Economics of Onion Production in the Northern Part of Omdurman Province, Khartoum State

Hag Hamed Abdelaziz

1. Department of Agricultural Economics, Faculty of Agricultural Studies, Sudan University of Science and Technology.

Abstract

The study was conducted (i) to evaluate the main constraints affecting onion production, (ii) to determine the most important cost items in onion production, and (iii) to determine the break-even point and the profitability of onion. The study used primary data collected from the farmers in the agricultural season 2003/04. The main findings of the study indicated that irrigation, fertilizer and family size variables were highly significant and the rest of the variables were insignificant but positively affected onion production. The analysis of the cost items indicated that the costs of land preparation, fertilizer, labour and irrigation were the most important cost items in onion production. The analysis of the break-even point pointed out that onion crop was profitable and this was reflected by the considerable difference between the average yield per feddan and the break-even point.

For improvement of onion production and raising the income of the farmers in the study area, the study recommended the provision of inputs at the proper time and reasonable prices and good storage facilities and these can be through farmers' agricultural cooperative societies.

Keywords: Onion Production; Northern Part of Omdurman Province; Economics; Main Constraints; Cost Items; Break Even Point.

Introduction

Onion is produced in almost all regions in the Sudan with the exception of the Southern Region. Table (1) shows the area and production of onion in the Sudan during the period 2003-2008.

In Khartoum State, onion is produced in Khartoum, River Nile and Omdurman Province. The production of onion in the northern part of Omdurman Province is concentrated in the Gezira Slang, El-Sarorab, El-
Abdelaziz

Sheikh El-Tayeb, Goz Nafessa, El-Huwashab, El-Hegair, Abo Doam and El-Hageeba (Adam, 2005). These areas are considered as well known production centres for onion production and the total grown area in the region is estimated at 4000 feddans (State Ministry of Agriculture and Animal Wealth, Khartoum State, 2004).

Table 1: Area (000 feddan) and production (1000 MT) in Sudan during the period 2003-2008.

<table>
<thead>
<tr>
<th>Year</th>
<th>Area</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>117.4</td>
<td>971</td>
</tr>
<tr>
<td>2004</td>
<td>127</td>
<td>1016</td>
</tr>
<tr>
<td>2005</td>
<td>110</td>
<td>880</td>
</tr>
<tr>
<td>2006</td>
<td>112.6</td>
<td>900.8</td>
</tr>
<tr>
<td>2007</td>
<td>115</td>
<td>920</td>
</tr>
<tr>
<td>2008</td>
<td>117.3</td>
<td>1238.4</td>
</tr>
</tbody>
</table>


There are two sources of irrigation for onion production in the study area: the first source is the River Nile using small pumps (3" to 4") and the second source is the underground water. There are two seasons for growing onion in the area; the first season starts from mid-August to December and the second one from January to June. Onion crop was chosen for the study because it is considered as the most important crop in the area and representing the main income generating activity.

Despite the importance of the crop in the study area, the crop is facing many constraints including high cost of production, unavailability of inputs, low prices, and lack of credit and storage facilities.

The main objective of this paper was to study the economics of onion production in the area. Specifically, it aimed (i) to evaluate the main constraints affecting onion production, (ii) to determine the most important cost items in onion production, and (iii) to determine the break-even point and profitability of onion.

Materials and Methods

Cross sectional data on socioeconomic characteristics of farmers, inputs and output of onion crop were collected by means of a questionnaire. A sample of 80 farmers was selected randomly in the study area in the season 2003/04. The effects of the factors on the output of
onion were studied through input-output relationship. A Cobb-Douglas production function of the following form was specified:

\[ Y = A X^b_i e^{u} \]

Where:
- \( Y \) = the dependent variable (output)
- \( X_i \) = the independent (explanatory) variables
- \( b_i \) = regression coefficients to be estimated
- \( e^{u} \) = disturbance term or disturbance error assumed to be randomly distributed with zero mean and a unit variance.

Many economists recommended the use of Cobb-Douglas production function for the analysis of farm data (El Feil, 1993). The generalized transformed Cobb-Douglas function:

\[ \log Y = \log A + \sum_{i=1}^{n} b_i \log x_i + \sum_{j=1}^{m} b_j x_j \]

Where:
- \( i = 1, \ldots, n \)
- \( j = 1, \ldots, n \)
- \( \sum_{i=1}^{n} b_i \log x_i \) = continuous variables in the log-form
- \( \sum_{j=1}^{m} b_j x_j \) = dummy variables

The model was specified as follows:

\[ \log \text{OP} = \log b_0 + b_1 \log \text{Seds} + b_2 \log \text{Fert} + b_3 \log \text{Irr} + b_4 \log \text{Fam} + b_5 \log \text{Age} + b_6 \log \text{Sow} + b_7 \log \text{Har} + b_8 \log \text{Pest} + b_9 \log \text{Herb} + b_8 \log \text{Edu.} \]

Where:
- \( \text{OP} \) = onion production in ton
- \( \text{Seds} \) = quantity of seeds per hectare
- \( \text{Fert} \) = quantity of fertilizers used in sacks per hectare
- \( \text{Irr} \) = number of irrigations
- \( \text{Fam} \) = family size
- \( \text{Age} \) = age
- \( \text{Sow} \) = sowing date (optimum versus not optimum)
- \( \text{Har} \) = harvesting time (optimum versus not optimum)
- \( \text{Pest} \) = dummy variable indicating the use of Swedan or Malathion pesticide
- \( \text{Herb} \) = herbicide, dummy variable (Stomp versus Goal),
- \( \text{Edu} \) = dummy variable (literate versus illiterate)
The variables in the model

The intercept
This coefficient sums up the effect of a number of variables that are not easy to incorporate in the model such as management factor, weather conditions, land and labour qualities, etc. In applied research, no major significance is normally attached to this term because there are relatively few instances where the intercept has an obvious economic interpretation (Johnson et al., 1987). Moreover, the estimation of the intercept term in the Cobb-Douglas production function is biased (Kennedy, 1985).

Seeds
This variable was measured in pounds per feddan. The majority of the farmers in the study area preferred direct seeding to transplanting because direct seeding results in higher yields and 20 to 30 day earlier crop compared to transplanting (Adam, 2005).

Fertilizer
It was measured in sacks per feddan. Hassan and Ayoub (1978) reported that raising the level of nitrogen gave a highly significant increase in total yield and average bulb size and reduced the percentage of bolting. The fertilizer levels used in developing countries are very low relative to the recommended ones (Velck, 1991). This is due to lack of credit, lack of knowledge and unavailability of the fertilizers themselves.

Sowing date
The best time for planting depends on the locality, type of onion and method of planting. Early sowing in August and September increases the yield, whereas, late sowing decreases the yields, average bulb size and weight markedly. The sowing date was considered as a dummy variable in the model.

Irrigation
This variable was measured as the number of irrigations given to the crop during the season. The number of irrigations assumed to affect onion yield. Zahalan (1986) reported that the irrigation shortage is the main limiting factor of crop production in the Sudan. Pumping from the Nile provides irrigation water in the study area and it is costly due to the high cost of spare parts and fuel (Abdelaziz, 1999).
Harvesting time
The late harvesting is known to cause reduction in the output of almost all field crops. The variable was treated as a dummy, i.e. optimum harvesting versus not optimum.

Pesticides
The farmers in the study area used two types of pesticides, namely Swedan and Malathion. The variable was treated as dummy variable, i.e. Swedan, which was the common versus Malathion.

Herbicides
The farmers in the study area in the past used to remove the weeds in onion by repeated hand weedings, which was a labour intensive operation and expensive and this was substituted by herbicides. The farmers used two types of herbicides, which were Stomp and Goal. The variable was treated as a dummy variable, i.e. Stomp, which was the common versus Goal.

Education
The level of education is assumed to have a significant effect on the output of agricultural crops. The better educated farmer not only has more knowledge to alternative enterprises and techniques than his uneducated neighbour but also has more confidence in his own judgment and feel less need for the approval of others (Upton, 1979). Gladwin (1992) stated that the major production constraints in the developing countries is the lack of knowledge about the importance of certain modern inputs, which is attributed among other reasons to the farmer’s educational level. The variable was treated as a dummy variable, i.e. those who received any kind of education versus those who did not receive any kind of education.

Family size
Family members given their educational level, income, social status and labour force affect the way in which the farm is managed and operations are conducted (Mohamed, 1997). The family of the farmer is an important source of the labour force in the study area (Adam, 2005). The variable was treated in the model as a continuous variable.

Age
A farmer’s age is expected to have influence on productivity and output of an individual as it affects the mental and manual abilities. Abd Elrahim (1994) found that farmer’s age has a negative effect on project
participants and this is consistent with the adoption theory that young farmers tend to be more innovative. Ali (1990) concluded that there is a positive relationship between farmer’s age and productivities up to a certain level beyond which the negative relationship will replace the positive one and he attributed this negative relationship to the decline in mental and physical abilities as one becomes old. The variable was treated in the model as a continuous variable.

Results and Discussion

Tables (2) and (3) present the regression coefficients and the statistics of onion production function.

Table 2: Regression coefficients and statistics of onion production function

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>T-value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.375</td>
<td>14.885</td>
<td>0.000</td>
</tr>
<tr>
<td>Seeds</td>
<td>0.030</td>
<td>0.013</td>
<td>0.450</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>0.100</td>
<td>1.941</td>
<td>0.056</td>
</tr>
<tr>
<td>Sowing date</td>
<td>0.100</td>
<td>4.403</td>
<td>0.000</td>
</tr>
<tr>
<td>Irrigation</td>
<td>0.200</td>
<td>4.180</td>
<td>0.000</td>
</tr>
<tr>
<td>Type of pesticide</td>
<td>0.030</td>
<td>2.244</td>
<td>0.028</td>
</tr>
<tr>
<td>Type of herbicide</td>
<td>0.010</td>
<td>0.857</td>
<td>0.394</td>
</tr>
<tr>
<td>Harvesting time</td>
<td>0.020</td>
<td>1.439</td>
<td>0.155</td>
</tr>
<tr>
<td>Family size</td>
<td>0.100</td>
<td>4.531</td>
<td>0.000</td>
</tr>
<tr>
<td>Education level</td>
<td>0.010</td>
<td>1.254</td>
<td>0.214</td>
</tr>
<tr>
<td>Age</td>
<td>0.100</td>
<td>1.254</td>
<td>0.214</td>
</tr>
</tbody>
</table>

R-square = 0.87

Table 3: Analysis of variance (ANova)

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Sum of square</th>
<th>Degrees of freedom</th>
<th>Means of square</th>
<th>F-value</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>0.848</td>
<td>10</td>
<td>0.08479</td>
<td>45.97</td>
<td>0.01</td>
</tr>
<tr>
<td>Residual</td>
<td>0.127</td>
<td>69</td>
<td>0.001844</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0.975</td>
<td>79</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tables (2) and (3) show that the production function used provided very good fits to the data according to the high R-square and F-value. The coefficients of the estimated parameters have the expected signs according to the economic theory. The irrigation variable was
highly significant ($P < 0.01$) indicating as expected before the importance of irrigation in onion production. The number of irrigations applied by the farmers was less than the recommended one due to high costs of fuel and spare parts. The fertilizer variable was significant ($P < 0.05$) reflecting the importance of fertilizer in onion production. Farmers used amount of fertilizers less than the recommended one due to high costs and unavailability of the fertilizers at the appropriate time. The family size variable was highly significant ($P < 0.01$) and this showed that onion is a laborious crop. The sowing date and type of pesticide were significant and greatly affected onion production. The rest of the variables of the model affected onion production because they had positive signs but they were insignificant at any reasonable level of significance.

Table (4) revealed that the cost of land preparation (16.53%), the cost of fertilizers (16.37%), the cost of labour (12.79%), and the cost of irrigation (10.77%) were the most important cost items in onion production.

### Table 4: Cost of onion production per feddan (SDG) in the study area

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (SDG)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land preparation</td>
<td>222.49</td>
<td>16.53</td>
</tr>
<tr>
<td>Transplanting</td>
<td>75.07</td>
<td>5.58</td>
</tr>
<tr>
<td>Irrigation</td>
<td>145.02</td>
<td>10.77</td>
</tr>
<tr>
<td>Harvesting</td>
<td>80.92</td>
<td>6.01</td>
</tr>
<tr>
<td>Seeds</td>
<td>82.98</td>
<td>6.16</td>
</tr>
<tr>
<td>Fertilizers</td>
<td>220.37</td>
<td>16.37</td>
</tr>
<tr>
<td>Pesticides</td>
<td>36.15</td>
<td>2.69</td>
</tr>
<tr>
<td>Herbicides</td>
<td>62.64</td>
<td>4.65</td>
</tr>
<tr>
<td>Labour</td>
<td>135.82</td>
<td>12.79</td>
</tr>
<tr>
<td>Total cost</td>
<td>1061.45</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2003/04

For calculating the break-even point and profitability of onion, the following formula was used:

\[
\text{Break Even Point (BEP)} = \frac{\text{Total cost of production}}{\text{Price per unit of yield}}
\]

\[
= \frac{1061.45}{43.05} = 24.66 \text{ sacks}
\]
The average yield per feddan exceeded the break-even point by 70.88 sacks/feddan. The percentage share of the break-even point of the average onion yield was

\[ \frac{24.66 \times 100}{95.54} = 25.81\% \]

**Conclusions**

The Cobb-Douglas production function adequately modeled the input-output relationship for onion production in the study area. The findings were consistent with the expectations and the economic theory. The coefficients of irrigation and fertilizer were highly significant indicating that they were used in amounts less than recommended due to their costs. The variable of the family size was also highly significant because onion needs intensive labour for different operations. The rest of the variables in the model were insignificant but positively affected onion production. The analysis of the cost items showed that the costs of land preparation, fertilizer, labour and irrigation were the most important cost items in onion production. The break-even point analysis revealed that onion is a profitable crop in the study area and this was reflected by the considerable difference between the average yield per feddan and the break-even point.

**References**


اقتصاديات إنتاج البصل في الجزء الشمالي لمحافظة إمدرمان - ولاية الخرطوم

حاج حمد عبدالعزيزة

قسم الاقتصاد الزراعي - كلية الدراسات الزراعية - جامعة السودان للعلوم والتكنولوجيا،
السودان.

موجز البحث

أجريت الدراسة بغرض التقييم الاقتصادي للعوامل التي تؤثر على إنتاج البصل وتحديد أهم بنود تكلفة الانتاج وذلك في موسم 2003/2004م.

اشتهرت نتائج الدراسة إلى أن الري والأسمادة وحجم الأسرة من أهم العوامل التي تؤثر في الإنتاج، بينما أوضحت الدراسة أن أهم بنود تكلفة البصل تشمل تحضير الأرض، الأسمادة، العمالة والري. أوصت الدراسة بتوفير مدخلات الانتاج في الأوقات المناسبة وبالأسعار المعقولة وتوفر خدمات التخزين وذلك من خلال قيام جمعيات تعاونية زراعية.

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