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DETERMINING THE OPTIMUM SIZE FOR RICE PRODUCTION FARMS IN DIYALA GOVERNORATE, IRAQ (STUDY FOR THE SEASON 2019)

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Abstract

The study examined with a study and estimating the total cost function of a random sample of rice producers in Diyala Governorate, Iraq, data were collected for a of rice producers through a personal interview of (38) farmers producing rice from the study population of (772) farmers producing rice in Diyala Governorate. And the cost function was analyzed for the short run after adding the farm area element to the function and the optimum production amount was reached by deriving the average total cost function for the long run and the optimum production amount by (8.001) tons / hectare as it became clear that the cultivated areas are less than the optimal size of the farm that is reached and which it reached (49.81) hectares and proved the statistical and economitrics analysis and significance parameters estimated cost function, As it became clear through the questionnaire that the problems of lying in the plant and the delay in the harvesting process and the loss of part of the crop during the harvesting process are among the obstacles that the farmer faced during the cultivation of the rice crop. there are also the problems of neglecting the rivers and the failure to adhere to the typical quantities of seeds and fertilization from the obstacles that faced the farmer during the 2019 season. It was recommended the need for horizontal expansion of rice farms and the exploitation of more agricultural area to reduce unemployment . the study also recommended paying attention to awareness programs for farmers by choosing the seed variety and identifying typical quantities of production resources to reach the optimal combination . as well as the importance of maintaining and irrigating the irrigation water network, and providing modern machines for developing agricultural production operations and improving yields, both quantity and quality, to achieve development and self-sufficiency in the rice crop.

Keywords **:** Rice farms. Optimum production. Production costs. The size of the farm.

Introduction

The rice (*Oryza sativa* L.) is the staple food of more than half of the world's population and it is a food grain crop. It is believed that its native origin in East Asia in China and India and then transferred to the Levant and Europe. It is an herbaceous plant belonging to the family of grasses cultivating rice crops in flooded lands. Rice cultivation in Iraq is still suffering from many difficulties, which affected the pace of production growth and the prevention of its cultivation in some regions of Iraq due to the low water level of the main rivers in Iraq. Also, rice crop production in Iraq suffers from the lack of development of the variety, where the variety (anber rice) is still prevalent until now and this variety suffers from the problem of lying in the plant in addition to the lack of agricultural diversity and the repeated cultivation of the same crop annually. Rice is a food for more than 15 countries in Asia and other countries in the world. Rice provides in developing countries the equivalent of 27% of the required calories. It also provides a large amount of energy as it does not contain the entire amino acid and contains limited quantities of the necessary nutrients. The rate of iron and zinc ranges from 1-6 mg. in rice and the protein rate from 5-14 mg. in every 100 grams of rice, and thus can help reduce malnutrition in the world. (Food and Agriculture Organization of the United Nations. 2004) The rice cultivation process requires agricultural requirements Multiple, the most important of which is the availability of irrigation water, low salinity soils, agricultural tractors, labor, technical knowledge, good seeds and fertilizers. These requirements must be adopted by the government to provide them at reasonable prices for farmers in order to be able to make a production decision and achieve good productivity. (Muhammad, 2010) concluded that one of the important requirements for growing the rice crop is the availability of transportation methods close to the farm for the easy transportation of supplies and the transport of the crop, as well as the availability of anti-pesticides for the soil infested with the bush. (Hammadi, 2010) also concluded that the regulation of irrigation and soil type selection are factors that help increase the weight of the seed and increase the vegetative total of the plant. These properties are available in soils that are subjected to continuous washing. (Hassan, 2011) states that reclaimed soils are not suitable for deep tillage, because the salts are concentrated in the sub-surface layer more than in the surface layer of the soil, therefore organic fertilization is preferred in this type of land. As he states (Karmasha.2011), the farmer must take into account the selection of good seeds that are resistant to local environment and determine the required quantity per hectare, as well as the selection of seeds free of impurities and fit for germination.

Research Problem

Decreased production quantity, delay and inefficiency of harvesting operations, and high production costs led to the failure to reach the optimum output.

Research goal

Study the accessibility to achieve the optimum size of production and the optimum area for the farm and determine the obstacles that faced the rice crop production.

Research Importance

The rice crop is a strategic crop on which the food of the population and the national economy depend and its cultivation is an urgent necessity for agricultural and economic development, therefore the cultivation of the crop must be studied to know the possibility of achieving optimum production.

Materials and Methods

- In December, a random sample of rice producers in Diyala Governorate was surveyed for the production

season 2019 and obtain data on the total costs of the studied samples, the quantities produced from the crop, the quantities lost during the harvest, as well as the most important constraints faced by the producers.

- The total number of rice producers, the number of farms and the total cultivated areas were obtained from the Diyala Agricultural Directorate - Planning and Follow-up Department.
- The forms were emptied into special tables, tabulated and analyzed using Excel and Evieos.

Table 1 : Characterization of the studied sample farms

The characteristics of studied farm				S
Total :772 farmer Sample : 38 farmer			Total rice producers	1
Total : 5150 HEC. Sample : 931 HEC.			Total rice areas	2
Farmers properties				
Ratio %	**Years of Experience**	**Ratio %**	**Academic achievment**	
%19	No Experience	% 14	Read and writes	3
%54	1-3 Year	% 16	Elementary study	4
%27	4-7 Year	% 17	Preparatoy study	5
----------	--------	% 24	Secondary study	6
---------	---------	% 29	University study	7

Reference: * Researcher based on the questionnaire * Iraqi Ministry of Agriculture. 2019

The highest percentage of farmers producing rice from the university was followed by the proportion of those who completed Secondary study, which means there is an ability to receive awareness agricultural programs and scientific seminars, and there is a possibility to apply the results of scientific research, but the concerned authorities did not provide these requirements, which caused weakness in achieving the optimum farm sizes in terms of area and amount of production. As evidenced by the same schedule, the poor years of experience of farmers producing rice because of the ban on cultivation of this crop for many years, so these farmers need training programs to cultivate and care for rice fields.

Results and Discussion

The long-run aggregate cost curve is the envelope curve for short-run cost curves (U-shaped) showing the minimum production cost per unit of a particular good. (Qitef and Khalil, 2004)

The most common forms of cost functions are the cubic function for ease of analysis and can be adopted after being subjected to statistical and standard tests and passing these tests, which is the following form: (Samurai, 2016)

$$Tc = b_0+b_1Y - b_2Y^2 + b_3Y^3 + Ui$$

Entering a second variable represents area (A). The short-run cost function takes the following form:

$$Tc =b_0+b_1Y-b_2Y^2+b_3Y^3-b_4AY+b_5A^2+ui$$

Excluding the constant term (b0) is the following long-run cost function:

$$LRTC = b_1Y-b_2Y^2+b_3Y^3-b_4AY+b_5A^2+ui \quad ....(1)$$

Long-run cost function.

Where:

A = The area of the farm / hectare
TC = total cost / dollars
bi = regression coefficients
Q = production quantity / ton
Ui = random variable

By writing the equation in its implicit form , as TC is an implicit function of A, Q

$$V = TC - b_1Q + b_2Q^2 - b_3Q^3 + b_4AQ- b_5A^2 - ui = 0 \quad ....(2)$$

By taking the partial derivative relative to A and equating it with zero, we obtain

$$b4Y - 2b5A = 0 \quad ....(3)$$

$A = 1/2\ b4Q \setminus b5$ .... (4) A was obtained as a function of (Q)

By substituting the value of A for the original short-run function (1), we get the cost function for the following long-run:

$$=b_1Q - b_2Q^2 + b_3Q_3 - b_4^2Q^2 / 2b_5 + b_5b_4Q^2/ 4b_5$$

$$= b_1Q - b_2Q^2 + b_3Q^3- b4^2Q^2 / 2b_5 + b_4 Q^2/ 4b_5$$

$$= b_1Q - b_2 Q_2 + b_3Q^3 - (1/2)b_4^2 Q^2/ b_5 + (1/4)b4^2 Q_2 /b_5$$

$$= b_1Q - b_2Q^2 + b_3Q^3 - (1/4)\ (b4^2 / b_5)$$

Collects the boundaries of Y^2

$$= b_1Y - (b_2 - (1/4\ b4^2 / b_5)\ Q^2 + b_3Q^3$$

The final formula for the costs function $LRTC = b_1Q - b_2Q^2 + b_3Q^3$

Total production costs:

The cost function included the following parameters:

T = total production costs / dollars

Q = total production / ton

A = area / hectare

The total production costs included the cost of renting the land, the cost of purchasing fertilizers and seeds, the cost of tillage and soil service, the cost of sowing, fertilizing, irrigation, guarding, capital interest, harvest costs, and separate additional costs. Production included the amount of rice harvested, plus the estimated amount lost during harvest. And the variable of area included the area of the farm.

Cost function estimation and analysis :

In order to find the optimal size of the farm and the optimum amount of production, the short-run cost function of the rice crop was analyzed and it turned out to be identical with the logic of economic theory, as the function passed statistical and econometrics tests and after the introduction of the area variable the function was as follows:

1- The short-run cost function of the rice crop:

$$SRTC = 88.947 + 5.418\ Q - 0.058\ Q^2 + 5.102\ Q^3 + 0.012\ AQ + 0.025\ A^2$$

Table 2 : Estimated short-run cost function of rice

Independent variables	Estimated parameters
Q (t*)	5.41835441 (5.525)
Q^2 (t*)	0.05874852 (-2.757)
Q^3 (t**)	5.1023112 (0.650)
AQ (t*)	0.012920 (1.954)
A^2 (t*)	0.02503225 (5.561)
Coefficient of determination (R^2) Adjusted R^2	0.982 0.979
test D.W*	1.815
test F*	331.92

*Significant at 0.05 ** significant at 0.25

2-Writing the function in its implicit form

$$V=TC -88.947 - 5.418\ Q +0.0587\ Q^2 - 5.102\ Q^3 - 0.012\ AQ - 0.025\ A^2 =0$$

Taking the first partial derivative relative to A, we get :

$$\partial V \backslash \partial A = -94.365Q +0.0587\ Q^2 - 5.102\ Q^3 - 0.012\ AQ - 0.025\ A^2 =0$$

$$= - 94.3063Q - 5.114AQ^2 - 0.025\ A^2 =0$$

$$= - 94.3063Q - 5.139\ Q^2\ A$$

$$= - 99.445\ QA$$

$$A= 99.445\ Q \qquad ....(5)$$

By substituting equation (5) with the equivalent of the original function, we obtain the long-run total cost equation as follows:

$$LRTC = 88.947 + 5.418\ Q - 0.058\ Q^2 + 5.102\ Q^3 + 0.012\ AQ + 0.025\ A^2$$

$$=88.947 + 5.418\ Q - 0.058\ Q^2 + 5.102\ Q^3 + 0.012(99.445\ Q)Q +(99.445\ Q)^2$$

By adding the (Q2) limits, we obtain the total cost function in the long run for the following rice crop:

$$LRTC =94.365\ Q+ 99.387\ Q^2 + 6.295\ Q^3$$

Statistical analysis:

The analysis explain the significance of the estimated parameters by testing (t) and at the level of significance (0.05 and 0.25) where it was found that the estimated value of (t) is greater than the tabular value, just as the significance of the function as a whole was demonstrated by testing (F) at the significance of 0.05 where Its value reached (331.92), and the Coefficient of determination (R^2) showed that 98% of the changes that occur in the total production are caused by the production costs and the remaining 2% due to other factors that were not subject to measurement by function.

Econometrics analysis:

The (D.W) test explain the absence of the auto correlation problem between the remaining values as its value (1.815) at the significance level of 0.05 and degrees of freedom (K = 5) where the base (du – 4 < DW < du) was achieved, meaning that its value (2.3 < 1.8 < 1.7) Achieving this rule proves that there is outo correlation problem between the remaining ones (Bakheet and Fathallah. 2006.P88-291), as demonstrated by the test Park test, which included estimating the equation for the error square regression as a dependent variable and the output (Q) independent variable, the absence of a phenomenon Heteroscedasticity, and the function was as follows:

$$Log(ei)^2 = -0.17700748442 + 0.0103752077186\ log(Q)$$

t (-0.153344) (0.365067)

R^2 (0.003688) F (0.133274)

Whereas, the parameters of the estimated function are not significant at the acceptable levels through the calculated (t) test where they were less than their tabular value, indicating the absence of the heterogeneity phenomenon that appears in the data of the cross section. (Bakhit and Fathallah. Previous reference)

1. The optimum amount of rice production

The optimal amount of rice crop production can be determined by deriving the average total cost equation in the long run by dividing by production (Q) and then applying the cost minimization condition. (Samurai 2016. Previous source)

$$LRATC = LRTC \backslash Q =94.365+99.387Q +6.295\ Q^2$$

Average long-run total cost function.

The necessary condition for minimizing costs is as follows:

$$\partial\ LATC/ \partial\ Y = 193.752Q+6.295\ Q^2$$

Q = 2.004 TON \ DUN = (8.001 TON \ HEC)

The optimum quantity to produce rice that minimizes costs and maximizes profit.

2. Determine the optimal farm size:

The optimum size of the farm area can be obtained by compensating the value of the optimal production reached in equation (5) as follows:

$$A= 99.445\ Q \qquad ....(5)$$

$$= 99.445(2.004)$$

= 199.27 DUN = 49.81 HEC

The optimum size of the farm that achieves optimal production.

The most important obstacles facing the rice crop production:

Table 3 : Obstacles facing farmers producing rice / season 2019

Sample ratio	Details	Obstacles	S
78%	Lying plant	Environmental obstacles	1
60%	Irrigation water problems		
32%	Harvest delayed	Obstacles to production requirements	2
72%	Crop loss during harvest		
90%	Neglecting of irrigation rivers	Obstacles of farm management	3
23%	Noticed with agricultural capital		
60%	Neglecting the typical quantities for sowing and fertilization	Obstacles to inexperience	4
41%	Use poor seed		

Source: The researcher, depending on the questionnaire

Table (3) shows a group of obstacles facing farmers and cause crop losses due to poor farm management of productive resources and the state's lack of interest in agricultural development projects where there was a loss of crops and neglect of irrigation rivers, as well as neglect some areas within the farmland without cultivation. Where (Buttner and other, 2015) mention that all the area of the farm should be cultivated as long as there is irrigation water available and reach the land and pay its wages, as well as the farmer should not reduce the risks that can be exposed during the production cycle such as financial or agricultural risks or the risks of non-regulation or lack of profitability Which directly affects the economic ability of the farmer. While there are obstacles that can be overcome by following agricultural programs or courses conducted by the agricultural extension centers, such as knowing the optimum quantities of sowing, fertilizing, combating, and these are among the most important obstacles facing farmers. Where it was concluded (Al-Ziyadi and Shati, 2010) through a research experiment to test the seed quantities in resisting the growth of the bush and it became clear that the higher seed quantity outperformed the other rates in the growth of the bush with rice plant. The risk of agricultural capital and adherence to appropriate harvest dates and knowledge of good seed varieties.

Conclusions

- The optimum quantity of rice crop reached in the research amounted to (8,001 tons / hectare) greater than the current production amount and the reasons may be attributed to the lack of knowledge of mixing production inputs and achieving the optimal combination.
- The optimum size of the farm reached (49.81 hectares) and this size was not exploited by a large part of the farmers of the sample studied by research as farmers did not achieve (the research sample) the optimum size may be due to the rule of risk and uncertainty.
- The most obstacles that were reached by the research are the problem of neglecting the maintenance of irrigation and drainage rivers that caused high soil salinization and the problem of losing part of the crop during the harvest due to the inefficiency of the harvesting machine and the problem of plant lying and the lack of awareness programs of fertilizing and watering the crop.
- The poor quality of the used seed variety (amber and Yasimin cultivar). These varieties suffer from lying down and have not been subjected to any hybridization or development to become resistant to conditions.

Recommendations

- The necessity of horizontal expansion of rice farms and the optimization of available resources, especially agricultural land, irrigation water and labor.
- The necessity of providing training and awareness programs for farmers producing rice that help in setting the quantities of seeds and fertilizing and organizing the irrigation process. It also helps the farmer to choose a good seed class that leads to achieving optimum productivity for the same unit area**.**
- Maintenance of irrigation and drainage drives to reduce soil salinity and for the state to provide modern agricultural machinery that helps reduce crop losses and improve production quantity and quality in order to achieve economic efficiency.

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