Economic analysis of the production costs of the potato crop in the Abu Ghraib region for the year 2021

Suaad H. Ali

Suaad.h@coagri.uobaghdad.edu.iq

Department of Agricultural Economics/ College of Agricultural Engineering Sciences/ University of Baghdad

Abstract:

The research aims to estimate the production cost function of the potato crop in the Abu Ghraib district for the spring season 2021, where the data was collected through a random sample that included (40) farmers within the Abu Ghraib district, despite the economic importance of the potato crop and as a result of the increasing demand for it for food and industrial purposes. Today, it has become at the forefront of the main food, as some called it the second bread. The estimated results indicated that the variable costs acquired the largest percentage of the total costs of the total potato crop in the research sample, at an average of 66.3% of the total costs. While fixed costs accounted for 33.7% of the total costs. The results of the research also concluded that the optimal production volume of potatoes amounted to (7.92) tons, achieving the lowest production cost. While the optimal area was (16.83) dunums, bearing in mind that the size of the farm holding for the research average was (12.5) dunums, so the research recommends expanding the cultivated areas of the potato crop to reach optimal production and the use of modern technologies in agriculture to reach optimal production capacities.

Keywords: Optimal production, Total Costs, Optimal Area ,variable costs ,fixed costs .

introduction:

Potato is a tuber crop (Solanum tuberosum) and belongs to the Solanaceae family. Mexico, Chile and Peru are its origin country, and then it moved to the United States, Europe and the rest of the world (4). Potato are at the forefront of the main foods in the world, and many food products such as potato chips are made from them, and their waste is used to make nutritional diets to be used in animal feed. Starch, glucose, and lactic acid (6). Potato are also distinguished by their delicious taste, which is of particular importance in dishes in European cuisine, and cannot be dispensed with in Iraqi cuisine. The potato crop is one of the crops of economic importance. It is grown in Iraq in two seasons, spring and autumn. Its cultivation is concentrated in the provinces of (Baghdad, Nineveh, Anbar). The potato crop suffers from fluctuation in the cultivated areas and a decrease in its productivity (3). Therefore, the production cost function was studied for it, as well as identifying the optimal size of production and the optimal area by estimating the functions of production costs for the crop and standing on the extent of the contribution of variable and fixed costs paragraphs in it, and then deriving The function of average total costs in the long term to be adopted in calculating the optimal volume of production, which reduces the cost of producing one ton of potato crop to the lowest possible extent and to benefit from it in calculating the optimal area for production, Since the problem of the farms is how this space can be optimally allocated between the different projects.

Materials and methods:

To achieve the aim of the research, a field survey was conducted for the potato crop farmers in Abu Ghraib district for the season 2021, and data was collected from the potato crop farmers in the district, who numbered (40) farmers, All (40) farmers belonging to the district were taken, and through a

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questionnaire prepared for this purpose, it included data and information on the crop for the agricultural season 2021, on production, costs, and cultivated areas in the district, as it included the total cultivated area (500) dunums and the total production (4439.6). tons, the data was analyzed using the program (SPSS, ver25). The following sources were also used(1,2,5,8)

First: The reality of the cultivated areas, production and productivity of the potato crop in Baghdad Governorate for the period 1990-2021

The data of Table (1) refer to the cultivated areas, production and productivity of potatoes in the Baghdad governorate, where we notice a clear fluctuation in the cultivated areas of the crop from year to year, as the annual average of the area was about (57151.5) dunums during the mentioned period

Table 4: Cultivated areas, production and productivity in Baghdad Conservationist of the potato crop for the spring season 2021.

Productivity / ton	production / ton	Cultivated area/dunum	years
2.41	3504	1454	1990
4.16	55448	13325	1991
4.86	188014	38679	1992
4.54	308868	68062	1993
3.90	324512	71356	1994
4.42	274817	70389	1995
3.97	426386	96487	1996
4.45	414100	104337	1997
4.31	438678	98588	1998
3.61	514726	119484	1999
4.33	349330	96733	2000
4.95	469404	108301	2001
4.24	568877	121450	2002
4.48	321451	10236	2003
4.50	396332	114415	2004
5.4	544157	101362	2005
2.86	515375	83050	2006
3.31	460336	30165	2007
3.18	237644	14681	2008
4.75	100081	80655	2009
5.93	46682	37402	2010
5.1	383261	80655	2011
4.38	221892	37402	2012
6.73	476202	95068	2013
6.06	329337	75181	2014
6.7	143854	21369	2015
6	159816	26371	2016
6.77	200207	28290	2017
6.5	127121	18889	2018
8.1	214897	25914	2019
8.2	335362	41452	2020
6.75	201853	30104	2021
6.76	386327.2	57151.5	average duration

Source: Ministry of Agriculture Planning and Follow-up Department

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It is also clear from this table that the production of the crop in the province recorded an average of about (386327.2) tons during the period 1990-2021, as the highest production of potatoes in the Baghdad governorate in 2002 reached about (568877) tons due to the large area cultivated with the crop compared to other years of the series, and this indicates However, the production is affected to a large extent by the fluctuation of the cultivated area in light of the stability of other factors.

Second: The annual growth rate of the potato crop in the spring season in Baghdad provainc for the period 1990-2021.

The annual growth rate was calculated for the time series data of the potato crop for the spring season for each of the production, cultivated area, and productivity for the period 1990-2021.Likewise, the growth rate was calculated for the period 1990-2003 and for the period 2004-2021 for Baghdad province, based on the data of Table 4, and based on the following equation in calculating the annual growth rate:(8)

$$Y = e^{b0+b1t}$$

Taking the logarithm to Y, we get:

LnY = b0 + b1T

whereas:

Y: represents production, area, or productivity

Bi: annual growth rate.

T: time

Table 1: Annual growth rates for the period 1990-2021.

variable	annual growth rate%
area	0.7-
production	1.5
Productivity	2.2

Source: Calculated based on Table 4 and using SPSS Ver 25 program.

Table 2: Annual growth rates for the period 1990-2003.

variable	annual growth rate%
area	18.5
production	20
Productivity	11

Source: Calculated based on Table 4 and using SPSS Ver 25 program.

Table 3: Annual growth rates for the period 2004-2021.

variable	annual growth rate%
area	6.3
production	1.9
Productivity	1.6

\Source: Calculated based on Table 4 and using SPSS Ver 25 program.

Tables (1,2,3) show the growth rates for each of the area, production and productivity at the level of Baghdad governorate for the period (1990-2021), which recorded a positive annual growth rate of about (1.5, 2.2)% for production and productivity, respectively, while the growth rate for the area was cultured negative (-0.7%), When the series was divided into two periods, the first period (1990-2003) and the second period (2004-2021), the results

for the first period recorded positive growth rates amounting to about (18.5, 20, 11)%, respectively, for area, production, and productivity. The second period also recorded positive growth rates. For area, production and productivity, it amounted to about (6.3, 1.9, 1.6) %, respectively.

Third: Potato Production Cost Structure:

It includes paragraphs of fixed and variable costs for the production of the potato crop and the percentage of the contribution of each of these paragraphs to the total costs of the sample for the agricultural season 2021 (for the spring season). Where the total variable costs accounted for 66.3%, Where, the total fixed costs accounted for 33.7%, which indicates that the variable costs paragraphs have a great importance in producing the potato crop for the 2021 season. As shown in Table (5).

Table 5: Contribution of fixed and variable costs to total costs for the 2021 season.

Contribution %	Value / dinars	Total cost paragraphs
33.7	5300873	Fixed costs
66.3	10399347.87	variable costs
100	15700220.87	total costs

Source: It was calculated based on the data of the questionnaire.

The paragraphs of each of the fixed costs and variable costs were studied to identify the contribution of each of these paragraphs to the total costs .Where table (6) shows the percentage of the contribution of fixed costs paragraphs to the total fixed costs, we note that the family business costs item amounted to (86.8%) and ranked first, While the alternative opportunity costs came in second place and amounted to (6.5%), and this confirms that potato farmers depend on family work more than rented work, due to the small areas cultivated from potatoes. Extinctions by (2.9%).

Table 6: Contribution percentage of fixed costs paragraphs to total fixed costs.

Contribution%	cost items
86.8	family business
3.8	rental costs
2.9	extinction costs
6.5	Opportunity costs
100	Total fixed costs

Source: It was calculated based on the questionnaire.

Table (7) also shows the percentage of the contribution of variable costs paragraphs to the total variable costs. We note that the item of the cost of purchasing seeds ranked first with a rate of (65.2%), followed, respectively, by the paragraphs of the costs of each of the rented labor wages with a rate of (11.5%) and the costs of purchasing fertilizers (DAP fertilizer and urea). harvesting and harvesting) by (6.5%), Followed by the prices of pesticide purchases at an average of (2.1%), and other expenses including (water, electricity and fuel fees) at an average of (2.5%), and fees for transporting the crop at an average of (1%).

Table 7: The percentage of the contribution of variable costs paragraphs to the total variable costs of potatoes for the 2021 season.

Contribution%	Variable cost items
65.2	Seed purchase costs
11.5	Fertilizer purchase costs (Dab and Urea)
2.1	pesticides
11.2	hired labor
1	Transfer fees
6.5	Automated work
2.5	(the cost of plowing, opening watercourses, reaping and harvesting)
100	Other expenses

Source: Calculated based on the questionnaire

The reason for the high costs of purchasing seeds and its acquisition of the first place is due to the lack of support from the Ministry of Agriculture to the producers of the potato crop, and therefore the producers resort to buying seeds from the markets. As for the cost of buying fertilizers (DAP and urea), and as we know that fertilizers are among the imported commodities, their cost is high, and because of the high dollar against the Iraqi dinar, As for the percentage of mechanized work, it is also considered expensive for potato producers, because the cultivation of the potato crop requires intensive agricultural operations such as plowing and uprooting the growing bushes and crop residues remaining in the soil. Then the ground is smoothed with discs well, adjustment and leveling of the land with the leveling machine, the process of opening the watercourses and other operations, preparing the land for planting, the operations of serving the crop after planting, such as watering operations, removing and uprooting Weed, and finally the operations of harvesting and marketing the crop, all of this requires mechanical work and therefore its cost is high.As for the percentage of the contribution of the cost of purchasing tubers, it is also high because it needs refrigerated stores, in addition to its need for fogging with fungicides before planting it to prevent the growth and spread of fungal diseases on it. Finally, the percentage of the contribution of rented labor costs is relatively low due to the dependence of the crop on family work.

and to clarify the ratio of the contribution of each of the family work and rented work to the total work as shown by the results of Table 8.

Table 8: The percentage of the contribution of family and rented labor to the total work of the potato crop for the 2021 season.

Contribution%	cost paragraphs
94	family business
6	hired work
100	Total farm work

Source: It was calculated based on the questionnaire.

The data contained in Table (9) refer to the average total cost per unit area and production, the average return per unit area and production, as well as the net return per unit area and production for the potato crop in the research sample.

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Table 9: The average total cost, average and net yield of the potato crop for the research sample.

Amount (thousand dinars(	Paragraph
1596.81	Average total cost per area unit (dinar/dunum)
171.29	Average total cost per unit of production (dinar /ton)
2500.2	Net revenue per unit area (dinar /Dunam)
285.9	Net revenue per unit of production (dinar / ton)

Source: It was calculated based on the data of the research sample

Results and discussion:

The short-run total cost function was estimated, in which the area was entered as a variable and was as follows:

SRTc = 331.1 + 280.24Q - 25.32Q^2 + 2.49Q^3 -12.46 AQ + 2.88A^2

t (2.3) (5.7) (-2.4) (2.03) (-1.78) (1.8)

R^2 =0.81 F = 171.4 D.W = 1.98 N= 40

whereas: -

Tc = the total cost of production (in dinars)

Qi = represents the quantity of production (tons)

A = represents the optimal area or farm size (dunums)

To derive the estimated total cost function for the long term in terms of output for the potato crop, we perform the following steps:

We transform the short-run cost function into an implicit function:

V = SRTc - 280.24Q + 25.32Q^2 - 2.49Q^3 + 12.46 AQ - 2.88A^2 =0

Taking the first derivative of the implicit function in terms of area (A) and working on its equality to zero.

$\partial V/\partial A = 12.46Q - 5.76A = 0$

$A = 2.16Q$ area equation

3. We substitute the value of (A) with its equal value in the original value, and then we obtain the long-run total cost function of potatoes as follows:

LRTc = 280.24Q - 25.32Q^2 + 2.49Q^3 - 12.46(2.16Q)Q + 2.88$(2.16Q)^2$

LRTc = 280.24Q – 38.796Q^2 + 2.49Q^3

The last function represents the total cost function in the long run.

To estimate the optimal production volume, we take the long-run average total cost (LRATC) equation by dividing the total cost equation by the quantity of output Q as follows:

LRATc =LRTc /Q = 280.24 – 38.796Q +2.49Q^2

And when applying the necessary condition for minimizing costs, by taking the partial derivative of the average costs function with respect to the quantity of production and setting it equal to zero, we get the optimal volume of production as follows:

∂LRATc /∂Q= -38.796 +4.98Q =0

optimum size for production

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ton

)Q= 38.796/ 4.98 = (7.792

And by substituting the optimal production volume in the previous area equation, we will get the optimal area that can be exploited by potato farmers to obtain the optimal amount of production that gives the highest net farm income (represents the normal profit) as follows

A =2.16(7.792) = (16.83) donum

Table(10): Optimal and real production areas and quantities of potatoes for the research sample

real level	optimal level	Paragraph
12.5	16.83	area / dunum
5.8	7.792	production / ton

Source: It was calculated by the researcher based on the calculated results and the questionnaire.

Supply function and supply elasticity for potato growers in Abu Ghraib district:

In order to obtain the producers' response to changes in the price of the product, the supply function of the potato crop must be derived from the estimated average total cost function in the long run, as follows:

LRTC Q = LAC

LAC = $280.24 – 38.796Q +2.49Q^2$

And to determine the volume of production at the lowest level of the average total cost by equating the first differential of the total cost function in the long run with respect to production to zero, as follows:

∂LAC/∂Q =- 38.79+4.98Q =0

Among them, the Q value reached (7.79) tons, meaning that in this value, the average total cost in the long term reaches its lowest end. As for the value of LRATC at this level of production, it amounted to about (250) thousand dinars. Therefore, if the product price is less than (250) thousand dinars, he cannot offer any production for sale. That is, this is the minimum price at which the producer offers his product. But if the price is (250) thousand dinars or more, the quantity supplied is positive and proportional to the price. To derive the supply function, we equate the output price (PY) to the marginal costs derived from the estimated average total cost function in the long run.

PY>250

To derive the supply function, we work on equating the output price (PY) with the marginal costs derived from the estimated total cost function in the long run, as follows:

MC = $280.24 – 77.59Q+ 7.47\ Q^2$

MC = PY

$280.24 – 77.59\ Q + 7.47Q^2 – P = 0$

$7.47Q^2 – 77.59Q +280.24 – P = 0$

After arranging the limits, we got an equation of the second degree that requires solving it in the constitution as follows:

$S=x = \frac{-b\pm\sqrt{b^2-4ac}}{2a}$

$S = \frac{77.59\pm\sqrt{(-77.59)^2-4(280.24-P)7.47}}{2(7.47)}$

S = 77.59+((6020.21 – (8373.57-29.88P))$^{0.5}$ /14.94

S =77.59 +(29.88P – 2353.36)$^{0.5}$ /14.94

S = 29.07+29.88$P^{0.5}$ /14.94

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It represents the supply function in the long term. Through the supply function, price elasticity can be found by deriving the supply function in relation to the price by conducting the first differentiation of the quantity supplied in relation to the price, as follows:

Es =14.64 $p^{-0.5}$

Conclusions:

1. By studying the structure of the total production costs of the potato crop for the research sample in the Abu Ghraib district of the spring period of 2021, it became clear that the contribution of variable costs was 66.3% of the total costs, while fixed costs accounted for 33.7%. This is due to the high costs of purchasing seeds from the private sector. .

2. The percentage of the contribution of human labor (lessee and family) is higher than the percentage of the contribution of automated work, as the percentage of human work contribution amounted to about (94%) of the total costs of the work, while the contribution of the automated work amounted to (6%) of the total costs of the work, and this indicates However, the respondents use traditional methods mostly in performing the work of serving the potato crop and not expanding the use of mechanization and were limited to the process of plowing, smoothing, leveling and milling. Potatoes for the spring harvest and many farmers do not have sufficient liquidity to provide the necessary needs for cultivation, and thus the impact will be on the productivity of dunums per unit area and the decline in total production.

3. The results of the study to display the potato crop, and depending on the derivation of the supply function for the research sample, showed that there is a positive relationship between the quantity offered of potatoes and the selling price.

Recommendations:

1. The necessity of recommending farmers to increase the production volume of potatoes in order to achieve the optimal volume of production by increasing the productivity of dunums by using modern techniques in cultivating the crop.

2. The use of modern technologies in crop cultivation, such as the use of modern irrigation methods such as sprinkler or drip irrigation, as well as the use of mechanization in harvesting operations lead to the reduction of production costs per dunum to the lowest possible extent.

3. State support for producers by providing seeds and fertilizers at subsidized prices and encouraging producers to produce the potato crop, which is considered one of the important crops in Iraq and the world.

4. . Expansion by establishing governmental refrigerated warehouses to accommodate locally produced quantities at the time of peak production from the produce of the spring season and storing them for the purpose of cultivation in the autumn season, as well as providing storage for food consumption at a time of scarcity.

5. The need to reduce the import of potatoes due to the impact of imports on the prices of the local product.

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