Economic Analysis of Rice Production in Akre city, Northern Region of Iraq

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ABSTRACT—Rice is one of the most important crops that consumed as a health food and basic food for more than half the world's population and play is an important source of employment and reducing poverty in the Iraq's economy. Rice production is one of the important grain crops and ranks second after wheat in terms of importance. The main objective of this study is to analyze and estimate the production function of the local rice crop in addition to the effects of inputs use, socio-demographic and economic factors of farmers on yields in Akre district of the Northern region of Iraq. To achieve this goal the data has been gathered by using (face-to-face) questionnaire with 169 rice producers in the study area. The Cobb-Douglas Production Function is employed to assess the effects of various inputs such as; seed, irrigation, fertilizer, Herbicide and Farm size. The result was revealed that that the coefficient for farm size, fertilizer, and herbicide were found statistically significant at 1 % level although, Farmers in the study area are faced with constraints such as lack of access to finance, poor storage facilities and the high cost of agrochemicals. The study recommended that credit facilities should be given to rice producers in the area so as to increase output and policy interventions aimed at protecting local producers should be put in place.

Keywords —Production function, Local rice, Akre city, Iraq.

1 INTRODUCTION

Globally, rice is a major food crop and an old crop consumed as healthy and staple food by more than half of the world population. Consumed by more than 4.8 billion people in 176 countries [1]. The history of rice cultivation before the 1500 years ago was probably introduced into the eastern parts of Africa when sea trade between East African and India was thriving. Portuguese dealers presented Indian rice or paddy either directly from India or from East Africa and Madagascar into The Senegal, Gambia, Guinea-Bissau, and Sierra Leone. Asian rice established well in many parts of West Africa, spreading rapidly into regions where the indigenous African rice (O. glaberrima Stud) was being planted also Asian name called Oryza sativa L.[2, 3].

Rice cultivation is the major activity and source of income for millions of households around the globe. Several countries highly dependent on rice are Asia and Africa as a source of foreign exchange earnings and government income [4]. Rice crop is the second largest produced cereal after wheat in the world it is a crop that cuts across regional, cultural, religious, and national also international boundaries with very high demand. Rice is grown and harvested on every continent except Antarctica [4], where conditions make its growth impossible. Rice production is geographically concentrated in Western and Eastern Asia. Asian countries (China, India, Vietnam, Indonesia, and Bangladesh) are the biggest rice producers, accounting for 92% of the world's production and consumption of rice [5]. More than 661 million tons of rice crops are produced annually around the world [6]. Rice cultivation area and production in Iraq have been changed last 15 years. Production of rice paddy

was increased from 60,000 tons to 393,000 tons from 2000 to 2008. In this period, the rice production have been changing and increased return back to increase of water for irrigation, increased with respect to irrigation opportunity and rainfall. Water from Euphrates (Furat) river comes from northeastern of Turkey, which provides nearly 90% of the total original flow. Also from 2007 to 2011, the production of rice was getting decrease again from 393,000 to 155,829 tons. The reasons of this decreased trend are lack of water for irrigation and economic crisis in the country. Rice cultivation was technically different from another crop, need more water for irrigation. In last 2 years production has increasing again, due to increase the water in rainfall [15].

The main objective of this study is to analyze and estimate the production function of the local rice crop focusing on the effects of inputs use and socio-demographic and economic factors of farmers on yields.

2. MATERIAL AND METHODS

A. STUDY AREA AND DATA COLLECTION

In this study, Rice growers were surveyed in Bjeel, Dinarta, Grdasen, of Akre District in the Northern Region of Iraq. Data were collected from the randomly selected 169 rice farmers by using a face to face survey in the 2015 production year. In the survey, respondents were asked questions surrounding the matters relating to the production characteristics, including measures such as farm size , type of ownership, commodity yields, rice varieties, amount and cost of using fertilizer, using chemical herbicide for plant protection, water sources and land tenure; farmer characteristics such as gender, age, farm experience and educational level… etc. Farmers profit from rice production estimated as:

II = TR – TC

Where;

TR = P*Q

TC = VC + FC

Where,

TC = Total cost

VC = variable cost

FC = fixed cost

B. DATA ANALYSIS

Data in this study have been analyzed by using Cobb-Douglas Production function that provides a plausible structure for the technical relationship between average rice yields and input use such as fertilizer and pesticide application, labor costs, irrigation, and socio-demographic characteristic of farmers such as farm sizes, age, and education of farmers.

Cobb-Douglas production function has been widely used in most agricultural researchers because of its simplicity. By developing the function in terms of the number of inputs, the function will be transformed to:

$$Y = \alpha X_1^{\beta 1} X_2^{\beta 2} X_3^{\beta 3} X_4^{\beta 4} X_5^{\beta 5} \varepsilon$$

In the function above, Y is the yield; Xi the production inputs with positive values, ε is the intercept and βi is the inputs elasticities. This type of function with any number of inputs may be changed to a logarithmic equation. The above

mentioned function has nonlinear form and its logarithmic form as shown below was used to make it linear:

$$LnY = \beta_0 + \sum_{i=1}^{n} Ln\beta_i X_i + \varepsilon$$

$$LnY = \beta_0 + \beta_1 LnX_1 + \beta_2 LnX_2 + \beta_3 LnX_3 + \beta_4 LnX_4 + \beta_5 LnX_5 + \varepsilon$$

Where

Y= Rice output (kg)

X_1 = Quantity of fertilizer (kg/acre)

X_2= Quantity of herbicides (Lt/acre)

X_3 = Experiences (years)

X_4 =Age (years)

X_5 =Farm size (Acre)

3. RESULT AND DISCUSSION

Table 1 showed the socio-demographic and economics characteristics of farmers in the study area. According to the field survey, the rice producers in the study area are dominated by the male which accounts for 100% of the respondents indicating that men who usually are the stronger gender carry out most of the activities on the farms. The study revealed that the largest proportion of the respondents (90%) was married. The finding is in consonance with the research finding of [9] that most rice farmers in the study area are married.

Many of the respondents (31.4%) were less than 35 years. Also, 40.2% of the respondents were between the age of 36 and 45 years old and 28.4% of the respondents were older than 45 years old. This result suggests that most of the rice farmers are a young person who is still strong and full of energy to make a meaningful impact in agricultural production. The average age of the respondents was 41.45years. This was close to the research finding of [7] which put the average of Nigerian rice farmers at 42 years.

About 62.1% of the respondents are illiterate, 30.2 % of the respondents are primary to high schools also 7.7% Academic level. This result is in agreement with the finding of [8] that majority of rice farmers in Nigeria could read and write.

Average farm size in the study area was found to be 3.66 acres (1 acre is 2500 m2) and average rice yield was 1038.35 kg/acre. About 34.1% of the respondents have farm size less than 2.6 acres under rice cultivation, 37.3% had between 2.6 and 5 acres, 26.6% had between 5.1 - 15 acre.

Most of the respondents (8.3%) have been growing rice between 1to10 years, (37.9%) have been growing rice between 11 and 20 years, 53.8% have been growing rice over 21 years. The average farming experiences of rice farmers in the study area are 22.16 years.

The majority of the households (47.7%) had less than five members, 47.7% had between 5 to 7 household sizes, and 4.5% of household had more than 8 members. Average of household size is 5.14 households. This result suggests that there would be adequate supplies of family labor in the study area.

According to the survey, about 61.5% of the respondents have quotas, a few of them (23.1%) use

to rent, also about 15.4% of the respondents are land own.

A large number of the respondents (64.1%) planted the (ShashMahi) variety while 27.3% planted the (Ruta). Based on the low rice variety of (Sadri) about 2.7 % of the respondents, also about 5.9% of the respondents cultivate of (KasNadita) variety.

Water source is the major important effect to rice production according to the survey results revealed that respondents have been 4 sources of water. The result showed that 43.2 % of the respondents almost used the river, 31.4% used wellspring, 23.7% used artesian and only a few of the respondents used water pump (1.7%).

Table.1 Demographic Characteristics of rice farmers

Factor	Group	Frequency	%
age	≤35	53	31.4
	36- 45	68	40.2
	>45	48	28.4
	Average	41.45	
Education level	Illiterate	105	62.1
	Prim to H. school	51	30.2
	Academic level	13	7.7
Marital Status	Married	148	87.5
	Single	21	12.5
Farm Size (Acre)	1 -2.5	72	34.1
	2.6- 5	67	37.3
	5.1 - 15	30	26.6
	Average	3.66	
Experiences (Years)	1 – 10	14	8.3
	11 – 20	64	37.9
	21 – 100	91	53.8
	Average	22.16	
Family Labor (Person)	2 – 4	57	47.7
	5 - 7	102	47.7
	8- 10	10	4.5
	Average	5.14	
Land Tenure	Land own	26	15.4
	Quotas	104	61.5
	Rent	39	23.1
Rice Variety	ShashMahi	141	64.1
	Ruta	60	27.3
	KasNadita	13	5.9
	Sadri	6	2.7
Water Source	Wellspring	53	31.4
	River	73	43.2
	Artesian well	40	23.7
	water pump	3	1.7
Total		169	100.0

Table 2 showed that the mean values of inputs and output used in rice production in Akre district of Northern of Iraq. Rice farmers in study area harvested 1038.35Kg/acre of rice in 2015 harvesting season. The average of farm size was 3.66 acre. Farmers on the average applied 30.03 Kg of seed input on one acre of land. The average family and hired labor inputs used were 5.14 men per acre. With 146.64Kg/acre of fertilizer and 3.90 liters per acre of herbicides whose costs were 121121.62 IQD/acre and 46377.33IQD/Acre respectively.

Table. 2 Statistics of output and input of rice production in the study area

Variable	Mean
Rice (kg/acre)	1038.3572
Land size (acre)	3.66
Seed input kg/acre	30.03
Family labor (person)	5.14
Fertilizer application (kg/acre)	146.64
Herbicide application (lit/acre)	3.90

Using fertilizer for any cultivation presses especially for rice production has an important role to increasing the yield. As appear in Table 3 and 4, most farmers (74.6%) used both of fertilizer or mixed fertilizer (NPK+Urea). Moreover, 16.6% and

8.9% of farmers used NPK and Urea, respectively. However, when firm size group less than 2.5 acres used 167.18 kg/acre and second group (2.6 to 5) acre used 138.23 kg/acre. Also when the farm size more than 5 acres used 116.15 kg/acre. The result showed that amount of fertilizer used in the first group of farmers bigger than another two groups of farm size. The average amount of fertilizer used by farmers is 146.64 kg/acre. That was two times higher than the recommended dosage used in Thrace and Black Sea regions [11]. This creates bidding and poor grain quality problems. On the other hand, it increases the production cost. Furthermore, it adversely affects the country economy and the environment.

Table. 3 Type of fertilizer used by farms

Farmer size (Acre)	No. of Farmers	(%)
Both NPK and UREA	126	74,6
NPK	28	16,6
UREA	15	8,9
Total	169	100,0

Table. 4 Fertilizer amount used by farm size groups

Farm size (acres)	No. of farms	Mean (kg/acre)	Std. Deviation (kg/acre)
1 - 2.5	72	167,185	98,347
2.6 - 5	67	138,233	78,185
5.1 - 15	30	116,156	32,216
Total	169	146,649	83,925

Table 5 investigated the average variable and fixed cost of rice production in the study area. According to the research results, 6.07% of the farmers has access to village that was suitable for rice cultivation (table 5), about 25.80% of the farmers has access to cost of fertilizer the proportion of fertilizer bigger than all costs due to more expensive in price, fertilizer is playing very important role of the rice production as it has been realized that it provides the support to the cultivation. About 17.64% of the respondents have used machinery for harvesting the proportion of farmers using machinery varies from the region. Also after harvesting used box cost for filling or input Rice about 1.05%. Smaller than all costs due box cost cheaper in the price. Table 5 also showed the average of fixed cost in rice production. Average 80.74% of fixed cost is rent and 14.44% is the capital interest rate. According to results average variable cost per acre was 469313.12 IQD and fixed cost was 408097.17 IQD. The share of variable cost in total costs was found to be 53.49%. (EGBODION &MED2015) showed that the percentage proportion cost of efficiency in rice production of labor, herbicide, fertilizer, seed, and transportation was 14.60%, 4.95%, 21.74%, 10.25%, and 4.77% respectively, so total variable costs was 56.31%. Were rent cost and depreciation of fixed input was 42.14%, and 1.55% respectively, the study indicated fixed cost about 43.65%. Total cost was 100%. [12].

Table.5 Rice production costs per planted acre (IQD/Acre)

Variable costs	Mean	Std.dv.	%

Tillage	28490,30	21906,28	6,07
Fertilizer	121121,6	68561,55	25,8
Herbicide	46377,33	35397,06	9,88
Irrigation	86904,51	154322,03	18,5
Gasoline	15021,13	133313,54	3,20
Box	4967,83	3375,52	1,06
Harvest1	82786,64	56985,38	17,6
Harvest2	57329,12	71811,27	12,2
Transport1	22734,44	20393,44	4,84
Transport2	18601,34	12675,51	3,96
Total variable costs	469313,1	241660,62	100,
Rent	329505,04	281725,05	80,74
Box	4967,83	3375,52	1,06
Harvest1	82786,64	56985,38	17,6
Capital Interest rate	58944,10	43367,68	14,44
Entrepreneur costs	19648,03	14455,89	4,81
Total Fixed cost	408097,1	333215,08	100,00
Total Cost	877410,2	473987,17	

*: IQD is mean Iraqi Dinar

From the profit analysis as presented in (Table 6), the average yield was 1038.36 kg/acre, moreover average price of amount rice per one kg about 2280.12 IQD. The study showed that the average income of rice production was about 2321833.92 IQD/acre, gross profit 1852520.80 IQD/acre and net profit was about 1444423.64 IQD/acre.

Table. 6 Income and Profit from rice production.

Variables	**Mean (IQD)**	**Std. Deviation**
Total Cost	877410,28	473987,17
Yield	1038,36	916,44
Price of Rice	2280,12	365,37
Total Income	2321833,92	1900048,11
Gross Profit	1852520,80	1877313,59
Net Profit	1444423,64	1841176,92

The Cobb-Douglas Production Function is utilized to assess the effects of various inputs like seed, irrigation, fertilizer, and herbicide and farm size. The result was revealed that that the coefficient for farm size, fertilizer, and herbicide were found statistically significant at 1 % level. According to the result in Table 8, fertilizer has significant and positive effect on production ($p<= 0.01$). The coefficient value of fertilizer is equal to 0.594 means that when the amount of fertilizer used by farmers increased by 1%, the amount of production will increase by 0.59%.

On the other hand, the herbicide factor has a significant and positive effect on the production of rice. According to results from the model when the herbicide increases by 1% the proportion of production will increase by 0.27%. Moreover, the farm's size (Ln Farm size) has a negative and significant effect on the production of rice. Increasing firm sizes in 1% decrease rice production 0.28% In addition According to results, however, farmer's age and experience level had not significantly affected rice production. According to the study of Ghana the coefficient of fertilizer application per (kg) was positive effect of rice production about 0.18, also chemical herbicide application per (lit) was negative effect of rice production about (-0.29) was significant at 1% level, also land area cultivation was significant at level 1% about 0.441

[13], also in another study in Nigeria the coefficient of fertilizer application per (kg) was negative effect of rice production about – 1.89, also farm size per (hectare) was positive effect of rice production about (2.96) was significant at level 1%. Also seed use per kg was significant and effect of rice production at level 1% about 2.54. [14].

Table. 7 The result of the model analyses

Model	standard coefficient	St.Error	T-Value	P-Value
(constant)	5.835	1.652	3.533	0.000***
Ln Farm size	- 0.281	0.086	- 3.24	0.001***
Ln fertilizer	0.594	0.0755	7.86	0.001***
Ln Herbicide	0.267	0.0827	3.24	0.001***
Ln age	- 0.023	0.199	0.12	0.905
Ln experiences	0.012	0.282	0.05	0.969

Dependent variable ln output (Y)

Source: Field Survey (2015)

Where: *** = Significant at 1 percent

R2= 0.2856, Adj. R2= 0.2637

4. CONCLUSIONS

In conclusion, the majorities of the respondents are male with a year experience of the technology and are of the secondary level of education. Rice production under study area system is profitable. Age of farmers, Farming experience statistically not significant but farm size, herbicide, and fertilizer were all significantly related to rice output under rice production.

There are many factors that affect rice productivity, namely socio-economic, biological, managerial and physical. In this study, some important factors were taken into account to determine their effect on rice productivity. These vital factors were the age of farmers, farming experience, farm size, herbicide, and fertilizer. All these factors were found positively contributing towards a higher yield of the rice crop in Akre district. However, farm size, herbicide, and fertilizer were significant also the age of farmers, farming experience insignificant.

5. RECOMMENDATION

The study, therefore, recommends that more awareness should be made for the technology through media, workshops, and seminars and supported by policies of government at various levels. The study also recommended that credit facilities should be given to rice producers in the area so as to increase output and policy interventions aimed at protecting local farmers should be put in place.

Reorientation of breeding research is required to evolve high yielding and disease resistant varieties for Rice. Moreover, extension systems should emphasize in training farmers to control weeds and disease and pest attack that infect rice. Field visits and exhibition by expansion staff could be correct strides in the right direction. There is a need to emphasize research and extension strategies. The provision of adequate resources to research and extension systems is suggested for developing and promoting new technologies to combat disease and

pest attack on rice crop.

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