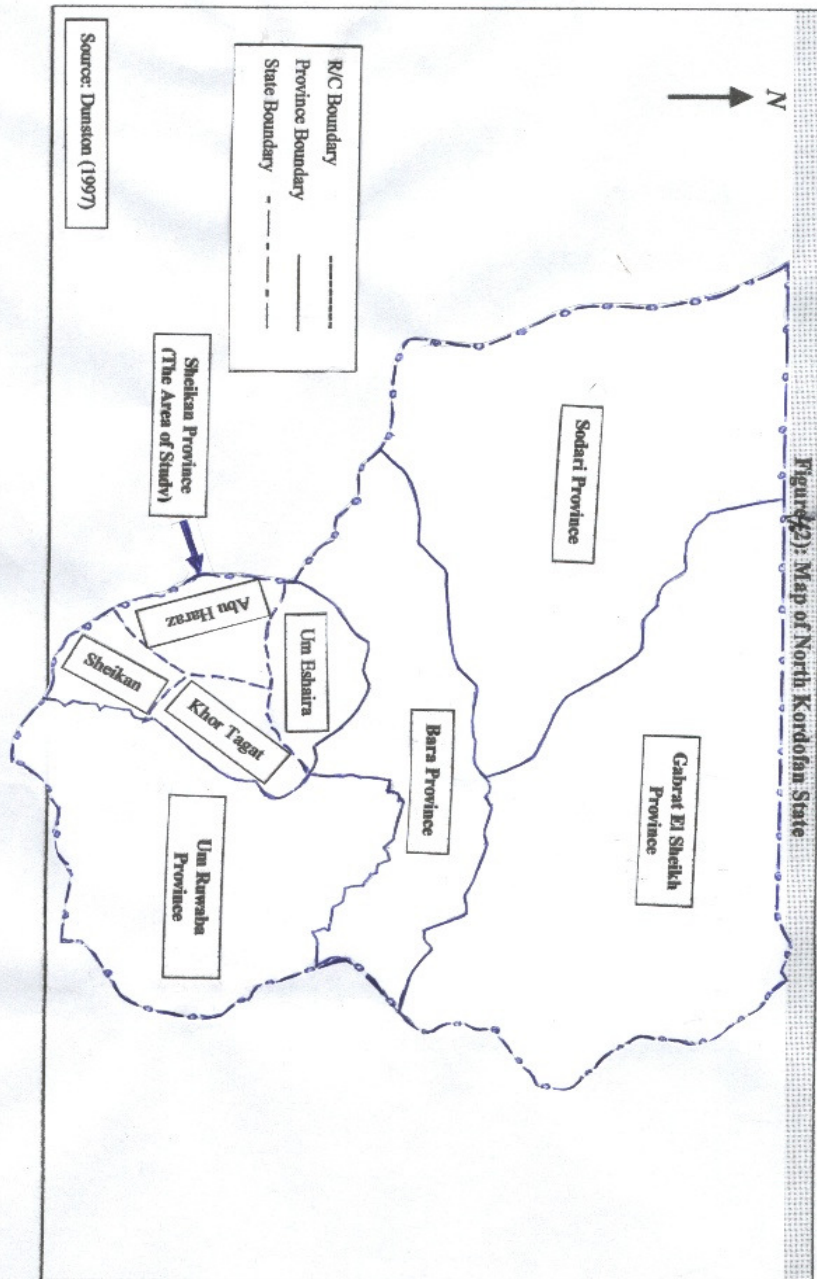
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Figure 40: Map of the Sudan





The Impact of Commercialisation on the Household Food Crop Production in
Western Sudan Dry Land Agriculture

Questionnaire

Rural Council: _____. ***Village Name:***

I. Household Characteristics

1. Name of Head HH: _____

2. Age (years): _____

3. Sex: 1. Female

 2. Male

4. Marital Status: 1. Married

 2. Single

 3. Widow

5. Level of education (years of schooling): _____

6. Occupation:

Primary _____

Secondary _____

7. What is the size of your family?

1. Those below 18 years of age _____

2. Those above 18 years of age _____

8. Age and sex of the household members (excluding the head)

No.	Name	Sex: 1 = female 2 = male	Age (yr.)
1			
2			
3			
4			
5			
6			

7			
8			
9			
10			
11			
12			
13			
14			
15			

9. Who did contribute to cropping and livestock herding of the family members mentioned in items 8?

Household Members	Farming (cropping)	Stock Herding	No Participation
Husband			
Wife			
Child			
Relative			

II. Farming System:

10. How long have you been farming in this village? _____ years.

11. What are your main food crops?

1. _____

2. _____

3. _____

4. _____

5. _____

12. What are your main cash crops?

1. _____

2. _____

3. _____
4. _____
5. _____

13. How many hectares did you allocate for each crop and how much did you produce and market in the last farming season?

Type of crops	Cultivated area (hectare)	Total output (kg.)	Amount of sold crop (kg.)	Value of sold crop (SD)

14. Where did you sell your crops?

1. Rural council market

2. Town (provincial) market

15. How long is the distance to the nearest market? _____ Km.

16. How many animals did you have beginning 2001 and how many sold during that year?

Animal	Number beginning 2001	Number sold	Value of sold (SD)
Goat			
Sheep			
Cattle			
Camel			

17. What are the family needs from the following items?

Item	Quantity Consumed During			Average Price (Sudanese Dinar)		
	Jan-Apr	May – Aug	Sep.-Dec	Jan -Apr	May – Aug	Sep.-Dec
Millet						
Sorghum						
Groundnut						

Sesame						
--------	--	--	--	--	--	--

III. Input Data:

18. How many family members worked on your farm and for how long during the last farming season?

19. How did you obtain the land for your farm business:

1. Inherited. _____ ha.
2. Purchased _____ ha.
3. Rent _____ ha.
4. Grants _____ ha.
5. Others. _____ ha.

20. Please answer by Yes or No to the following statements:

- (One) You practice crop rotation: () Yes () No
- (Two) The extension service in your area is strong: () Yes () No
- (Three) You use fertiliser: () Yes () No
- (Four) You use pesticides: () Yes () No
- (Five) You received credit from the bank: () Yes () No
- (Six) You have access to all weather roads: () Yes () No
- (Seven) You use tractor: () Yes () No
- (Eight) You use animal traction: () Yes () No
- (Nine) You use hand tool (*hoe*): () Yes () No

21. What quantity of the following **purchased inputs** did you use in the last farming season and what is the cost incurred for each, field crops? **PLEASE FILL IN THE**

FOLLOWING TABLE.

Input	Millet		Sorghum		groundnut		Sesame	
	Quanti	Value (SD)	Quanti	Value (SD)	Quanti	Value (SD)	Quanti	Value (SD)
Improved Seeds (Kg)								
Fertiliser (Bag)								
Labour (MD)								
Tractor (Hrs)								
Animal (AD)								
Hand Tools								
Others								

SD => Total costs of the inputs used in Sudanese Dinars

Table (4.11): Household Crop Production by Rural Council in Sheikan Province: 2001/02

Type of crop	Kazgel (RC ₁)			Abu Haraz (RC ₂)			Um Asheira (RC ₃)			Khor Taga	
	Average cultivated area ¹	Average Yield ²	% of Household	Average cultivated area	Average Yield	% of Household	Average cultivated area	Average Yield	% of Household	Average cultivated area	Average Yield
Millet	0.8 (0.3)	118.1 (143.4)	88.6	1.8 (0.4)	50.5 (35.6)	100	2.8 (0.4)	104.1 (145.9)	100	5.4 (2.5)	10.4 (15.4)

¹ The unit of measurement is hectare.

² The unit of measurement is kg/hectare

Sorghum	2.8 (3.5)	163.4 (137.0)	94.3	3.1 (3.9)	91.3 (77.7)	75.0	6.0 (4.5)	91.3 (142.2)	94.1	6.2 (4.9)	95 (11)
Groundnut	2.1 (1.6)	150.8 (178.7)	82.2	3.0 (2.4)	192.8 (206.4)	100	3.0 (2.2)	290.4 (225.6)	94.1	2.4 (0.8)	161 (11)
Sesame	1.7 (2.2)	105.1 (71.8)	96.8	1.6 (2.1)	94.4 (77.8)	100	1.6 (1.4)	79.6 (119.1)	94.1	1.2 (1.8)	58 (49)

Source: Field survey, 2001/02

Note: (.) Standard Deviation in parentheses

Table (4.12): Percentage of Households Involved in Crop Marketing by Rural Council in Sheikan Province: 2001/02

Type of crop	Kazgel (RC ₁)			Abu Haraz (RC ₂)			Um Asheira (RC ₃)			Khc	
	Average Sold Quantity ³	Average Received Value ⁴	% of Household	Average Sold Quantity	Average Received Value	% of Household	Average Sold Quantity	Average Received Value	% of Household	Average Sold Quantity	
Millet	0.0	0.0	0.0	0.0	0.0	0.0	31.8 (131.0)	1784.2 (7356.4)	5.9	0.0	
Sorghum	10.6 (48.4)	379.4 (1759.1)	5.7	83.6 (122.3)	7889.3 (20675.2)	35.7	0.0	0.0	0.0	0.0	
Groundnut	188.3 (183.4)	5518.3 (5362.6)	84.8	183.8 (148.4)	5378.4 (4249.4)	100	459.8 (574.5)	14610 (18346.2)	100	1633 (419.4)	
Sesame	55.6 (160.2)	3270.6 (9401.2)	23.5	48.2 (156.8)	2985.7 (10360.0)	25	45 (52.8)	2364.7 (2692.8)	47.1	109 (168.6)	

Source: Field survey, 2001/02

Note: 1 sack of sorghum or millet = 90 kg, and 1 sack of groundnut or sesame = 45 kg.
(.) Standard Deviation in parentheses

³ The unit of measurement is kg

⁴ The average received value is in Sudanese Dinar (1 US\$ = 256.3 SD)

Table (5.2): Empirical Results of Commercialisation and Food Crop Production Models, Sheikan Province, North Kordofan State, Sudan.

Endogenous Variables	Equation (1) Dep. Var.: commercialisation index (%) (OLS)		Equation (2) Dep
	Coeff.	T-stat	Coeff.
	--	--	0.375
Commercialisation index			
<i>Exogenous variables</i>			
Farm size (ha.)	0.206	1.614	0.529
Adult equivalent (No.)	0.189	1.842*	0.409
HH head school years (yrs)	-0.217	-2.029**	0.258
Crop income ratio (%)	-0.126	-1.298	0.246
Pesticides used (SD)	0.038	0.401	-0.078
Livestock income (SD)	-0.405	-3.301***	0.564
Improved seeds used (SD)	0.190	2.105**	0.066
Credit accessibility = 1	0.101	0.965	0.713
Crop rotation = 1	0.224	2.467**	0.174
Extension service = 1	0.331	2.770***	0.053
Constant	13.662	1.678*	-10120.8
<i>Instrumental variables</i>			
Distance. To market (km)	-0.208	-2.276**	--
Gender (1 = female)	-0.219	-2.182**	--
N	100		100
Adjusted R-square	0.257		0.377

*F-value = 3.418****

*F-value = 6.848****

*Note: ***, ** & * Denotes statistical significance (one tailed test) at 1%, 5%, and 10% level, respectively.*