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Optimized combinations of economic resources that achieve the most optimal and profitable production volumes of wheat crop in Nineveh governorate for the 2022 productive season

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ABSTRACT

The research aims to study and estimate the optimal combinations that must be used of production resources in order to achieve different production volumes and the extent to which these quantities are close to the actual volume quantities of the crop farmers, and to urge farmers to adopt these quantities and volumes that have been reached in order to achieve profits, as the study concluded that the production volume at the point Breakeven is (347.918) kg, while the actual volume of sample production reached (933.729) kg The optimal volume of production that reduces costs amounted to (1026.919) kg, while the volume of production that maximizes profit amounted to (1096.381) kg. It turned out that the largest net profit achieved by a farmer if he produced at the maximum volume of profit amounted to (418538.855) dinars, while it reached At the optimal volume of production (387905.12) dinars, the volume of production of the sample amounted to (380195.6) dinars, and this indicates the inability of most farmers to mix the elements of production to obtain the highest profits. The reason for this is due to the high costs of production on the one hand and the low volume of production on the other hand. The study also found that Weak government support for production requirements, which made production not reach its maximum Therefore, the study recommends that there be an effective role for the government in influencing the prices of production inputs, which contributes to achieving the highest profits.

التوليفات المثلى للموارد الاقتصادية التي تحقق الحجوم الإنتاجية المختلفة المثلى والمعظمة للربح لمحصول القمح في محافظة نينوى للموسم الإنتاجي 2022

فرح محسن علي آل شرين
قسم الاقتصاد الزراعي، كلية الزراعة والغابات، جامعة الموصل، موصل، العراق

الخلاصة

يهدف البحث إلى دراسة وتقدير التوليفات المثلى الواجب استخدامها من الموارد الإنتاجية لأجل تحقيق حجوم الإنتاج المختلفة ومدى تقارب هذه الكميات مع كميات الحجوم الفعلية لمزارعي المحصول، وحث المزارعين لتبني هذه الكميات والحجوم التي تم التوصل اليها لأجل تحقيق الارباح، إذ توصلت الدراسة إلى أن حجم الإنتاج عند نقطة التعادل هو (918,347) كغم ، في حين بلغ الحجم الفعلي لإنتاج العينة (729,933) كغم ، أما الحجم الأمثل للإنتاج الذي يدني التكاليف فقد بلغ (919,1026) كغم، أما حجم الإنتاج المعظم للربح فقد بلغ (381,1096) كغم، وتبين بأن أكبر صافي ربح يحققه المزارع فيما لو أنتج عند الحجم المعظم للربح بلغ (855,418538) دينار، في حين بلغ عند الحجم الأمثل للإنتاج (12,387905) دينار، وبلغ عند حجم انتاج العينة (6,380195) دينار وهذا يدل على عدم إمكانية أغلب المزارعين من مزج عناصر الانتاج للحصول على أعلى الارباح، ويرجع السبب في ذلك إلى إرتفاع تكاليف الانتاج من جهة وإنخفاض حجم الانتاج من جهة أخرى، كما توصلت الدراسة الى أن ضعف الدعم الحكومي لمستلزمات الانتاج الامر الذي جعل الانتاج لا يصل الى اقصاه، لذا توصي الدراسة بأن يكون هناك دور فعال للحكومة بالتأثير على أسعار مستلزمات الانتاج مما يسهم ذلك في تحقيق أعلى الارباح.

الكلمات المفتاحية: الكفاءة الاقتصادية، إستدامة الإنتاج الزراعي، تحليل دالة الإنتاج، وتعظيم الربح.

INTRODUCTION

Costs resulting from poor potential in the mix of agricultural resources and the extent to which they are used, as well as most farmers' ignorance of the efficient use of these resources but also used negatively reflecting low productivity (Zanzil,2013). Based on the above, the problem of the research lies in the fact that most wheat crop farmers in Nineveh Governorate are still suffering from a decline in the volume of agricultural production, this is due to the lack of economic and technical efficiency in the use of economic resources, which in turn is reflected in the optimal combinations of mixing production elements and achieving the necessary profits. As an important strategic crop in the world, wheat crop comes first among grain crops and contributes mainly to the preservation of food security as a major human food in many countries of the world. Thus, we need to study how to help farmers make efficient use of the farm resources available to them to maximize profit by minimizing their production costs, This is done by estimating the optimal volume of civil cost production, Which is the farmers' best option to maximize their profits under available resources(Al Zubei and Samurai, 2011). Therefore, the research aimed to estimate the optimal combinations that must be used of economic resources in order to achieve different production volumes at (the break-even point, the sample production volume, the optimal volume, and the maximum profit volume), as well as calculating the amounts of profits achieved at different levels.

One of the most important studies on estimating optimal combinations of economic resources was the study (Zanzil, 2013) which estimated optimal quantities of work combinations and capital for the option crop, the study found that the optimal volume of low-cost production was (3168) kg/dunm, the largest net profit at optimal volume of production was (431.850) dinars. As for(Mashhadani, 2018) the results of his research resulted in fluctuating wheat crop production due to fluctuating dunum productivity as most agricultural land is a demic land concentrated in northern Iraq and wheat consumption continues to increase due to an increase in the population. While (Shiyaa, 2021) the study found that the optimal quantities of production were (1589.68, 1258, 1027.5) kg for (Bora, Adnah, Aba99) respectively. (Faraj, Abdulaziz, 2021) completed a search for the efficient use of available resources for the production of wheat crops, the study found that the

average economic efficiency of category first, Second and Third was (0. 77, 0. 73, 0.71) respectively. While (Al Qaq et al., 2014) estimated the production and cost of the wheat crop, the study found that the production flexibility of category First, Second and Third was (1.18, 0.86, 0.86) respectively. (Semerci, 2013) identified resource efficiency in wheat, The study found that land value and pesticide agents were used in increasing quantities in wheat production, The study recommended increasing the quantity of seeds and fertilizers to increase wheat production. (Iqbal et al., 2022) conducted a study on farmers' perceptions of natural hazards and their impact on food productivity: evidence from the rice and wheat growing area of Punjab, Pakistan where data from (540) farmers were collected using a random sampling technique. However, there has been a positive impact of moisture on food production, the study recommends the formulation of appropriate policies to mitigate the negative impact of natural hazards on rice and wheat production. He also presented (Iqbal et al., 2022) research entitled application of local soil moisture sensors for precise irrigation of wheat crop in different irrigation methods where field experiments were conducted for two consecutive years (2017-2016) and (2018-2017) for the production of wheat crop at the water management research center and agricultural research station for graduate studies of the university of agriculture, included field irrigation methods in faisalabad irrigation using cloth pipes, perforated irrigation and drip irrigation in various forms of agricultural engineering and irrigation.While (Mustafa et al., 2021) completed research entitled "Development of low inputs and techniques for wheat cultivation for the management of crop residues in the rice and wheat cultivation system" A two-year track was conducted at the agricultural extension farm and adaptation research in gujranwala Pakistan in the period (2013-2012) and (2014-2013) to identify the most profitable rice waste management technique of this system using seven tillage method, How much traditional tillage and three nitrogen application timings have been used, The study found that among the different cultivation methods without tillage gave the turbine seed a better yield. While the publication (Noor et al., 2018) of research entitled use of controlled Phosphate fertilizer to improve growth, Productivity and Phosphorus efficiency of wheat crop, the study showed that phosphorus efficiency (p) deficient from (5) to (25) due to installation with ca2mg2 in alkaline soil reducing the availability of phosphorus for plant absorption s phosphorus ", there is a need to improve the availability of phosphorus for plant growth and for this purpose phosphate fertilizer coating with organic polymer may reduce phosphorus stabilization causing more efficient use. Presented (Li et al., 2024) research entitled Integrating Crop Modeling and machine learning to Improve Prediction of wheat productivity in Drylands The study used wheat growth, crop management, and production environment data in experimental fields in the Andeng area of Dingxi, Gansu Province, from 1984 to 2021 to build eight machine learning and group models, in addition, simulators of agricultural production systems were used (APSIM), machine learning (ML), and APSIM along with machine learning (APSIM-ML) to predict the wheat crop in 2012, 2016, and 2021, and results show that APSIM-ML is likely, the group prediction model improved to reduce MSE and performed best compared to the improved ML and APSIM models At the same time, we found that the dynamic flow of water and nitrogen between soil and crops had the greatest impact on the prediction of wheat crop, this study improved the accuracy of the forecast of wheat harvest in the drylands of the province of Gansu and provided technical support for the intelligent production of dryland wheat in the Lucian hills. (Ali et al., 2023) studied the economic, social, and institutional factors affecting the

adoption of higher-order wheat seeds.The research aimed to know the impact of economic, social, and institutional factors in adopting the program for propagating higher-order wheat seeds, the results of the ADOPT analysis showed that after the first five years have passed after Launching the program's seeds and farmers' knowledge of their existence, it is expected that the adoption rate will reach about (90.9%) From farmers, reaching the adoption peak, which reaches about (95%) of farmers, requires a period of time of about (7.4) years. Also completed (Bakr and Tamimi, 2023), research entitled Determining the optimal volume of production and measuring specialized efficiency in vineyards in Diyala governorate - Iraq for the 2021 season, the research's objective is to measure the specialized efficiency of productive factors and know the optimal combination of production by estimating the multi-variable production function (4734.5) kg/dunum, the study recommended the application of optimal formulation of production factors to achieve optimal volume of dunum production. She also presented (Hamad and Zanzil, 2021) research entitled "Estimating the optimal size of cucumber crop farms in Kirkuk Province _ Al-Hawija District (As a model) for the 2020 production season, the research objective is to estimate the optimal size of the space and production of the option crop and estimate the proportion of economics of the volume achieved for the crop farmers, and the study finds that the optimal size of the production of the option crop has reached The optimal areas of this crop (13.453 dunums) are (15.517) tonnes, Therefore, the farmers of the crop do not achieve the optimal volume of production, The study recommended drawing on the competent farmer owners' expertise and utilizing them to employ their expertise in efficient farms in order to reach full levels of efficiency.

Data collection method

The data was obtained through a questionnaire designed by the researcher and distributed to wheat crop farmers in Nineveh governorate/Hamdaniya district, and 90 forms formed (25%) of crop farmers were collected in the judiciary for the 2022 production season.

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MATERIALS AND METHODS

The data was analyzed using statistical programs (using the SPSS program to estimate production functions and using the Excel program to arrange and tabulate the data), the results were reached through regression analysis and its statistical and standard tests, the results of the analysis showed their statistical significance through (t, f) tests, the determination factor (R2) showed that (85%) Of the variables, it was caused by the effect of the two independent variables, labor and capital, on the dependent variable, which is production, and (15%) of those variables fall within the random variable, and the equation also passed all standard tests and did not show a standard problem.

Quantitative analysis of wheat crop production volumes

The data were analysed using statistical programs and the results were achieved through regression analysis and its statistical and measurement tests, and the results of the analysis showed their statistical morale through tests (t, f). The determination coefficient (R2) showed that (85%) of variables were caused by the impact of independent variables working and capital on the dependent variable of production and (15%) One of those variables falls within the random variable. The equation has passed all the standard tests as well and has not shown a standard problem.

RESULTS AND DISSCUSION

The results of the analysis showed that the estimated logartic production function of the wheat crop was as follows:

Ln y = 1.400 + 0.224 Ln L + 0.401 Ln K

t (3.535) (19.727) (13.463)

R2 = 0.859 $\overline{R}^2$ = 0.856

F = 265.050 D-W = 1.717

We then reformulate the above formula and convert it from the logarithmic function to the exponential function after extracting the corresponding number of natural constant log so that the production function takes the following form:

y = 4.055 L0.224 K0.401

When you look at the wheat crop production function, we see that the total (***Production flexibility = B1 + B2 foundation set for business and capital components***) Production flexibility for both business components (L) and capital (K) less than the correct one yields, indicating that the wheat crop production function reflects the decrease in yield to the productive feature, This situation indicates that the production phase of wheat farmers is the second stage of production of the decreasing yield law, at which production is decreasing. Their production levels are in the middle of the second production phase, which is confirmed by the values of average production (AP) and the marginal output (MP) in tables (1, 2):

Table 1: Shows the production function of the wheat crop if the capital is constant at its arithmetic mean and the labor changes

N	L	K	$\hat{y}$	APL	MPL	EL
1	9.517	229988	948.619	99.676	21.195	0.213
2	10.517	229988	969.814	92.213	20.049	0.217
3	11.517	229988	989.863	85.947	18.904	0.220
4	12.517	229988	1008.767	80.591	18.152	0.225
5	13.517	229988	1026.919	75.972	15.645	0.206
6	14.517	229988	1042.564	71.816	16.04	0.223
7	15.517	229988	1058.604	68.222	14.893	0.218
8	16.517	229988	1073.497	64.993	14.321	0.220
9	17.517	229988	1087.818	92.100	13.176	0.143

Source: Calculated by the researcher based on the estimated production function.

Table (2): Shows the production function of the wheat crop in the case of constant labor at its arithmetic mean and changing capital

N	L	K	$\hat{y}$	APK	MPK	EK
1	10.656	254340	1012.737	0.00398	0.00159	0.399
2	10.656	256340	1015.925	0.00396	0.00158	0.399
3	10.656	258340	1019.599	0.00394	0.00157	0.398
4	10.656	260340	1022.253	0.00392	0.00233	0.594
5	10.656	262340	1026.919	0.00391	0.00803	0.205
6	10.656	264340	1028.525	0.00389	0.00155	0.398
7	10.656	266340	1031.637	0.00387	0.001549	0.400
8	10.656	268340	1034.736	0.00385	0.001542	0.401
9	10.656	270340	1037.821	0.00383	0.00153	0.399

Source: Calculated by the researcher based on the estimated production function.

Tables (1, 2) show that wheat crop outputs are increasing decreasing as the amount of variable production element used increases when the other production element is stable at computational medium. This is demonstrated by the values of the marginal and intermediate outputs of the two production components as they were positive and decreased at each increase of the variable production component and that the threshold output values are smaller than the average output values, as well as that the threshold output remains positive and larger than zero, indicating that farmers' productive levels are at the end of the second stage of production And according to production flexibilities, most farmers have not reached maximum production because the value of the threshold output has not reached zero, We have also shown that the production flexibility of each of the production components increases in decreasing increases with increases in the values of the production components' marginal and moderate outputs. The processes used for human labour, the capital used and the costs for one dunum of the wheat crop grown in the sample under study can be explained as in table (3).

Table (3): Showing the amount needed for both capital and human labour and variable, fixed and quantitative costs per dunum grown with wheat crop

Crop	Capital (dinar)	Labour (Man/Day)	Total costs/dinar		
			FC	VC	TC
Wheat	229988	10.656	175161.8	283988	459149.8

Source: Calculated by researcher based on questionnaire form.
*1 USD = 1.310 IQD

Table (3) shows that the amount of capital required to grow one dunum of wheat crop was 229988 dinars, and one dunum of labor requires (10.656) men/day, while the total costs amounted to (459149.8) dinars, and the fixed costs amounted to (175161.8) dinars, while the variable production costs amounted to (283988) dinars. In order to optimize the quantities of work and capital that will achieve the different production volumes of the wheat crop where it can be calculated, as follows:

Optimal amounts of labor and capital that achieve the productive level at the break-even point

The production size at the tie point of the wheat crop can be extracted by the following formula:

Production volume at parity point = $\frac{(\text{production quantity} \times \text{fixed costs})}{(\text{production value} - \text{variable costs})}$ (Al-Samarrai, 1980)

Using the above law we get:

Output size at tie point = $\frac{175161.8 \times 1026.919}{283988 - 800996.82} = \frac{179876980.5}{517008.82}$

Output size at tie point = 347.918 kg/dunum

After extracting the volume of production at the break-even point, it is necessary to extract the optimal quantities of the labor and capital components that achieve those production volumes by equating the technical replacement rate with the inverse price ratio of those agricultural resources (labor and capital), as follows:

$\frac{b_1 K}{b_2 K} = \frac{w}{r}$

Where:

b1 = production flexibility for work element.

b2 = production flexibility for capital element.

w = Worker's wages.

r = Capital rate used to grow the wheat crop under consideration in the governorate of 1.1 after the interest rate of 10% in Iraqi banks at the overall average. As follows:

$\frac{\partial K}{\partial L} = \frac{0.224\ K}{0.401\ L} = \frac{1800}{1.1}$

$= \frac{7218\ L}{0.2464} = \frac{0.2464\ K}{0.2464}$

∴ K = 29293.831 L ……. (1)

Offsetting the value (K) of the crop under consideration in the estimated production function, Since the value of y is known, which is the volume of production at the parity point and which is calculated according to the law above, we will receive the value of L, and offsetting the L value in K of the confirmed relationship between K, L we will receive the corresponding K value as follows:

y = 4.055 L0.224 K0.401

Offset by the quantity of production at the parity point of (347.918) kg and the value of capital (29293.831 L) that we have received above, we will receive the amount of L at which the parity volume of production is achieved for crop farmers as follows:

347.918 = 4.055 L0.224 (29293.831 L)0.401

347.918 = 4.055 L0.224 (29293.831)0.401 L0.401

347.918 = (61.826) 4.055 L0.625

347.918 = 250.704 L0.625

∴ L0.625 = 1.387

L = (1.387)y0.625

L = (1.387)1.6

∴ L = 1.689 man/day

The amount of work needed to achieve the equivalent size of the wheat crop under consideration.

Offsetting the value of L in K we get K as follows:

K = 29293.831 L = 29293.831 (1.689) = 49477.2805 dinar

The amount of capital needed to achieve the equivalent wheat crop size.

One result can be concluded that to achieve a production quantity of 347.918 kg of wheat crop, 1.689 men/day and 49477.2805 dinars must be made available to farmers of the above crop.

Optimal quantities of work and capital at sample production volume
It is necessary to calculate the optimal quantities of the suppliers of labor and capital and the quantity of production in the sample studied for the wheat crop, as shown in table (4), by equalizing the marginal replacement rate for the two components of production (labor and capital) with their inverse price ratio, and by compensating their results in the estimated production function, previously, optimal quantities of the two components (labor and capital) will be obtained.

Optimal quantities of work and capital to be used at optimal volume of production
Optimal quantities of work and capital must be extracted at the optimal volume of production that makes production costs at their lowest level, by equating the threshold replacement rate of the labour and capital components to their inverse prices ($\frac{b_1 L}{b_2 K} = \frac{r}{w}$) with fixed capital and working at their arithmetic, offset by quantities of production elements resulting from subsequent equations in production functions to obtain the civil optimal production volume of costs for the thoughtful crop, and the work required for one dunum of wheat crop is 10.656 men/day and the capital required for dunum is 229988 dinars.
With compensation in the amount of 229988 dinar we receive:

$$\frac{b_2 L}{b_1 K} = \frac{r}{w}$$

$$\frac{0.401 L}{0.224\ (229988)} = \frac{1.1}{18000}$$

7218 L = 56669.043
∴ L = $\frac{56669.043}{7218}$
∴ L = 7.851 man/day

The amount of work needed to achieve the optimal volume of wheat crop production.
With compensation for the amount of 10.656 man/day work required for the dunum, we receive the amount of capital as follows:
$\frac{0.401\ (10.656)}{0.224\ K} = \frac{1.1}{18000}$
0.2464 K = 76915.005
So K = $\frac{76915.008}{0.2464}$ = 312155.064 dinar
∴ K = 312155.064 dinar

The amount of capital needed to achieve the optimal volume of wheat crop production.
After we have estimated the optimal amounts of labor and capital, we can find the optimal volume of production by substituting the optimal values for each of (K, L) into the estimated production function, as follows:

y = 4.055 L0.224 K0.401
y = 4.055 (7.851)0.224 (312155.064)0.401
y = 4.055 (1.586) (159.677)
y = 1026.919 kg/don
Optimal volume of wheat crop production at optimal combinations achieved.
Optimal Quantities Of Work, Capital And Maximum Production Volume Of Profit
After we have found the size of the tie, the optimal size and the size of the average sample production, you have to find the maximum size of the profit and the optimal quantities that you achieve. (Al-Aswadi, 2001), the maximum volume of production for profit and optimal quantities of work and capital achieved by equalizing the value of the threshold output of the two elements of production multiplied by the output price of wheat for the price of work and capital, and for the purpose of obtaining values (K, L) and offset in the thoughtful crop production function we will get the maximum profit size (Al-Zubaidi, 1997) as follows:
y = 4.055 L0.224 K0.401
Threshold output value of work (threshold output × production price) = working price (VMPY = PL)
MPY = $\frac{\partial y}{\partial L}$ = [4.055 (0.224) L-0.776 K0.401] 780 = 18000
708.489 K0.401 = 18000 L0.776
L0.776 = 0.0393 K0.401
L = (0.0393) 1/0.776 K0.401/0.776
L = (0.0393)1.288 K0.516 ……. (1)
VMP y = PK
Value of capital threshold output = capital price
$\frac{\partial y}{\partial K}$ = 4.055 L0.224 0.401 K-0.599
= 4.055 (0.401) L0.224 0.401 K-0.599
= $\left(\frac{(4.055)(0.401)L^{0.224}}{K^{0.599}}\right)$ 780 = 1.1
1268.322 L0.224 = 1.1 K0.599
L0.224 = 0.000867 K0.599

L = (0.000867)1/0.224 K0.599/0.224
L = (0.000867)4.464 K2.674 ……. (2)
Equating the equation (1) to the equation (2) we get the value of K as follows:
(0.0393)1.288 K0.516 = (0.000867)4.464 K2.674
Divide by K0.516 we get:
(0.0393)1.288 = (0.000867)4.464 K2.158
(0.0393)1.288/2.158 = (0.000867)4.464/2.158 K
(0.0393)0.596 = (0.000867)2.068 K
0.145 = 0.000000465 K
∴ K = 311827.957 dinar
Offsetting K value in L value we get L value, and as it comes:
L = (0.0393)1.288 K0.516
L = (0.0393)1.288 (311827.957)0.516
L = (0.0154) (683.691)
∴ L = 10.528 man/day

The amount of work needed to achieve the maximum size of profit.
By offsetting the value of L and K in the estimated output function we get the optimal amount of production maximized for profit and as follows:
y = 4.055 L0.224 K0.401
y = 4.055 (10.528)0.228 (311827.957)0.401
y = 4.055 (1.694) (159.609)
y = 1096.381 kg/don
The volume of the most profitable production of wheat crop.
The above findings can be explained in table (4).

Table (4): Shows the optimal amounts of labor and capital, production volume, total revenues, costs, and net profit for the different production volumes of the wheat crop

Different production volumes	Production volume (kg)	Optimal amount of work (man/day)	Optimal amount of capital (dinar)	Total revenues (dinar)	Total costs (dinar)	Net profit (dinar)
At the break-even point	918,347	689,1	2805,49477	04,271364	04,271364	00,00
At the sample output size	729,933	196,8	238,240092	62,728308	02,348113	6,380195
At optimal size	919,1026	851,7	064,312155	82,800996	7,413091	12,387905
At the maximum profit size	381,1096	528,10	957,311827	18,855177	325,436638	855,418538

Source: Calculated by the researcher based on sample data.
*1 USD = 1.310 IQD
*Hectare is equal to 4 dunums

It is clear from table (4) that the optimal quantities of the two components of production (labor and capital) used at the break-even point amounted to (1.689) men/day and (49477.2805) dinars, respectively, and that the total revenues amounted to (271364.04) dinars, which is equal to the total costs, which made the net profit equal to Zero at break-even size. While the volume of production achieved as an arithmetic mean for the sample amounted to (933.729) kg/dunum, and the optimal amount of work reached (8.196) men/day, the invested capital amounted to (240092.238) dinars, while the net profit amounted to (380195.6) dinars, we conclude from this to maximize Production to the highest level Large amounts of labor and capital must be used The reason for the low production is due to the inability of the farmers in the sample to integrate the two components of production efficiently in order to achieve the largest possible amount of production, because the agricultural knowledge of most of the sample's farmers is low and weak and is acquired through daily practice and experience resulting from agriculture and not through specialized academic learning. While production at the optimal size reached (1026.919) kg/dunum, and the optimal quantities of the two components (labor and capital production) are (7.851) men/day and (312155.064) dinars, respectively, while the net profit is (387905.12) dinars, and this is in line with the logic of economic theory. To achieve the maximum profitable production volume of (1096.381) kg/dunum of wheat crop, the

optimal amounts of labor and capital, amounting to (10.528) men/day and (311827.957) dinars, respectively, must be used, and from this a net profit of (418538.855) dinars per dunum is achieved, and thus the best production volume is achieved, the greatest profit is achieved using the optimal quantities in the above table of labor and capital for the wheat crop, which is the volume of production that maximizes profit, this is not consistent with the study conducted by (Zenzel, 2013) where the best production volume that achieved the greatest profit was the optimal production volume.

Marginal replacement rates of the two production components at different production sizes The threshold replacement rates of the production components (work and capital) at the production volumes at the parity point, the optimal volume of production and the computational medium of the sample production volume and the maximum profit volume of the wheat crop were extracted through the following formula (MPSL, K = $\frac{\mathbf{b_2 L}}{\mathbf{b_1 K}} = \frac{\mathbf{r}}{\mathbf{w}}$) Assuming capital stability at the arithmetic center because the optimal expansion path that farms can pursue in the short term is only to increase the amount of work used because the capital in the short term is characterized by stability, as follows:

A. At the tie point:

RTSL, K = $\frac{0.224\ (229988)}{0.401\ (1.689)} = \frac{51517.312}{0.677}$ = 76096.472

B. At optimal size:

RTSL, K = $\frac{0.224\ (229988)}{0.401\ (7.851)} = \frac{51517.312}{3.148}$ = 16365.092

C. When sample production size:

RTSL, K = $\frac{0.224\ (229988)}{0.401\ (8.196)} = \frac{51517.312}{3.286}$ = 15677.818

D. At the maximum profit size:

RTSL, K = $\frac{0.224\ (229988)}{0.401\ (10.528)} = \frac{51517.312}{4.221}$ = 12205.001

Here we can show the values of the threshold replacement rate that we have received at different levels of production in the form of a scale, as follows:

Table (5): Showing the threshold replacement rate of different production volumes

Crop	**Different production volumes at breakeven**	**Marginal (technical) substitution rate(RTS) 76096.472**
Wheat	At optimal size	16365.092
	At sample production size	15677.818
	At the Maximum Size of Profit	12205.001

Source: Calculated by researcher in previous mathematical analysis methods.

Table (5) shows that the threshold substitution rate decreases as we move to a higher production level for the wheat crop and this applies to the economic logic of economic theory, which asserts that the values of the technical replacement rate decrease when expanding production in the short term. When production reaches a maximum, the technical replacement rate is equal to zero because the limiting output of the variable production element of work is equal to zero at the maximum output, and because RTS between the two elements of production is equal to the threshold product divide by the

threshold output of the other element. (MRTS = MPL/MPK) (Koustsoyians, 1975), from which we conclude that the farmers studied did not reach the maximum production volume shown by the study through RTS values in the calculus of the thoughtful crop and their values were positive and greater than zero and their optimal production volumes were lower than the presumed production levels. This is demonstrated by the positive and greater-than-zero values of RTS technical replacement rates at maximal profit volumes. This indicates that the prices of the studied agricultural crop do not allow access to maximum productivity levels. (Koustsoyians, 1975). Impact of different production volumes on the use of optimal quantities of work and capital

This can be explained by the relationship between the different production sizes of the wheat crop and agricultural resource uses in the following table. Table (6) shows that optimal quantities used by suppliers (Work and Capital) Increasing Production Levels Towards Profit Volume where the quantities used at the maximum profit volume exceed the quantities used from the work at the parity point and the optimal size and volume of the sample production for different production volumes, While capital has also continued to increase production expansion, it has not exceeded optimal size, and this indicates that optimal size is best for crop farmers.

Table (6): Showing the quantities used for work and capital at the productive volumes of the studied crop

Crop	**Productive Size**	**Optimal quantities of work**	**Optimal amounts of capital**
Wheat	At tie point	1.689	49477.2805
	At sample production size	8.196	240092.238
	At optimal size	7.851	312155.064
	At the Maximum Size of Profit	10.528	311827.957

Source: Calculated by the researcher based on the data in Table (4).

Table (7) Production ranges between different production volumes and quantities used by labour and capital suppliers

Paragraphs	**Values**
Production range between tie point and sample production volume (kg)	585.811
Working element range between tie point and sample production volume (man/day)	6.507
Extent of capital element between tie point and sample production pilgrimage (dinar)	190614.957
Production range between sample production size and optimal size (kg)	93.19
Working element rate between sample production size and optimal size (man/day)	- 0.345
Extent of capital element between sample production size and optimal size (dinar)	72062.826
Production range between optimal size and maximum profit size (kg)	69.462
Working element range between optimal size and maximum profit size (man/day)	2.677
Extent of capital element between optimal size and maximum profit size (dinar)	- 280327.107

Source: Calculated by the researcher based on previous findings.

*1 USD = 1.310 IQD

*Hectare is equal to 4 dunums.

Table (7) shows that the quantities used for both components of production (Work and Capital) increases as we move from my productivity to another productivity. The quantities used at sample production volume were greater than the quantities at the optimal

volume of production. Their results took a negative signal. The amount of capital at the maximum profit volume was lower than the optimal volume because price levels did not respond to the expansion of production. production ", That is, the different productive periods have an impact on the quantities used by labour and capital suppliers. From the observation of the two tables (5, 6) production is subject to the Decreasing Yields Act, where we have observed increased production when comparing resource use at parity point to maximizing profit by dividing the quantities of production achieved by the amount of resources (once using work and capital) and that this situation represents the first stage of production and then the output takes the decreasing increase by increasing the output factor when comparing the optimal output volume to the optimal production range and the sample production volume using optimal quantities of production elements, When comparing the optimal size with the production range of the maximum profit volume from the division of the quantities of production at those volumes and the productive range of the corresponding quantities used from the work element once again and from the capital element, for all levels we find it represents the second stage of production and, therefore, if we assume the stability of one of the production elements and the change of the second production element, the production functions of the studied crop will be cubic according to the different production volumes, productive periods and quantities of the corresponding variable production element, This reflects the law on declining yields in agricultural production referred to in economic theory.

CONCLUSION

1- The study demonstrated that the production achieved is after the middle of the second stage of production, due to the fact that all the values of the production components' threshold output rate were positive and approaching zero.
2- The study also found that the amount of labor used at the break-even size reached (1.689) men/day, and this indicates that production is very close to the beginning of the production level, which indicates the efficiency of farm management for the crop farmers at the beginning of the production factor, and that the use of larger quantities Of the variable production component, it will lead to a greater increase in the amount of production.
3- The study found that the volume of maximum profit production had reached (1096.381) kg/dunum while the optimal volume of production (1026.919) kg/dunum indicates that the maximum profit volume is greater than the optimal volume of production, due to the fact that price levels respond to the expansion of production levels, because the higher costs of production supplies and the entry of the imported product into the market resulted in a decrease in the amount of profits realized by competitor farmers.
4- The study also proved that the largest profit achieved was at the maximum profit, which amounted to (418538.855) dinars per dunum, while the lowest profit achieved was at the sample's production volume, which amounted to (380195.6) dinars per dunum, this indicates the inability of most farmers to Mixing production elements to obtain the highest profits, the reason for this is the high costs on the one hand and the low production volume on the other hand.
5- The study also proved that the weakness of government support for production requirements made production not reach its maximum, thus achieving the greatest profits for the crop's producers, in addition to the failure of most of the crop's farmers

to keep pace with the development taking place in the use of modern technologies, which contribute to increasing crop productivity and maximizing farmers' profits, by reaching maximum profits.

6- The study recommends that there be an effective role for the government in influencing the prices of production inputs, which contributes to achieving better profits for the producer by supporting the price of the output and helping producers by supporting the prices of production factors by increasing the production volumes achieved for most farmers.

CONFLICT OF INTEREST

The author declare no conflicts of interest associated with this manuscript.

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