ECONOMICS OF ONION PRODUCTION
IN KHARTOUM STATE, SUDAN:
A CASE OF ALGAZIRA SLANG

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of Master of Science in Agricultural Economics

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August, 2006
With my heartfelt appreciation of God and great love of my parents,
I wish to dedicate this work to my parents
To my husband who guided me through the darkness
step by step to the light of future
To my kids Elmunzir, Mohamed and Omer
With all the beauty of brotherhood, my dedications
Go to my brothers, sisters and friends.
I thank the Almighty Allah for granting me patience, power and guidance.

I wish to express my sincere thanks to my supervisor, **Dr. Salah Mohamed El Awad** for his continuous support and guidance.

My sincere appreciation goes to the staff of the Department of Agricultural Economics, Faculty of Agriculture, University of Khartoum, for helping me in this research.

Special thanks and gratitude go to my husband Abdel Magid for his supports and patience during the study Period.

My sincere gratitude goes to my sister Hanan and all my family for their continuous encouragement.

Finally, my deepest thanks and gratitude go to my Friends and Colleagues and to all those who made this study possible.
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ABSTRACT

Onion is one of the most popular and widely grown vegetables in Sudan. Khartoum State is considered as one of the productive areas of onion in Sudan. However, Omdurman Locality is a leading Locality producing onion in the State. Algazira slang is the centre stone of onion production in the State.

The main objective is to study the economics of onion production in Khartoum State (Algazira slang is a case study). Also, the Study is intended to investigate the socio-economic characteristics of onion farmers and their effect of onion yield. The Study also identified and analyzed the main cost items for both autumn onion and winter onion.

The Study depended mainly on primary data which were collected by direct interviewing of a randomly selected sample of 80 onion growers using a structured questionnaire. The survey was carried during the period (August – September, 2005).

The Study depended also on secondary data which were collected from different relevant sources.

Data were analyzed by using descriptive analysis, crop budget analysis and regression analysis.

The Study found that farmers in the study area were homogenous, sharing the same characteristics. Also, the Study found that the cost of the winter onion is more than the cost of the autumn onion yield. The Crop Budget Analysis of the Study found that autumn onion yield is more profitable than winter yield.

Regression Analysis of autumn onion found that educational level, cost of weeding and land preparation cost affected onion yield.
significantly.

Regression Analysis of winter onion found that harvesting date and land preparation cost are highly significant for winter onion yield.

To improve onion production in Khartoum state, the study recommended the removal of production constraints specially irrigation, inputs, improvement of extension services and establishing factory of onion dehydration.
المنطقة الشمالية

البحث

الخصائص الوصيفية

الانحراف الخرفي

مصادر الجزيرة الأرضية

الإنتاج

تحليل

الاصة في

أكبر منها.

المنطقة

تحضير السودان في.

مز الطاقة

المنتج

تحليل

على حيث

الكفاءة،

تكلفة

الأخير

الخزنة

إلى مدينة محلية

قلة

كما

الأساسية

ورسائل تحليل

اثر

عند

المعالمة،

بالمضاف

التي

البضائع

السودان

من

الخزنة،

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الاستجابة

على مستوى
دراسة أو صيانت昱 توزيع كميات حادة خاصة بالإنتاج الساحة تدنير و ضرورة الأساسيات الخدمات تقدم على العمل تتوفر له وقت الجمع hendki

辆车 1920 تمتلك 123 أي انت كما المشكل للاستفادة بالصل لتجفيف المصانع قد يكون لمدة يوجد كثافة في نسبة الأكمالفين كاملاً
CHAPTER ONE
INTRODUCTION

Khartoum State lies between longitudes 25 34° and 31 35°E and latitudes 15 15° and 16 40°N with an area about 5 million feddan or 20971 square kilometers (Ministry of Agriculture, Animal Wealth and Irrigation, Khartoum State). The population of the state is 4.7 million (Central Bureau of Statistics 2000). The dominant climate is semi desert with very hot summer and mild winter (Elamin 2001).

1.1 Agriculture in Khartoum State:

Khartoum State is rich of agricultural resources like land, experienced farmers. Also the State has good location, infra structures and water resources availability. All these factors make the State suitable for cultivating and marketing many crops.

Vegetables are produced in the State due to the high population density in addition to the awareness of its residents with the importance of vegetables. Also vegetables are attractive to farmers due to the fact that they are profitable, so there are large areas grown with vegetables in the State as shown in Table (1.1). The main vegetables grown in the state are tomatoes, onion, potatoes, okra and leafy vegetables.

1.2 Onion production in Khartoum State:

Khartoum State is considered one of the main areas of producing onion in Sudan. Onion is profitable crop this leads to more production of it as shown by Table (1.3). The Table shows that production of onion in the State is increasing. Also there is fluctuation in ton's price and this is due to the seasonality of the crop.
Table (1.1): Area Grown with Vegetables in Khartoum State in Seasons 2000-2006:

<table>
<thead>
<tr>
<th>Year</th>
<th>Area (feddan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000/01</td>
<td>60122</td>
</tr>
<tr>
<td>2001/02</td>
<td>114016</td>
</tr>
<tr>
<td>2002/03</td>
<td>57764</td>
</tr>
<tr>
<td>2003/04</td>
<td>81848</td>
</tr>
<tr>
<td>2004/05</td>
<td>70139</td>
</tr>
<tr>
<td>2005/06</td>
<td>50733</td>
</tr>
</tbody>
</table>

Source: Ministry of Agriculture, Animal Wealth and Irrigation, Khartoum State

Table (1.2): Average Onion Production and Cost of Production and Net Returns during Seasons 1996 - 2005

<table>
<thead>
<tr>
<th>Season</th>
<th>Average of production (ton)</th>
<th>Ton Price (SD)</th>
<th>Returns (SD/ton)</th>
<th>Cost of ton Production (SD)</th>
<th>Profit (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996/97</td>
<td>6.4</td>
<td>16741</td>
<td>107142</td>
<td>48499</td>
<td>58643</td>
</tr>
<tr>
<td>1998/99</td>
<td>6.8</td>
<td>16277</td>
<td>110683</td>
<td>151639</td>
<td>40956</td>
</tr>
<tr>
<td>2000/01</td>
<td>6.9</td>
<td>35870</td>
<td>247503</td>
<td>129660</td>
<td>117840</td>
</tr>
<tr>
<td>2001/02</td>
<td>7.7</td>
<td>76209</td>
<td>586809</td>
<td>115041</td>
<td>471768</td>
</tr>
<tr>
<td>2003/04</td>
<td>9.5</td>
<td>33368</td>
<td>316996</td>
<td>184947</td>
<td>132049</td>
</tr>
</tbody>
</table>


The study revealed that onion is profitable crop, this encourage farmers to produce it. Onion is a main income generating activity.
1-3 Nutritional Value of Onion

Dried onion and Green onion have different nutritional value as shown in Table (3.1).

Table (1-3): Nutritional Value of Dried Onion and Green Onion.

<table>
<thead>
<tr>
<th>Nutrition component</th>
<th>Dried onion</th>
<th>Green onion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity</td>
<td>89.10</td>
<td>89.4</td>
</tr>
<tr>
<td>Heat calories</td>
<td>38.00</td>
<td>36.0</td>
</tr>
<tr>
<td>Protein (gm)</td>
<td>11.51</td>
<td>1.50</td>
</tr>
<tr>
<td>Fat (gm)</td>
<td>0.10</td>
<td>0.20</td>
</tr>
<tr>
<td>Total carbohydrate (gm)</td>
<td>8.70</td>
<td>8.20</td>
</tr>
<tr>
<td>Fibres (gm)</td>
<td>0.60</td>
<td>1.00</td>
</tr>
<tr>
<td>Calcium (mgm)</td>
<td>27.00</td>
<td>51.00</td>
</tr>
<tr>
<td>Potassium (mgm)</td>
<td>157.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Vitamin A (world unit)</td>
<td>-</td>
<td>231.00</td>
</tr>
<tr>
<td>Riboflavin (mgm)</td>
<td>0.04</td>
<td>0.50</td>
</tr>
<tr>
<td>Ascorbic Acid (mgm)</td>
<td>10.00</td>
<td>32.00</td>
</tr>
<tr>
<td>Magnesium (mgm)</td>
<td>12.00</td>
<td>-</td>
</tr>
<tr>
<td>Phosphorus (mgm)</td>
<td>36.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Iron (mgm)</td>
<td>0.50</td>
<td>5.00</td>
</tr>
</tbody>
</table>

Source: Arab Organization for Agricultural Development (1996)

1-4 Onion Production in Karari Locality

Karari Locality is located in the north of Omdurman. It is good area for growing crops especially vegetables with an area of about 42000
feddan from which 41444 feddan are small private schemes and 556 feddan are agricultural co-operatives (Karari Locality – Omdurman Office of Agriculture). It represents the main area of growing onion in Khartoum State. Onion is about 44%, 26.2% and 42% of the area grown with vegetables during years 2002/2003, 2003/2004 and 2004/2005 respectively as shown by Table (1.5).

Table (1-4): Areas Grown with Onion in Karari Locality Compared with Vegetables in Karari Locality in Seasons 2002-2005

<table>
<thead>
<tr>
<th>Year</th>
<th>Vegetable area (feddan)</th>
<th>Onion area (feddan)</th>
<th>% of onion area</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002/03</td>
<td>25270</td>
<td>11305</td>
<td>44.7</td>
</tr>
<tr>
<td>2003/04</td>
<td>7625</td>
<td>2000</td>
<td>26.2</td>
</tr>
<tr>
<td>2004/05</td>
<td>26675</td>
<td>11205</td>
<td>42.0</td>
</tr>
</tbody>
</table>

Source: Ministry of Agriculture, Animal Wealth and Irrigation, Khartoum State.

Algazira slang is the most popular and more productive area of onion (about 6400 feddan). This is because of skilled and experienced farmers of onion and due to water resource availability. In Algazira slang farmers grow onion crop and sell it directly to Omdurman markets and do not store it (Adam 2005).

The Table also shows that there are other areas growing onion in the north of Omdurman they are Alsarorab, Aldishenab, Alshekh Altyeb, Aldowab, Um katti, Alshobrab, Goz Nafisa and Abu dam. Onion is more popular crop in the areas onion production is increased widely in Khartoum State as well as other states of Sudan. This is due to the increased in demand of it among consumers, the lack of alternatives of the crop and the storage possibilities.
1.5 Problem Statement

In spite of the importance of the crop for the farmers in the study area, the crop is faced with many problems affecting its productivity. Onion production has the problem of the low productivity because of many factors such as shortage of inputs, pests, diseases and small area which is grown with the crop. Also it is difficult to make storage for the crop due to climatic conditions (hot summer and rains in autumn season) Onion prices are fluctuated due to the seasonality of production .The fluctuation of prices might lead to decrease return. Moreover, the cost of onion production is high .Therefore it becomes essential to study the impact of these variables on the yield of onion.

1.6 Objectives of the study

The main objective is to study the economics of onion production in Khartoum State, Karari Locality (Algazira slang). Specific objectives are:

1. To describe production and marketing system of onion in Khartoum State.
2. Investigate the socio economic characteristics of farmers growing onion in the study area and their effect on onion yield.
3. To estimate the cost of production and to determine the main cost items.
4. To estimate and analyse factors leading to yield variation during winter and autumn season.
5. To suggest recommendations for solving problems facing onion producers in the area of the study.
1.7 Hypotheses of the study

The research raises the following hypotheses:

1. The population of onion farmers in the study area is homogenous.
2. Fluctuation of onion productivity can be attributed to insufficient irrigation, pests and diseases.
3. Irrigation cost, fertilizer cost and pesticide cost are the main cost items.

1.8 Methodology

Adopting case study approach, Algazira slang is selected as a main producer areas of onion. A sample of 80 farmers is selected randomly for the purpose of the field questionnaire. The study used descriptive statistical analysis, regression analysis and crop budget analysis for data analysis.

1-9 Organization of the study

The study is comprised of six chapters. Chapter one is an introduction which includes, Agriculture in Khartoum State, onion production in Khartoum State, onion production in Karari locality, problem statement, objectives of the study, hypothesis of the study and methodology. Chapter two is the description of production and marketing of onion in Khartoum state. Chapter three includes methodology. Chapter four describes the socio economic characteristics of onion farmers, while Chapter five deals with Crop Budget Analysis and Regression Analysis. Chapter six includes summary, conclusions and recommendations.
CHAPTER TWO
DESCRIPTION OF PRODUCTION AND MARKETING SYSTEM OF ONION IN KHARTOUM STATE

2.1 Vegetable Production in Khartoum State

Khartoum State is considered one of the main productive states for vegetables and one of the more consumptive states which might be due to large agriculture areas, availability of irrigation, and the existence of energy and transportation and high population density. Table (2.1) shows that Khartoum State is the most consumptive state of vegetables.

Table (2.1): The Per Capita Consumption of Vegetables in Different States of Sudan (Kg/Year).

<table>
<thead>
<tr>
<th>Region</th>
<th>Vegetable consumption (kg year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khartoum</td>
<td>65</td>
</tr>
<tr>
<td>Central</td>
<td>60</td>
</tr>
<tr>
<td>Northern</td>
<td>55</td>
</tr>
<tr>
<td>Eastern</td>
<td>50</td>
</tr>
<tr>
<td>Kordofan</td>
<td>20</td>
</tr>
<tr>
<td>Darfur</td>
<td>10</td>
</tr>
</tbody>
</table>

Source: Food and Agriculture Organization (1996)

2.2 Onion Production in Khartoum State

2.2.1 Locations of production

Onion is mainly produced in Khartoum State in north of Omdurman Locality and Bahri Locality. In Omdurman Locality, the main areas of production are Algazira slang, Alsarorab, Alshihenab, Goz Nafisa, Alshobrab, Alsheikh Altayeb, Alnofalab, Om katti, Abu dam and
Alhawaweet gharb. Agricultural areas in the north of Omdurman Locality are shown in Table (2-2).

Table (2-2): Agricultural Areas in the Northern Region of Omdurman

<table>
<thead>
<tr>
<th>District</th>
<th>Area (feddan)</th>
<th>Crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Karari</td>
<td>1500</td>
<td>Potatoes, tomatoes, fodders</td>
</tr>
<tr>
<td>Algazira slang</td>
<td>6400</td>
<td>Onion, fodders</td>
</tr>
<tr>
<td>Aligaiga</td>
<td>1400</td>
<td>Green pepper, tomatoes, fodders</td>
</tr>
<tr>
<td>Algazira um hosan</td>
<td>5700</td>
<td>Potato, tomato</td>
</tr>
<tr>
<td>Sero Alkhogalab</td>
<td>500</td>
<td>Vegetables, tomato, egg plants</td>
</tr>
<tr>
<td>Wadi sayedna</td>
<td>150</td>
<td>Vegetables, fodders</td>
</tr>
<tr>
<td>Alsarorab</td>
<td>3300</td>
<td>Onion, potato, fodder</td>
</tr>
<tr>
<td>Aldishenab</td>
<td>1000</td>
<td>Onion, potato</td>
</tr>
<tr>
<td>Alshekh Altyeb</td>
<td>1200</td>
<td>Onion, potato, fodder</td>
</tr>
<tr>
<td>Aldowab</td>
<td>1200</td>
<td>Onion, potato, fodder</td>
</tr>
<tr>
<td>Alshihenab</td>
<td>2500</td>
<td>Potato, fodders</td>
</tr>
<tr>
<td>West wawissi</td>
<td>824</td>
<td>Potato, fodders</td>
</tr>
<tr>
<td>Um katti</td>
<td>1100</td>
<td>Onion, spices</td>
</tr>
<tr>
<td>West alhakmab</td>
<td>440</td>
<td>Onion, potato</td>
</tr>
<tr>
<td>alshobrab</td>
<td>4000</td>
<td>Onion, potato</td>
</tr>
<tr>
<td>Goz Nafisa</td>
<td>1400</td>
<td>Onion, potato</td>
</tr>
<tr>
<td>alkodab</td>
<td>220</td>
<td>Onion, spices</td>
</tr>
<tr>
<td>Abu dam</td>
<td>1350</td>
<td>Onion, spices</td>
</tr>
<tr>
<td>West Alhowaweet</td>
<td>220</td>
<td>Onion, fodders</td>
</tr>
</tbody>
</table>

Source: Office of Agriculture –Karari Locality
The average productivity of onion per feddan in Omdurman Locality is about 100-150 sacks/feddan (Table 2-3). In Bahri Locality the main areas of onion production are Wad Albasal, Gaili, Saggai, Wawissi, Khilaila, Haweet, Wawissi, Kabbashi and Tomaniat (Elamin, 2001).

The average productivity per feddan in Bahri Locality is about 200-250 sacks/feddan (Table 2-4).

**Table (2.3): Area Cultivated and the Amount Produced of Onion in Omdurman Locality.**

<table>
<thead>
<tr>
<th>Season</th>
<th>Area (fed)</th>
<th>Quantity (sack)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 / 01</td>
<td>9420</td>
<td>12200</td>
</tr>
<tr>
<td>2001 / 02</td>
<td>40250</td>
<td>21305</td>
</tr>
<tr>
<td>2002 / 03</td>
<td>11305</td>
<td>13744</td>
</tr>
<tr>
<td>2003 / 04</td>
<td>2000</td>
<td>12600</td>
</tr>
<tr>
<td>2004 / 05</td>
<td>11260</td>
<td>67320</td>
</tr>
</tbody>
</table>

Source: Agriculture Office, Omdurman Locality and State Ministry of Agriculture, Animal Wealth and Irrigation –Khartoum State

**Table (2.4): Area Cultivated and the Amount Produced of Onion in Bahri Locality.**

<table>
<thead>
<tr>
<th>Season</th>
<th>Area (fed)</th>
<th>Quantity (sack)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001/02</td>
<td>1560</td>
<td>23400</td>
</tr>
<tr>
<td>2002/03</td>
<td>2348</td>
<td>35220</td>
</tr>
<tr>
<td>2003/04</td>
<td>8200</td>
<td>1220000</td>
</tr>
<tr>
<td>2004/05</td>
<td>1505</td>
<td>325750</td>
</tr>
</tbody>
</table>

Source: Agriculture Office –Bahri Locality and Ministry of Agriculture.
2.2.2 The period of production

Onion is produced in 3 seasons:

i. Autumn season: The crop is grown in mid August and harvested in December –January.

ii. Winter season: The crop is grown in October –November and harvested in mid February –April.

iii. Summer season: Cultivation starts in December -January and the harvest is carried out in May and June.

In Omdurman Locality, onion is usually grown in summer season except Algazira slang where it is grown in two seasons autumn season and winter season. In Bahri Locality, onion is grown only in winter season.

2.2.3 Requirements of production

i. Land: The land of Khartoum State is fertile because of its site adjacent the Nile.

ii. Credit: It is either private or in kind from Agricultural Bank in form of irrigation pumps, fertilizers, pesticides and seeds

iii. Farmers of Khartoum State: Farmers in most cases are the owners of the land. Labourers are either hired or family labour. According to (Elamin, 2001) Khartoum State farmers are estimated at about 28701 farmers. Farmers of Bahri represent about 4461 farmers. Farmers of Khartoum and Omdurman are estimated at about 24220 farmers. It is known that the number of farmers in Khartoum Locality must be less than the number of farmers of Omdurman. It means that the large number of farmers is found in Omdurman which has no official number.
2.2.4 Storage of Onion

Winter crop is stored in traditional stores. The store period is about 6 months. Due to climatic condition in summer (high temperature and rain), summer crop is usually not stored and sell directly to consumers.

2.3 Marketing of Onion in Khartoum State

2.3.1 Marketing Channels

Marketing channels include the producer, the retailer, the Whole sealer, the middleman and the consumer (Fig. 1).

```
    Producer
     /\      /\    \\
    /  \    /  \   \\
   /    \  /    \  \\
  Whole seller     Retailer
   /\        /\         /\  \\
  /  \      /  \       /  \  \\
 Central Market    Middleman
   /\    \\
  /  \\
Consumer
```

Fig. (1): Marketing channels

2.3.2 Marketing Structure

In Khartoum, the main market is the Khartoum central market. It is located in the south of the Locality the sales are both whole saling and retail saling. Onion is brought to this market from Algazira slang, Alsarorab, Wad ramli, Wad albasal and Alsaggai.
In Bahri Locality, the main markets are:

i. Central market Shambat: In this market the most sellers are whole sellers. There is small number of retailers. They sell onion to consumers in small units. Onion is brought to this market from Alsaggai, Wad Ramli, Algaily and Shendi.

ii. Soug Bahri: The selling is practised at verandas, shops, or on floor. There are both whole saling and retail saling.

In Omdurman Locality: The main markets are:

i. Zareebat Almahaseel, it is located in the West of the Locality. It is specialized in the sales of sorghum and onion. Onion is brought from Algazira slang, Alshihenab, Alsarorab and other locations in the north of the Locality.

ii. Central market of Omdurman "Alshaabi": It is located in the north of Omdurman. In this market, there are a big number of whole sellers. Onion is brought from Zareebat Almahasel in addition to Algazira slang and other locations in the north of the Locality.

iii. Omdurman market: It is a retail market. Onion is brought from Zareebat Almahaseel.

2.3.3 Marketing Performance

There is free marketing system. Onion producers can either store it or they can sell it directly after harvest. In case of buying big amounts of onion from producers, the whole sale may store it in seasons of abundant and gets it out in seasons of scarcity so as to achieve high prices.

2.3.4 Marketing functions

It includes pick up, charging, grouping, handover, fright, deprived, taxes and fees.
2.3.5 Marketing costs

Marketing cost is the cost of functions provided by the marketing process. Marketing costs include:

1. Direct cost which is paid for direct services like loading, transportation, land preparation, seeds, fertilizers, pesticides and irrigation.
2. Capital cost in form of opportunity cost i.e. capital which is utilized for trading or purchasing onion in stead of other use.
3. The loss cost or the damage cost during marketing process.

2.3.6 Marketing margins

Gross Margins: It is equal to the difference between the total revenue and the total variable cost.

\[
\text{Gross Margin} = \text{Total Return} - \text{TVC}
\]

Net Margins: It is equal to the difference between the total gross margin and total fixed cost.

\[
\text{Net Margin} = \text{Gross Margin} - \text{TFC}
\]

Marketing efficiency can be achieved when the crop is marketed with minimum marketing cost. Studies of production Economics in the State Ministry of Agriculture in the year 2004 recorded onion marketing costs and margins in both whole sell market and retailer market as shown in Tables (2.5 and 2.6). The Table (2.5) revealed that in the wholesale market, the main cost items are Zakat and Transportation cost. In the retailer market, the main cost items are transportation cost and local fees. The crop is more profitable in the whole sell market.
Table (2.5): The Costs and Marketing Margins of A ton of Onion in the Whole Sell Market – Khartoum State in the year 2004

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (S Dinar)</th>
<th>Percentage of the item from total cost</th>
<th>Percentage from total return</th>
<th>Percentage from the sell price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase price</td>
<td>34061</td>
<td>83.60</td>
<td>174.34</td>
<td>63.55</td>
</tr>
<tr>
<td>Transportation</td>
<td>1500</td>
<td>3.68</td>
<td>7.68</td>
<td>2.80</td>
</tr>
<tr>
<td>Handover</td>
<td>975</td>
<td>2.39</td>
<td>4.99</td>
<td>1.82</td>
</tr>
<tr>
<td>Storage</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lose</td>
<td>500</td>
<td>1.23</td>
<td>2.56</td>
<td>0.93</td>
</tr>
<tr>
<td>Zakat</td>
<td>2000</td>
<td>4.91</td>
<td>10.24</td>
<td>3.73</td>
</tr>
<tr>
<td>Local fees</td>
<td>800</td>
<td>1.96</td>
<td>4.09</td>
<td>1.49</td>
</tr>
<tr>
<td>Kenana/Rahad</td>
<td>500</td>
<td>1.23</td>
<td>2.56</td>
<td>0.93</td>
</tr>
<tr>
<td>Others</td>
<td>400</td>
<td>0.98</td>
<td>2.05</td>
<td>0.75</td>
</tr>
<tr>
<td>Sell price</td>
<td>53600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total marketing</td>
<td>66775</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cost</td>
<td>40736</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return</td>
<td>19539</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net profit</td>
<td>12864</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Ministry of Agriculture, Animal Wealth and Irrigation, Khartoum State and Author calculations
Table (2.6): The costs and margins of the ton of onion in the Retailer Market Khartoum State

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (Dinar)</th>
<th>Percentage of the item from total cost</th>
<th>Percentage from total return</th>
<th>Percentage from the sell price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase price</td>
<td>42047</td>
<td>84.97</td>
<td>13.56</td>
<td>68.11</td>
</tr>
<tr>
<td>Transportation</td>
<td>1933</td>
<td>3.90</td>
<td>9.82</td>
<td>3.13</td>
</tr>
<tr>
<td>Handover</td>
<td>390</td>
<td>0.79</td>
<td>1.98</td>
<td>0.63</td>
</tr>
<tr>
<td>Storage</td>
<td>232</td>
<td>0.47</td>
<td>1.18</td>
<td>0.37</td>
</tr>
<tr>
<td>Lose</td>
<td>234</td>
<td>0.47</td>
<td>1.19</td>
<td>0.38</td>
</tr>
<tr>
<td>Zakat</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Local fees</td>
<td>1947</td>
<td>3.93</td>
<td>9.89</td>
<td>3.15</td>
</tr>
<tr>
<td>Kenana/Rahad</td>
<td>4000</td>
<td>0.81</td>
<td>2.03</td>
<td>0.65</td>
</tr>
<tr>
<td>Others</td>
<td>500</td>
<td>10.21</td>
<td>2.52</td>
<td>0.81</td>
</tr>
<tr>
<td>Sell price</td>
<td>61736</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total marketing</td>
<td>7436</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cost</td>
<td>49483</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return</td>
<td>19689</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net profit</td>
<td>12253</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Ministry of Agriculture, Animal Wealth and Irrigation – Khartoum State 2004 and Author calculation
CHAPTER THREE
LITERATURE REVIEW

3.1 Onion classification:

**Onion has the Arabic Name:** Basal, **Latin Name:** *Allium Cepa* L.,
**Class:** Liliaceae and **Family:** Amaryllidaceae. Onion is an important crop because most people in the world consume it. It can be eaten in raw form or used in the preparation of food. Elamin (2001) concluded that there were 90 genera and 1200 varieties of onion in warm and hot areas. There are large areas in the world cultivated by onion compared with other vegetables (Henry, 1963).

3.2. Centre of Origin and History of Production

The centre of origin is west Asia in the area lying between Palestine and India. Some writers agreed that the origin was North Iran. Ancient Egyptian used onion for food and medical purposes. The largest producers for onion were Japan, Egypt, China, turkey, India and Soviet Union. The average per capita consumption of onion worldwide is 412kg/year (Elamin, 2001). Egypt is one of the largest consumers of onion (Ahmed, 1993').

3.3. Agronomic Factors Affecting Onion Productivity in Khartoum State

They contain cultural operations which are used in onion production.

3.3.1. Land preparation

It needs 2-3 times to plough the land, then harrowing the land by disk. It needs about 5-6 hours per feddan by the tractor.
3.3.2. Direct seedling and transplanting

In the study area, farmers usually use the transplanting method for onion propagation. Farmers transplant the crop from nursery to the field after 45 days from seedling using intensive family labour or rent labours.

3.3.3. Fertilization

It is vary from a place to another. Onion is fertilized by urea and Super phosphate. Mustafa (1997) concluded that in Sudan Nitrogen application separately or in combination had no appreciable effect on yield, however the application of Nitrogen has tendency to increase onion weight. The best time for nitrogen application is 2 weeks after sowing (Ali, 1999).

3.3.4. Irrigation

Mustafa (1997) concluded that irrigation is supplied to supplement water available from the rainfall and the contribution to soil moisture from ground water. FAO (1993) reported that the irrigation of seven to ten days intervals results in highest yield and greatest average bulb weight (Ali, 1999).

3.3.5. Harvesting

It begins in full maturity stage when maturity signs appear. Mustafa (1997) showed that harvest before optimum time decreased yield by 30%. Onion takes 5-7 months to mature after planting seedlings. The length of period depends on varieties, temperature, soil texture, soil moisture and Nitrogen (Elamin, 2001).
Sowing date

The optimum date for sowing onion in Khartoum State is the fifteenth of August (autumn season). The early sowing of onion increased yield of onion because of avoiding the attack of pests and diseases that normally attack the crop during winter.

Varieties of onion

Onion's seeds which are used by farmers in Khartoum State are usually local but there are imported varieties.

According to Ali (1999) onion's varieties are:

1. Saggai: It is of colour or pink colour. It is good variety of good keeping quantity.

2. Zalingi: It is grown in western Darfur. The bulb colour is ranging from red to white. It has poor keeping quality

Seed rate

The amount of seeds applied per unit area depends on farmer's knowledge and the kind of seeds (Ali, 1999).

According to reports of Ministry of Agriculture, Animal Wealth and Irrigation Khartoum State, the optimum quantity of onion seeds in feddan is 10 pound/feddan. Too high seed rates results in decreasing seedling emergence.

Pests and Diseases

The main pests that attack onion are:

1. Thrips: They live inside leaves and destroy them
2. Green worms: They cause damage of the main veins of the leaves.
The main diseases that attack onion are:
1. Pink root rot: It is fungus disease attacks the roots of onion and made it pink and the plant does not reach maturity stage.
2. Neck rot: It attacks bulb during storage due to early harvesting or because of high temperature.

3.4. Cost of Production

It is relatively high according to many writers. Elamin (2001) concluded that the highest cost of production of onion in Bahri Province was the irrigation cost followed by labor cost and other input costs.

Mustafa (1997) concluded that the cost of production of onion per feddan was high compared to farmers' income due to labor scarcity and no subsidization.

Ali (1999) stated that the main cost items of onion in Shendi area were inputs, irrigation and labor.

Babiker (2000) found that the main cost items of potatoes in Khartoum State was the seed cost followed by labor and watering.

Ahmed (2000) found that the main cost items of tomatoes in Omdurman were transportation, harvesting and seeds. He recommended that onion's yield would increased by increasing both seed rate and fertilizer quantity.

Onion is seasonal crop. It is more profitable in some months of the year. Ali, (1999) stated that production of onion in Shendi area is profitable to farmers since they have positive net returns. He concluded that farmers of Nile Schemes obtained the highest profitability when the crop is sold in May and July (time of early selling) and in November and December (time of low supply. While farmers of co-operative schemes obtained the highest profitability when the crop is sold in September
Elamin (2001) showed that profitability of onion increased with increasing the storing period till November (time of low supply) during which the profitability reached its maximum then decreased in December.

Babiker (2000) concluded that potato production in Khartoum State was profitable to farmers since they have positive net margins.

Hamad (2000) showed that a tomato in Khartoum State was profitable at producer level.
CHAPTER FOUR
RESEARCH METHODOLOGY

This chapter represents the research methodology including area of the study, data collection, methods of analysis and model specification.

4.1 Area of Study

North of Khartoum represents the main area of onion cultivation in the state. North of Omdurman represents the main area of onion production. Algazira slang represents the centre stone of growing onion in addition to Alnofalab, Alshihenab, Alshekh Atyeb, and Alsarorab. Algazira slang is taken as a case study

Farmers of Khartoum State

Farmers in most cases are the owners of the land. Labours are either hired or family labour (Bilal, 1998).

According to (Elamin, 2001) Khartoum State farmers are estimated at about 28701 farmers. Farmers of Bahri represent about 4461 farmers. Farmers of Khartoum and Omdurman are estimated at about 24220 farmers. It is known that the number of farmers in Khartoum must be less than the number of farmers of Omdurman. It means that the large number of farmers is found in Omdurman which has no official number.

4.2 Data collection

The study depends mainly on primary data and secondary data. The primary data were collected through questionnaires from farmers of Algazira slang in the north of Omdurman.

The secondary data were collected from various relevant sources such as past thesis, libraries, Ministry of Agriculture, Agricultural Offices ….etc.
The interviewers were interviewed during the period (August - October, 2005). Onion growers were asked about the cost of inputs of production so as to know factors that affected onion yield significantly.

The questionnaire is composed of 4 categories, they include:

1. Demographic characteristics of onion growers about age, marital status educational level of farmers and family size
2. Socio-economic characteristics of onion farmers like farm size, land tenure and credit.
3. Production of onion and productivity
4. Cost of onion cultivation which includes land preparation cost, input cost (labors cost, fertilizer cost, pesticides cost, irrigation cost, sacks and threads cost) and transportation cost.

The questionnaire is formulated in simple form so as to adequate illiterate farmers to achieve high level of respondents

As we could not find the actual number of farmers in the study area, the total number of farmers is estimated by the head Farmers Union about 800, therefore sample of 80 farmers is used to represent the whole population.

4.3 Data Analysis

Data is analyzed by using Descriptive Analysis, Crop Budget Analysis and the Linear Regression Model.

4.3.1 Descriptive Analysis

To achieve the objective of the study, the data collected the data is analyzed through 2 methods. They are descriptive analysis includes the tools, percentages which were used through out the study to describe the socio economic characteristics of onion growers (age, educational level, family size and farm size.
4.3.2. Crop Budget Analysis

It is used to assess the main cost items of onion production and to examine onion's profitability.

4.3.3. The Linear Regression Model

The linear regression model is used to estimate such functions that represent the model as best as possible.

The Microsoft programmed SPSS/PC is used for estimating the functions.

4.4. Model Specification

The model is specified by assuming that the exogenous (independent variables) influence the dependent variable.

To estimate the econometric model, the OLS estimation method is used by calculating regression equation that summarise and describes the relationship between set of variables. Under certain conditions, the OLS method is one of the most powerful and popular methods of regression analysis. The properties of OLS are that it is linear function, unbiased and has minimum variance.

In this study, there are 2 models show the degree of influence and level of significance between the dependent variable and independent variables.

The first model is the winter yield model which represent the winter season.
The model of winter onion yield is:
\[ \ln Y = b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 \]

Where:
- \( Y \) = Dependent variable (winter yield)
- \( b_1, b_2, b_3, b_4, b_5, b_6 \) = Standardized coefficients
- \( X_1 \) = Harvesting date
- \( X_2 \) = Land preparation cost (per feddan)
- \( X_3 \) = Fertilizer cost (per feddan)
- \( X_4 \) = Toxicity cost (per feddan)
- \( X_5 \) = Irrigation cost (per feddan)
- \( X_6 \) = Land rent (per feddan)

The model of autumn onion yield is:
\[ \ln Y = a_1 X_1 + a_2 X_2 + a_3 X_3 + a_4 X_4 + a_5 X_5 + a_6 X_6 \]

Where:
- \( Y \) = Dependent variable (autumn yield)
- \( a_1, a_2, a_3, a_4, a_5, a_6 \) = Standardized coefficients
- \( X_1 \) = Education
- \( X_2 \) = Cost of weeding (per feddan)
- \( X_3 \) = Land preparation cost (per feddan)
- \( X_4 \) = Fertilizer cost (per feddan)
- \( X_5 \) = Onion area
- \( X_6 \) = Land rent (per feddan)
CHAPTER FIVE
SOCIO-ECONOMIC ANALYSIS OF ONION FARMERS

The socio-economic characteristics of onion farmers have great effect on production process. Many writers argued about the socio-economic characteristics of farmers. Elamin (2001) found that onion farmers in Bahri Locality were more or less homogenous. The majority of them were at the productive age group 20-60 years. He indicated that the majority of farmers were married (77%). He stated that 91% of them were farming only.

Ali (1999) found that the farmers of onion in Shendi area were homogenous, almost shared the same characteristics.

Babiker (2000) found that farmers of potato were homogenous in Khartoum State about 65% of farmers shared the same social – economical and cultural practices.

Hamed (2000) stated that the statistical analysis of socio-economic characteristics of tomato farmers revealed that farmers were homogenous group.

Farmers socio-economic characteristics studied include age distribution, educational level, family size, martial status, land tenure and credit of onion. The yield which is taken in this chapter is the autumn yield because all farmers produce in autumn season.

5.1 Age distribution
The total number of onion farmers interviewed as a sample in the area of the study was 80 as shown in Table (5.1) about 61.3% of the farmers were at the age group less than 45 years. They are active and they can adopt new technology to improve yield. The average yield of this
category was 96 sacks /feddan. 38.8% of farmers were within the age group 45 years and above. They are experienced but they are lagers (adoption of new innovation and technology). The average yield of this category was 90 sacks /feddan. This reflects that younger farmers were more active and they can produce more.

Table (5.1): The Distribution of Onion Farmers According to their Ages.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Number of farmers</th>
<th>Percentage</th>
<th>Yield (sacks per feddan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 45 years</td>
<td>49</td>
<td>61.7%</td>
<td>96</td>
</tr>
<tr>
<td>45 years and above</td>
<td>31</td>
<td>38.3%</td>
<td>90</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Source field survey 2005

5.2 Educational level:

It is expected that informal farmers have positive influence in the production process. Education has important role on managerial ability and decision making. Table (5.2) showed that 18.7% of farmers were illiterate having has no sort of education at all. The average yield of this category was 80 sacks/feddan 36% of farmers were slightly illiterate they include farmers who had elementary schools and secondary schools. The average yield of this category was 99 sacks/ feddan. Farmers in this category produced more than the first category because they can adopt new innovations and easy to accept new ideas to increase yield while 10% of farmers were at universities and higher institutes. The average yield of this category was 95 sacks /feddan. The yield of this category was 95 sacks /feddan. The yield of this category is not so high this is attributed to the fact that farmers of this category take the agriculture as a
second occupation. They focus on other jobs rather than agriculture.

**Table (5.2): The Distribution of Onion Farmers According to their Educational Level.**

<table>
<thead>
<tr>
<th>Education level</th>
<th>Number of onion farmers</th>
<th>(%)</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>15</td>
<td>18.7</td>
<td>80</td>
</tr>
<tr>
<td>Slightly illiterate</td>
<td>57</td>
<td>72.0</td>
<td>99</td>
</tr>
<tr>
<td>High</td>
<td>8</td>
<td>10</td>
<td>95</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>80</strong></td>
<td><strong>100</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field survey (2005)

**5.3 Family size:**

The survey results showed that 77% of farmers were married. 40% of farmers families were composed of 1-5 persons, 50% were composed of 6-10 while 8.9% was composed of more than 10 persons. As shown in Tables (5.3 and 5.4) large family size might increase onion yield directly by the man power or indirectly by supporting the members and the farm in case of working outside the farm.

**Table (5.3): The Martial Status of Onion Farmers.**

<table>
<thead>
<tr>
<th>Martial status</th>
<th>No. of farmer</th>
<th>Total percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>61</td>
<td>77</td>
</tr>
<tr>
<td>Non married</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>Widow</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Source: Field survey (2005)
Table (5.4) The Distribution of Onion Farmers According to Family Size and the Yield of Onion.

<table>
<thead>
<tr>
<th>Family size</th>
<th>No. of farmers</th>
<th>(%)</th>
<th>Yield Sacks/fed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 5</td>
<td>33</td>
<td>41.3</td>
<td>84</td>
</tr>
<tr>
<td>6 – 10</td>
<td>40</td>
<td>50.0</td>
<td>106</td>
</tr>
<tr>
<td>More than 10</td>
<td>7</td>
<td>8.7</td>
<td>90</td>
</tr>
</tbody>
</table>

**Source:** field survey (2005)

The table above showed that family size affected yield of onion. The families whose members are composed of 1-5 persons produce about 84 sacks /feddan. It is relatively small yield and this is because the family members do not share in farm labouring. The families whose members are composed of 6-10 persons produce about 106 sacks/ feddan. It is relatively high yield. The members of these families shared in the farm labouring, so they increase yield.

The third category is the families whose members are more than 10 persons. The yield of onion in this category was 90 sacks /feddan. It is more than the yield of the first category and less than the yield of the second category. The members of these families were either married or work in other jobs rather than agriculture.

**5.4 Land tenure:**

The survey results showed that 37% of farmers in the study area owned their farms. Table (5.5) shows that the average yield of this category was 110 sacks /feddan. It is relatively high yield this is because the land owners can exploit the money in well preparing of the land in addition to improvement of cultural practices of the land so as to produce more. 40% of farmers were crop sharer. The average yield of this
category was 103 sacks /feddan. The yield was relatively good but it was lowered than the yield of the owners of the land.

The third category was the renters of the land. 23% of farmers were renters. The average yield of this category was about 87 sacks /feddan. It was relatively low yield this might be due to the lack of finance and the non usage of technical package.

Table (5.5): The Distribution of Onion Farmers According to the Land Tenure and the Yield of Onion

<table>
<thead>
<tr>
<th>Farm of land tenure</th>
<th>No. of farmers</th>
<th>Farmers (%)</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner</td>
<td>30</td>
<td>37.5</td>
<td>110</td>
</tr>
<tr>
<td>Crop sharer</td>
<td>32</td>
<td>40.0</td>
<td>103</td>
</tr>
<tr>
<td>Renters</td>
<td>18</td>
<td>22.5</td>
<td>87</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Source: field survey (2005)
CHAPTER SIX
ECONOMETRIC ANALYSIS

This chapter presents and discusses crop budget analysis and results of regression equations and correlations for autumn onion yield and winter onion yield.

6.1 Crop Budget Analysis

The crop budget analysis of onion is determined by calculating the average variable cost and the gross return.

6.1.1 The Analysis of Variable Cost of Production

The variable cost of production of onion is determined by calculating the sum of costs of the following items, cost of land preparation, labour cost, seeds cost, fertilizer cost, pesticides cost, irrigation cost, land rent cost, sacks and threads cost and transportation cost.

The cost items were calculated in order to determine the respective share of each item in the total cost of production and to determine the main cost items.

6.1.1.1 Land Preparation Cost

Farmers in the area of the study prepared the land before planting. Land preparation includes first harrowing, second harrowing and levelling. The tractor took about 3 hours for harrowing and levelling. The cost of one hour is 2000 SD/feddan. The average cost of land preparation is about 17183 SD/feddan representing 16.2 and 12% of the total variable cost of production of autumn onion and winter onion per feddan, respectively.
6.1.1.2 Labour Cost

The cost of labour includes:

i. Sowing cost

Onion farmers usually transplant the crop from nursery to the field after 45 days after seed scattering. The survey result shows that the cost of labour per feddan was about 10000 SD for both autumn onion and winter onion.

ii. Weeding

Weeding is conducted by traditional tool called Alnaggama. Farmers usually weed the land more than 2 times at autumn season because weeds affected the autumn crop more than the winter crop. The survey results show that the average cost of weeding in autumn season was about 7000 SD.

iii. The harvest

Onion takes about four months from the sowing date until the harvesting date. The survey results showed that labours who harvest the crop are either family labours or labours take wages in kind instead of cash.

The average cost of labour per feddan was about 17000 SD representing 16.2 and 10.6% of the total cost of production of autumn onion yield and winter onion yield, respectively.

6.1.1.3 The cost of inputs

i. Seeds

The type of onion grown in the study area is Saggai and Abu freiwa. The survey results revealed that the seed rate is about 7 – 10 pounds/feddan. Farmers buy onion seeds from north of Omdurman market. The survey results showed that average cost of seeds in both of
autumn season and winter season was about 9000 SD representing 8.5 and 6.4 of the total average cost of production for autumn onion yield and winter onion yield, respectively.

**ii. Pesticides**

Pesticides are used to control pest and diseases. Farmers showed that the main pesticides used in the study area are Melathion, Selicron, Folimat and Samsodine. The survey results showed that the amount of pesticides used by farmers is about ½ - 2 litre/feddan. The average cost of pesticides for autumn onion was about 3000 SD/feddan, representing 2.8% of the total cost of production of feddan while the average cost of pesticides for winter crop was about 4500 SD/feddan representing 3.2% of the total cost of production of feddan.

**iii. Fertilizer**

Farmers in the study area usually use Urea. The amount of Urea used in the area of the study is about 2 – 6 sacks feddan. The survey results showed that the average cost of fertilizer for both autumn onion and winter onion was about 9098 SD/feddan representing 8.7 and 6.4% of the total cost of production of the autumn onion and winter onion, respectively.

**iv. Irrigation**

Onion requires about 15 – 20 number of irrigations. In the first days onion is irrigated every 3 – 4 days, and then it needs a weekly irrigation. The survey result showed that the average cost of irrigation of autumn onion was about 4200 SD/feddan, representing 4% of the total cost of production of feddan. The average cost of irrigation of winter onion was about 6500 SD, representing 6.7% of the total cost of production.
6.1.1.4. Transportation cost

Onion is transported from the farm to markets by using camels and vehicles. The survey results showed that the average cost of transportation for autumn onion was about 17000 SD representing 16.2% of the total cost of production of feddan. The average cost of winter onion was about 27000 SD representing 16.1% of the total cost of production of feddan.

6.1.1.5. Land rent

Usually the land adjacent to the Nile is more expensive than the land away from the Nile. The survey results show that the average cost of land rent for both seasons was about 20000, representing 19 and 14.2% of the total cost of production of autumn onion and winter onion, respectively.

6.1.1.6. Sacks and Threads Costs

The costs of sacks and threads depend on the yield of the feddan. The survey results showed that the average cost of sacks and threads for autumn onion yield was about 17400 SD representing 16.6% of the total cost of production of feddan while the average cost of sacks and threads for winter season about 33000 representing 23.3% of the total cost of production of feddan.

6.1.2. The Total Variable Cost of Production

The total variable cost of production is the summation of the previous cost items. The total variable cost of the autumn yield was estimated at about 124698 SD/feddan while the total variable cost of the winter yield was estimated at about 141098 SD/feddan.
Crop Budget Analysis

Crop budget analysis is determined by calculating returns and profits of onion for both seasons as shown in Table (6.1).

**Table (6.1): The Cost of Onion Yield and the Average Price and Returns (Dinar /feddan)**

<table>
<thead>
<tr>
<th>Cost item</th>
<th>Autumn onion cost</th>
<th>% of total cost</th>
<th>Winter onion cost</th>
<th>% of total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land preparation</td>
<td>17000</td>
<td>16.2</td>
<td>17000</td>
<td>12.0</td>
</tr>
<tr>
<td>Labour</td>
<td>17000</td>
<td>16.2</td>
<td>15000</td>
<td>10.6</td>
</tr>
<tr>
<td>Seed</td>
<td>9000</td>
<td>8.5</td>
<td>9000</td>
<td>6.4</td>
</tr>
<tr>
<td>Pesticide</td>
<td>3000</td>
<td>2.8</td>
<td>4500</td>
<td>3.2</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>9098</td>
<td>8.7</td>
<td>9098</td>
<td>6.4</td>
</tr>
<tr>
<td>Irrigation</td>
<td>4200</td>
<td>4.0</td>
<td>6500</td>
<td>6.7</td>
</tr>
<tr>
<td>Transportation</td>
<td>17000</td>
<td>16.2</td>
<td>27000</td>
<td>16.1</td>
</tr>
<tr>
<td>Sacks and thread</td>
<td>17400</td>
<td>16.6</td>
<td>33000</td>
<td>23.3</td>
</tr>
<tr>
<td>Land rent</td>
<td>20000</td>
<td>19.1</td>
<td>20000</td>
<td>14.2</td>
</tr>
<tr>
<td>Total</td>
<td>124698</td>
<td></td>
<td>141098</td>
<td></td>
</tr>
<tr>
<td>Average price</td>
<td>6500</td>
<td></td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>Average yield</td>
<td>85 sacks</td>
<td></td>
<td>150 sacks</td>
<td>450000</td>
</tr>
<tr>
<td>Profit</td>
<td>447802</td>
<td></td>
<td>308902</td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Crop Budget Analysis

6.1.3. Returns

The gross return was obtained by multiplying the average yield by average price. The average return obtained was 552500 SD for autumn onion while the average return of winter onion was 450000 SD. The gross return recorded for autumn onion was higher than the gross return of
winter onion although onion's yield was high, this is due to the lower price of the autumn onion and the large supply of the winter onion.

6.1.4. Profitability

The profitability of onion is obtained by deducting total cost from return. The survey crop budget revealed that the profitability of onion in autumn season was 447802 SD while profitability of winter onion was about 308902 SD. Autumn onion is more profitable than winter onion, this is because in autumn season onion's price is higher than in winter season because of the less amount supplied from the crop.

6.2 Econometric analysis

The econometric analysis presents and discusses the result of regression equations and correlation for winter onion model and autumn onion model. The results of regression analysis of winter onion yield are explained in Table (6.2).

<table>
<thead>
<tr>
<th>Variable number</th>
<th>Independent variables</th>
<th>Standardized coefficient</th>
<th>T value</th>
<th>Level of significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>X₁</td>
<td>Pesticides cost</td>
<td>.458</td>
<td>2.253</td>
<td>.035</td>
</tr>
<tr>
<td>X₂</td>
<td>Irrigation cost</td>
<td>.264</td>
<td>1.789</td>
<td>.124</td>
</tr>
<tr>
<td>X₃</td>
<td>Land preparation cost</td>
<td>.875</td>
<td>4.453</td>
<td>.004</td>
</tr>
<tr>
<td>X₄</td>
<td>Land rent</td>
<td>.058</td>
<td>.279</td>
<td>.790</td>
</tr>
<tr>
<td>X₅</td>
<td>Fertilizer cost</td>
<td>-.516</td>
<td>-2.900</td>
<td>.027</td>
</tr>
<tr>
<td>X₆</td>
<td>Harvesting date</td>
<td>-.779</td>
<td>-4.333</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Source: Regression Analysis

$R^2 = .782$

F value = 8.18

Level of significant 0.11
The winter onion yield regression equation is:
\[ \ln Y = -11.463 + 0.458 \ln X_1 - 0.264 \ln X_2 + 0.875 \ln X_3 + 0.058 \ln X_4 - 0.516 \ln X_5 - 0.779 \ln X_6 \]

Where:
\[ Y \] = winter onion yield
\[ X_1 \] = Pesticide cost
\[ X_2 \] = Irrigation cost
\[ X_3 \] = Land preparation cost
\[ X_4 \] = Land rent
\[ X_5 \] = Fertilizer cost
\[ X_6 \] = Harvesting date

Table (6.2) shows the results of winter onion. The adjusted R² is 0.78 which means that 78% of the variation in the winter yield is explained by the model while 22% of variation in yield is explained by other factors. The F value is 8.18 indicates the overall fit of the equation. The T values are shown in Table (6.1) indicates the fitness of individual variables.

The coefficients of exogenous variables in the model represent elastic ties, which indicate the change in yield relative to change in input.

Table (6.2) shows that the coefficient of pesticide cost has positive significant. It has direct effect on yield which means that 1% increase in pesticide cost will lead to increase yield by 45%. This is because the pesticides used in the study area are often bad (out of date) and good pesticides are expensive. The winter onion is affected by pests and diseases, this fact supported the result of Elamin (2001).

Also the table shows that the coefficient of irrigation cost has negative sign (-.264) and significant. It means that an increased 1% of irrigation cost will lead to 26% decease in the winter yield; this is because
if the irrigation cost is high, farmers will reduce the optimum number of irrigation and this has negative effect on yield. Winter onion needs sufficient irrigation about 16-18 number of irrigation, which lead to increase yield this fact supported with (1999)

Table (6.2) also shows that coefficient of land preparation cost has positive sign (-.875) and highly significant. There is direct relation between land preparation and onion yield. This means that 1% increase in land preparation cost will lead to increase the yield by 87%. This is because the well preparation of the land has positive effect on the yield. The table (6.2) also shows that coefficient of land rent has positive sign (.58) and non significant. There is direct relation between winter onion and land rent which means that 1% increase in land rent cost will lead to increase the yield by 58%, this is because as farmers show that the land adjacent to the Nile are more expensive than the lands away from Nile, they are more fertile and more productive.

Table (6.2) also shows that the coefficient of fertilizer cost has negative sign (-.516) and significant which implies that 1% increase in fertilizer cost will lead to increase the winter yield by 51%, this means that when the cost of fertilizer increases, farmers reduce the optimum quantities of fertilizer, which has negative effect on yield.

The table also shows that the coefficient of harvesting date has negative sign (-.779) and highly significant which means that 1% delay of harvesting date will lead to decreasing yield by 77%. This is because if the crop is delayed from the optimum date of harvesting, this will lead to pest and insect infestation.
6.3 Statistical Test of Winter Onion

In this section, regression results are shown for the winter onion yield.

6.3.1 The $R^2$

It is the coefficient of multiple determinations. It is the percentage variation in the dependent variable explained by the regression portion of the equation (Suliman, 2001). It expresses as how much of the variation in the dependent variable is explained by independent variables in the regression equations. It is calculated automatically by computer by using SPSS programme.

The estimated winter yield regression equation shown in Table (6.2) the adjusted $R^2$ is 78% which means that 78% of the variation in winter onion yield is explained by the variation in the independent variables. The coefficients of independent variable in the model represent elasticity.

6.3.2 The T-test for Winter Onion Yield

The T tests are related to the individual coefficient in the regression model. It is used to test whether each individual coefficient is significantly different from zero or not. T values are calculated by the division of regression coefficient of any variable by its standard error. The T values calculated for winter onion is shown in Table (6.2).

6.3.3 The F test of Winter Onion Yield

It is used to test the whole regression model whether the equation hold or not. As shown in Table (6.2) the F value of the winter onion is 8.18 which is significant at level 0.01.
6.3.4 Econometric Test of Winter Onion (Multi-co linearity test):

The inter correlation of variable for the winter onion is shown in Table (6.3). It indicates that there is no multi-co linearity between variables.

Table (6.3): The Matrix of Inter Correlation of Winter Onion.

<table>
<thead>
<tr>
<th></th>
<th>X₁</th>
<th>X₂</th>
<th>X₃</th>
<th>X₄</th>
<th>X₅</th>
<th>X₆</th>
</tr>
</thead>
<tbody>
<tr>
<td>X₁</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₂</td>
<td></td>
<td>0.055</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₃</td>
<td></td>
<td>0.29</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₄</td>
<td></td>
<td>0.37</td>
<td>0.108</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X₅</td>
<td></td>
<td>-0.024</td>
<td>0.226</td>
<td>-0.016</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>X₆</td>
<td></td>
<td>-0.216</td>
<td>0.086</td>
<td>-0.210</td>
<td>-0.030</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Source: Regression Analysis Results.

Where:

X₁ = Pesticide cost  
X₂ = Irrigation cost  
X₃ = Land preparation cost  
X₄ = Land rent  
X₅ = Fertilizer cost  
X₆ = Harvesting date

Among the variables included in the model, 4 of them namely, pesticide cost, land preparation cost, fertilizer cost and harvesting date are statistically significant at 1% level.
### Table (6.4): Regression Results of Autumn Onion Yield.

<table>
<thead>
<tr>
<th>Variable number</th>
<th>Independent variables</th>
<th>Standardized coefficient</th>
<th>T value</th>
<th>Level of significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>X₁</td>
<td>Education</td>
<td>.637</td>
<td>3.971</td>
<td>.001</td>
</tr>
<tr>
<td>X₂</td>
<td>Weeding cost</td>
<td>.443</td>
<td>2.709</td>
<td>.015</td>
</tr>
<tr>
<td>X₃</td>
<td>Land preparation cost</td>
<td>.404</td>
<td>2.722</td>
<td>.015</td>
</tr>
<tr>
<td>X₄</td>
<td>Fertilizer cost</td>
<td>-.343</td>
<td>-</td>
<td>.029</td>
</tr>
<tr>
<td>X₅</td>
<td>Onion area</td>
<td>-.364</td>
<td>-</td>
<td>.052</td>
</tr>
<tr>
<td>X₆</td>
<td>Land rent</td>
<td>-.337</td>
<td>-</td>
<td>.045</td>
</tr>
</tbody>
</table>

Source: Regression analysis results.

\[
R^2 = 60 \\
F \text{ value} = 6.15 \\
\text{Level of significance} = .001
\]

The autumn onion yield regression equation is:

\[
Y = .637 \times X_1 + .443 \times X_2 + .404 \times X_3 + .343 \times X_4 + .364 \times X_5 - .337 \times X_6
\]

Where:

- \( X_1 \) = Education
- \( X_2 \) = Cost of weeding
- \( X_3 \) = Land preparation cost
- \( X_4 \) = Fertilizer cost
- \( X_5 \) = Onion area
- \( X_6 \) = Land rent
Table (6.4) shows the results of autumn onion. The adjusted $R^2$ is 60 which means that 60% of the variation in autumn onion yield is explained by the model while 40% of variation in yield is explained by other factors. The F value is 6.15 indicating the overall fit of the equation, while the T values are shown in the table.

The T test is related to individual coefficient in the regression model. The T values calculated for the autumn onion are shown in Table (6.4).

The coefficients of independent variables in the model represent the changes in the output due to the changes in inputs.

Table (6.4) shows that the coefficient of education has a positive sign (.637) and highly significant which means that 1 unit increase in education level will lead to an increase in yield by .63. Education increases knowledge of the farmers of using optimum amounts of inputs to increase yield.

The table also shows that the coefficient of cost of weeding has a positive sign (.44) which means that 1 unit increase in weeding cost will lead to an increase in yield by .44 and affects autumn yield significantly. High cost of weeding in autumn season means cleaning the land from weeds which are grown as a result of rainfall and this has a positive effect on yield.

Table (6.4) also shows that land preparation cost has a positive sign (.404) which means that 1 unit increase in land preparation cost will lead to an increase in yield by .40 units. Well-prepared land is resulted from high cost of land preparation which has a positive effect on yield.

Table (6.4) also shows that fertilizer cost has a negative sign (-.343) and significant. It means that 1 unit increase in fertilizer cost will lead to a decrease in yield by .34 units. This is attributed to the fact that when fertilizer cost increases, farmers will reduce the amount used from fertilizer and this has a negative effect on yield.
Table (6.4) also shows that onion area has a negative sign (-.364) and affects the yield significantly. This means 1 unit increase in onion area will lead to reduce the yield by 0.36 units. This is because (as farmers show) the farmers who have large area of onion use small amounts of inputs to the whole area while the farmer who has one or two feddan can use the optimum amount of inputs. So the yield of big area is less than the yield of small area.

Table (6.4) shows that there is a negative relation between onion yield and land rent (-.337) and significant. It means that 1 unit increase in land rent cost will lead to decrease the yield by 0.33 units this is because farmers who rent the land can not own sufficient cash for doing different cultural practices, so they will reduce the optimum practices for the land which has negative effect on yield.

6.4 Econometric test of autumn onion: (Multi co linearity test)

The inter correlation of independent variables is shown in Table (6.4). The table indicates that there is no multi co linearity between variables.

Table (6.5) the Matrix of Inter Correlation of Autumn Onion.

<table>
<thead>
<tr>
<th></th>
<th>X_1</th>
<th>X_2</th>
<th>X_3</th>
<th>X_4</th>
<th>X_5</th>
<th>X_6</th>
</tr>
</thead>
<tbody>
<tr>
<td>X_1</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X_2</td>
<td>.179</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X_3</td>
<td>.087</td>
<td>.096</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X_4</td>
<td>.226</td>
<td>.244</td>
<td>-.019</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X_5</td>
<td>.091</td>
<td>-.027</td>
<td>.119</td>
<td>-.023</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>X_6</td>
<td>.092</td>
<td>.173</td>
<td>-.266</td>
<td>.043</td>
<td>.041</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Source: Regression analysis results.
Where:

\( X_1 = \) Education
\( X_2 = \) Cost of weeding
\( X_3 = \) Land preparation cost
\( X_4 = \) Fertilizer cost
\( X_5 = \) Onion area
\( X_6 = \) Land rent

6.5. Autumn Onion Yield Discussion:

As negative to what is hypothesized the yield of onion in autumn season is more profitable than the winter season.

There is direct negative relation between the yield of onion and Fertilizer cost, this fact support the hypothesis of fertilizer as a main cost item.

Among variables, five of them namely: (education, cost of weeding, land preparation cost, fertilizer cost and land rent cost) are significant.

As negative to what Ali (1990) founds, there is positive relation between education level and onion's yield.

Autumn onion is affected by weeds which resulted in the decrease of yield.
CHAPTER SEVEN
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1 Summary

Khartoum State is considered as a main site for growing onion in the Sudan. It plays a major role in onion production of the country as a whole.

The study was conducted in Omdurman Locality (Khartoum State) in season 2004 – 2005.

The main objective of the study is to study the economics of onion production in Khartoum State taking Algazira slang as a case study of onion production in the state. Other objectives of the study included investigation of socio-economic characteristics of the farmers in area of the study, estimation of total variable cost of production and determination of the main cost items, calculations returns and profitability of onion for both winter onion and autumn onion and investigate factors affecting yield of onion grown in autumn season and winter season.

Primary data were collected by structured questionnaire of 80 farmers of Algazira slang. Secondary data was collected from relevant sources.

The descriptive statistical analysis of Socio-economic Characteristics revealed that farmers were homogenous. About 61% of farmers were within the active age group (less than 45 years). About 18% of farmers were illiterate had no sort of education and 72% of farmers had primary and secondary education.
Agriculture was the main occupation of the farmers. 77% of the farmers were married and 37% of farmers' family sizes were ranging between 6 – 10 members.

Onion price is fluctuating not only among seasons but also within the same season. In season 2004 – 2005, onion price ranged between 2000 – 10000 SD/feddan. The analysis of cost structure showed that the average total cost of production per feddan of the autumn season was 124698 SD while the average cost of production per feddan of winter season was 141098 SD.

The profitability of onion crop was recorded high in autumn season compared to winter season. Regression analysis revealed that autumn onion yield is affected by labor cost, land preparation cost and weeding cost, while winter onion yield was affected by pests and disease cost, fertilizer cost and harvesting date.

### 7.2 Conclusions

The study concluded that in Algazira slang there is difference between the yield of autumn onion and winter onion.

Farmers in the study area are homogenous group since most of them share the same socio-economic characteristics.

The average cost of winter onion yield is more than the average cost of autumn onion yield.

The winter onion yield is more profitable than the autumn yield.
7.3 Recommendations

The following recommendations would be helpful for improving onion yield in the area of the study:

1. Irrigation problem that represented the essential cost, must be solved by providing sufficient quantities of fuel to farmers and spare parts.

2. Input cost was high, so there should be reasonable price of them.

3. Availing good quality of seeds so as to obtain good production.

4. Establishing onion dehydration factory and encouragement of export.

5. Strengthen the agricultural extension programmed for farmers.

6. The pesticides used by farmers are out of date so therefore farmers should have to be provided recommended pesticides of suitable prices.

7. Availing recommended herbicides to reduce the effects of weeds on onion growth, thus improving onion productivity.
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