Journal of Agricultural Sciences and Sustainable Development

Open Access Journal
https://jassd.journals.ekb.eg/

ISSN (Print): 3009-6375; ISSN (Online): 3009-6219

Estimating the optimal amounts of labor and capital for the boro wheat crop irrigated with pivot sprinklers in Salah al-Din Governorate for the productive season (2021-2022)

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Abstract

The research aimed to estimate the wheat crop production function to determine the relationship between the optimal combination of using productive resources (labor and capital), in order to reach the optimal production level. A random sample of (70) pivot sprinklers of (60) dunums was selected. The Cobb-Douglas function was estimated for the wheat crop irrigated by spraying in Salah al-Din Governorate using (SPSS23) program. It turns out that the average amount of work, which is (9.1) workers/day, is greater than the optimal amount of work in the sample, which is (6.314) workers/day. As for the amount of capital resource at its average in the research sample, it reached (264. 041.34thousand dinars), which is greater than the optimal quantity of capital resource, which amounts to (237.579) thousand dinars. Therefore, if the farmer wants to achieve optimal production, he must reduce the amount of work and capital used to achieve to the optimal amount of production. The optimal production in the sample was (905.39) kg, while the average production was (1028.6) kg. This means that the amounts of work and capital used must be reduced, to achieve economic efficiency and then raise production to the optimal level. The net profit is 357. 235thousand dinars. This means that the farmers obtained a higher net profit from using the optimal quantities of the labor and capital components compared to the quantities used by the sample farmers.

Manuscript Information:

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Received: 17/01/2024
Revised: 24/01/2024
Accepted: 28/01/2024
Published: 03/02/2024
DOI: 10.21608/JASSD.2024.263552.1006

Keywords: Optimal Size, Wheat Yield, Production Function.

مجلة العلوم الزراعية والتنمية المستدامة

Open Access Journal
https://jassd.journals.ekb.eg/

الترقيم الدولي (مطبوع): 3009-6375 الترقيم الدولي (أونلاين): 3009-6219

التحليل الاقتصادي والقياسي لإنتاج محصول القمح (صنف بورو) المروي بالمرشات المحورية فئة 60 دونم في محافظة صلاح الدين للموسم الإنتاجي (2022/2021)

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الملخص العربي:

هدف البحث الى تقدير دالة إنتاج محصول القمح لمعرفة العلاقة التوليفة المثلى من استخدام الموردين الانتاجيين (العمل ورأس المال)، في سبيل الوصول الى مستوى الانتاج الامثل. إذ تم اختيار عينة عشوائية تقدر بحوالي (70) مرشة محورية فئة (60) دونم. جرى تقدير دالة كوب–دوجلاس لمحصول القمح المروي بالرش في محافظة صلاح الدين بإستخدام برنامج (SPSS23). أتضح بان متوسط كمية العمل والبالغة (9.1)عامل/يوم هي اكبر من الكمية المثلى للعمل في العينة والبالغ (6.314) عامل/ يوم. أما كمية مورد رأس المال عند وسطه في عينة البحث بلغت نسبته (264041.34) الف دينار، وهي أكبر من الكمية المثلى لمورد رأس المال والبالغة (237579) الف دينار. لذلك إذا اراد المزارع تحقيق الانتاج الامثل عليه أن يقلل من كمية العمل ورأس المال المستخدم للوصول الى الكمية المثلى من الانتاج .أما الانتاج الامثل في العينة بلغ (905.39) كغم، أما الانتاج عند المتوسط فبلغ (1028.6) كجم . هذا يعني وجوب التقليل من كميات العمل ورأس المال المستخدم، لتحقيق الكفاءة الاقتصادية ومن ثم رفع الانتاج إلى المستوى الامثل. وبلغ صافي الربح 357235 ألف دينار. هذا يعني أن المزارعين حصلوا على صافي ربح أعلى من استخدام الكميات المثلى من عنصري العمل ورأس المال مقارنة بالكميات المستخدمة من قبل مزارعي العينة.

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تاريخ استلام البحث: 2024/01/17م
تاريخ إجراء التعديلات: 2024/01/24م
تاريخ القبول: 2024/01/28م
تاريخ النشر: 2024/02/03م
معرف الوثيقة:
DOI: 10.21608/JASSD.2024.263552.1006

الكلمات المفتاحية: الحجم الأمثل، محصول القمح، دالة الإنتاج.

INTRODUCTION:

In the agricultural sector, wheat is considered one of the most important major grain crops, if not the most important, and is closely linked to human life, in addition to being ranked first among grain crops, especially the type (Triticum astavum L), as it occupies an important economic place in Iraqi agriculture, both in terms of its contribution In agricultural income or in terms of cultivated area. It ranks first among the grain crops in the world and in Iraq (wheat, barley, rice, and yellow corn), and given the global circumstances and conditions now, it has become necessary to study the various aspects that would increase the production yields of this important crop. One of the innovations that have shown success in increasing production for various crops is supplementary irrigation, which is one of the most important methods adopted by farmers in Iraq in recent years and which has proven effective in increasing production and reducing water waste.

RESEARCH PROBLEM:

Although farmers use center pivot irrigation in agriculture, the research problem is summarized in the farmers' inability to reach the optimal production that maximizes profits. The research will address the most important reasons that prevent them from reaching the optimal level of production.

RESEARCH OBJECTIVES:

The research aims to:

(1) Estimating the wheat crop production function to know the amount of production of this type of wheat per unit area.

(2) Knowing the optimal sizes of the two components of production (capital, labor), to reach optimal production.

(3) Maximizing production and thus maximizing profits.

RESEARCH HYPOTHESIS:

The research assumes that farmers in Salah al-Din Governorate achieve good levels of productivity, but they do not reach the optimal production level from the point of view of agricultural economics. In addition, there is a waste of farm resources due to inefficient use of resources, especially the capital resource, which makes there a surplus in use, which leads to increased costs, thus reducing the achieved return.

RESEARCH IMPORTANCE:

The importance of the research lies in the importance of the crop that is the subject of the study, as the wheat crop is closely linked to the country's food security. In addition to that, choosing varieties with high productivity to reduce cultivated areas, reduce the use of water, reach self-sufficiency, and benefit from water storage.

DATA COLLECTION METHOD:

The questionnaire form was relied upon, through which data was collected in the field from wheat farmers in Salah al-Din Governorate, for a random sample that included 70 farms of 60 dunams as a selected sample, and the quantitative method was used in analyzing the data to reach the results.

THEORETICAL FRAMEWORK:

Concept of Production: The agricultural production process is complex and constantly changing according to the emergence of new technology (Al-Affendi, 2012: 224). Production is defined as (creating or increasing a benefit). In this field, the benefit is divided into (formal benefit), which means creating a change in the

form of matter, such as transforming the elements in the soil into a crop. There is also (spatial benefit), which means transporting a crop from one place to another. (Al-Awad, 2017: 25).Another in which the benefit derived from it increases. There is (temporal benefit), which arises as a result of storing the crop until a time when it is most useful, and there is (use of ownership), which means increasing the benefit of the commodity when it is transferred from one individual to another who can benefit from it (Al-Sheshtawi et al., 2013:38).

Production function: The production function is what shows the relationship between the different amounts of production factors and the largest amount of production that can be obtained from them, during a specific period of time, regardless of prices. In other words, the production function shows the proportions in which the factors of production are mixed in order to transform them into output. Therefore, it There are a number of functions equal to the number of ways in which these resources can be mixed to turn into an output (Jamal et al., 2017: 107).

The production function takes the following mathematical form (Martin,2016:190):

TP=f(K,L,T….)

It represents:

Tp= represents the amount of production of the crop.

K = amount of capital used to produce the crop.

L = represents the amount of labor used to produce the crop.

T= represents the amounts of land used to produce the crop.

MATERIALS AND METHODS:

Description and formulation of the model:

Formulating a mathematical model is the first step that econometricians take when studying any relationship between a group of variables to obtain a model through which economic phenomena can be studied in an applied manner. This step is called hypothesis formulation, in which the dependent variable and independent variables of the studied phenomenon are identified. The mathematical form of the model is also determined in terms of the number of equations and whether the relationship is linear or non-linear. Based on the above, the proposed model included the following variables:

$Y = A\ \mathrm{L}^{b1}\ \mathrm{K}^{b2}$

$Ln\ Y = A\ b1\ Ln\ L + b2\ Ln\ K$

Y = Dependent variable, which represents the estimated production quantity of the wheat crop (kg).

L (labor) = human labor (family + wage), (man/day)

K (capital) = total variable capital expenditures that are converted into production, such as (mechanical work costs, seed purchase expenses, fertilizers, pesticides, fuel and oils, equipment maintenance and repair, irrigation water cost, marketing expenditures) and all other requirements that are converted into output from Wheat crop during the same agricultural season (thousand dinars).

RESULTS AND DISCUSSION:

(1) Estimating the production function and its derivatives for the wheat crop

This research was adopted to estimate and analyze the results of the model coefficients for the wheat

crop production function according to the Cobb-Douglas function and the known function formulas (linear, semilogarithmic, inverse semilogarithmic, double logarithmic) by relying on the questionnaire form for a sample of wheat crop farmers in Salah al-Din Governorate for the productive season (2021 - 2022).

The data collected through a questionnaire form for wheat farmers in Salah al-Din Governorate included the two components of production (labor and capital), in addition to the amount of production achieved and the costs expended to grow the crop under study, as the labor component included the human labor (man/day) consisting Of family work and wage labor, the wage is (15,000 dinars) for a man who works (8) hours a day, while a woman's work is equivalent to (3/4) of a man's work, and a child's work is estimated to be equivalent to (1/2) a man's work. The unit of work was standardized and equalized (man/day). The percentage of family work constituted (31%) of the total human work, while the percentage of wage labor was (69%). The amount of work per dunum of crop was estimated, which includes plowing, amending, seeding, watering, fertilizing, pest control, and harvesting the crop. The amount of the capital component per dunum of crop was estimated at one thousand dinars, which includes the costs of purchasing seeds, pesticides, fertilizers, mechanical operations, maintenance, irrigation water and fuel costs, marketing expenses, and all supplies used for the purposes of growing the crop. The quantity of wheat production was estimated on the basis of productivity (kg/dunum). As for the costs of producing the crop in the short term, the fixed production costs were divided into two parts and included (family work, land rent, interest on capital, and depreciations) and were estimated in dinars per dunum of crop grown, including the land rent of (1000) dinars per dunum and interest on capital. (10%) and annual extinction. Variable production costs were also estimated in dinars per dunum, including the wages of hired human labor in addition to the items that were calculated within the capital component items).

The following table shows the descriptive composition of the population studied in the sample for the wheat crop for the productive season (2021-2022). The agricultural labor resource consists of labor (family and rented). Below is the contribution of each of them to agricultural work.

Table (1): Percentage of contribution of family and wage labor to total labor:

Total work	Relative importance %
Family business	31
Hired work	69
Total agricultural work	100

Source: Prepared by the researcher based on the questionnaire form.

(2) Economic analysis of the wheat crop production function for the production season (2021-2022):

The production function was estimated using the least squares (OLS) method to estimate the model parameters, as this method is one of the most important and most widely applied methods in estimating the economic model, due to its characteristics such as small variance (minimum) and unbiased. Several models were formulated, including the model (linear function, logarithmic, double logarithmic, and inverse logarithmic

function), with the aim of representing the relationship between the total output of the wheat crop as a dependent variable and the labor and capital components as independent variables. The results of the analysis showed that the double log function is the function that is most consistent with economic logic and represents the relationship in that it passes statistical and analogical tests. After conducting statistical analysis using the SPSS program, it was possible to estimate a production function for the wheat crop according to the following model:

$$\text{Ln } Y = bo + b1 \text{Ln } L + b2 \text{ Ln } K$$

$$\text{Ln } Y = 0.000 + 0.121 \text{ Ln } L + 0.481 \text{ Ln} K$$

By converting the function to exponential form

$$\text{Ln } Y = 1.661 + L^{0.121} + K^{0.481}$$

t = (4.516) (2.304) (2.031)

$F=10.225$,$R^2 =0.881$, D.W = 2.058 , n =70

Since:

Y = total yield of wheat crop (kg).

L = Total working hours (hours).

K= represents the amount of capital (thousand dinars).

n = sample size.

From the above equation, the t-test shows the significance of the estimated parameters. The (F) test also proved the significance of the function as a whole at a significance level of (1%). The results showed that the value of the coefficient of determination was (0.881). This means that (88.1%) of the fluctuations in the total output of the wheat crop were caused by the independent variables included in the model (labor and capital), while the remaining percentage (11.9%) of those fluctuations are due to variables. Others were not included in the estimated model.

(3) Econometric analysis of the wheat production function:

In order for the model to be acceptable and reliable in explaining the studied phenomenon, it is necessary to conduct the necessary standard tests related to the standard problems (second-order problems), which are:

Autocorrelation problem

The (D.w) test showed that the model is free of the problem of autocorrelation between random variables. At the significance level (1%), its value was about (2.058), and the value was greater than the value of (du), which was (1.82) and smaller than (4-du), which was (2.058), meaning that 1.82 <2.058>2.37 at a significance level of (5). %). Also at a significant level (1%), as 1.65 > 2.058 > 2.71. This means that it falls in the region of rejecting the alternative hypothesis and accepting the null hypothesis that this phenomenon does not exist, that is, there is no autocorrelation between the random variables.(Gujarati,et al,2004:5-17)

Heteroskedasticity problem

Given the study's reliance on cross-sectional data, it is expected that there will be a problem of non-stationarity of homogeneity of variance, which often accompanies cross-section data. The presence or absence of this problem was revealed through the (Park) test, which included estimating a square regression equation. Error is considered a dependent variable, and both labor and capital are independent variables. The estimated relationship was as follows.

Error bound square test with work element (L):

$$Lnei^2 = 2.253 + 0.091 \text{ Ln } L$$

t = -1.142 -0.0730

R^2=0.009 F=0.005

Square error test with the capital variable (K):

$Lnei^2$ = -1.481 – 0.634

t = -1.126 - 0.732

R^2 =0.053 F=0.349

We note from the test results for the models that the regression coefficients for the estimated factors are not significant at the level of significance (5% and 1%) according to the t-test, as is the case for the F-test, and this indicates that there is no problem of non-stationarity of variance.

Multicollinearity problem

There are some sources that mention that the problem of multicollinearity only exists when the relationship between variables is linear (Attia,2004:73) and there are many methods to detect this phenomenon, the most important of which are (the Farrar-Clobber method, the determinant of the matrix, deleting R2, in addition to testing Klein). The Klein-Test is used to detect the problem of linear correlation, and it is observed through the simple partial correlation matrix (correlation coefficient matrix) between the variables and comparing the square root of the coefficient of determination with the simple correlation coefficient between any two independent variables. If the value of (R2) is greater or If the value of the correlation coefficient is equal between any two variables, we infer that the problem does not exist and vice versa. The test is based on the variance and covariance matrix, and by performing the aforementioned test on the model under study, it became clear that it is free from the problem of multiple linear correlation between the explanatory variables, as the correlation coefficient for the model reached (0.90), while the The simple correlation matrix between the independent variables included in the model.

(4) Economic analysis of the wheat crop production function:

Economic analysis of the wheat crop production function in the event that labor changes and capital remains constant at its arithmetic and agency mean

$Y = 1.661\ L^{0.121}\ \ K^{0.481}$

Exponential formula

The results of the statistical estimation of the parameters of the wheat production function showed that the sign of all parameters agrees with economic logic, and since the parameter value of the variable in the double logarithmic function represents the production elasticity of this variable. The elasticity of production for the labor resource was (0.121), meaning that whenever labor increases by one unit, production increases by (0.121%) when the capital component remains constant. As for the elasticity of the capital component, the value was (0.481), meaning that by increasing capital by one unit, it increases Production increased by (0.481%) when the labor element remained constant. When looking at the estimated wheat crop production function, it becomes clear to us that the sum of the production elasticities for the components of labor (L) and capital (K) is less than the correct one, reaching (0.602). This means that the wheat crop production function reflects a state of diminishing return to production capacity, and this The situation indicates that the productive stage of the governorate's farmers is the second production

stage of the law of diminishing returns, in which production increases in a decreasing manner, and that their production levels are in the middle of the second production stage (the rational production zone).

(5) Finding the optimal quantities of labor, capital and production suppliers:

The optimal values of labor, capital, and production resources were reached by equating the marginal product of the productive resource with its price. Note that the prevailing wage is (15.000) dinars when the average selling price of the crop is (820) dinars per kilogram of wheat crop.

Wheat production function in its exponential form:

$Y = 1.661\ L^{0.121}\ K^{0.481}$

From the above function, we find the marginal product of the labor component by taking the first derivative

$\frac{\partial y}{\partial L} = 0.20098\ L^{-0.879}\ K^{0.481}$

$0.20098\ \frac{K^{0.481}}{L^{0.879}}$

When we apply the equation to equate the value of the marginal product of the labor resource with its price, VMPL = W, we obtain:

$(0.20098) \times (820) \times [\frac{K^{0.481}}{L^{0.879}}] = 15000$

$164.804\ [\frac{K^{0.481}}{L^{0.879}}] = 15000$

By dividing both sides by 164.804, the following is achieved.

$\frac{K^{0.481}}{L^{0.879}} = 91.017$

Multiplying both sides by the middle gives:

$L^{0.879}\ \ 91.017\ = K^{0.481}$

Multiplying the power of both sides of the productive suppliers by (1/0.481) results in:

$K = (91.017\ L^{0.879})\frac{1}{0.481}$

$K = (91.017\ L^{0.879})^{2.079}$

$K = 11830.9\ L^{0.76481}$ … Capital value ..... (1)

From the first equation, we find the value of the marginal product of the capital component in the same way:

$\frac{\partial y}{\partial K} = 0.79894\ \frac{L^{0.121}}{K^{0.519}}$

When applying the equation to equate the marginal product of the capital resource with its price (1.1) dinars with the average

The selling price of the crop is (820) dinars. The equation becomes as follows: VMPk = r

$(0.79894) \times (820) \times [\frac{L^{0.121}}{K^{0.519}}] = 1.1$

$(655.132) \times [\frac{L^{0.121}}{K^{0.519}}] = 1.1$ ..... By dividing both sides of the equation by(1.1)

$595.574\ \frac{L^{0.121}}{K^{0.519}} = 1$..... We multiply the means by both sides

$K^{0.519} = 595.574\ L^{0.121}$ ..... We multiply both sides of the equation(1/ 0.519)

$K = (595.574\ L^{0.121})^{1.92678}$

$K = 222173\ L^{0.01709}$ … Value of capital resource (2)

By equating the value of the capital resource in Equation (2) with Equation 1, we get:

$222173\ L^{0.01709} = 11830.9\ L^{0.76481}$ |… By dividing both sides of the equation by (11830.9)

$18.7791\ L^{0.01709} = L^{0.76481}$ .....

Convert a value $L^{0.01709}$ We get

$18.7791 = L^{0.74772}$ Multiplying both sides $(\frac{1}{0.74772})$

$L = (18.7791)^{1.3374}$

$L = 50.5142$ The optimal amount of labor resource working hours

$L = \frac{50.5142}{8} = 6.314$

$L = 6.314$ The amount of work required to produce the crop during the season at its arithmetic mean

Substituting the optimal value of L into equation (1 or 2) we obtain the optimal capital value

$K = 222173\,(50.5142)^{0.01709}$

$K = 237579$

Optimal capital value

$K = 237.579$ The amount of capital required to produce the crop during the season at its arithmetic mean

The optimal output from the wheat crop is extracted by substituting the optimal values of labor and capital into the main equation of agency production.

$Y = 1.661\,(50.5142)^{0.121}\ (237579)^{0.481}$

$Y = 1.661 * 1.60736 * 385.268$

$Y = 1028.06$ Optimum production (kg/dunum)

To compare the results obtained for the optimal quantities of labor and capital suppliers with their average use in the sample, it became clear that the average quantity of labor, which is (9.1) workers/day, is greater than the optimal quantity of labor in the sample, which is (6,314) workers/day. As for the amount of capital resource at its average in the research sample, it reached (264,041.34 thousand dinars), which is greater than the optimal quantity of capital resource, which amounts to (237,579) thousand dinars. Therefore, if the farmer wants to achieve optimal production, he must reduce the amount of work and capital used to achieve To the optimum amount of production.

The optimal production in the sample was (905.39) kg, while the average production was (1028.6) kg. This means that the amounts of labor and capital used must be reduced, to achieve economic efficiency and then raise production to the optimal level.

The supply function derived from the production function:

The supply function was extracted from the production function using the following equation:

$$Y = A^{\frac{1}{1-a-b}}\ (\frac{a}{w})^{\frac{a}{1-a-b}}\ (\frac{b}{r})^{\frac{b}{1-a-b}}\ PY^{\frac{a+b}{1-a-b}}$$

We substitute the values of (A, a, b, w, r) into the above equation.

$Y=(1.661)^{2.5126}\ (0.00000807)^{0.304}\ (0.405)^{1.2085}\ PY^{1.5126}$

$Y= 3.5785 \times 0.02828 \times 0.3680\ PY^{1.5126}$

$Y=0.03724\ PY^{1.5126}$

Table (2) shows the quantities of the crop supplied at different prices:

Sequence	Selling prices of wheat crop	Quantities offered are kg
1	820	951.449
2*	750	831.323

Source: Prepared by the researcher based on the selling prices of the crop.

*The price 750 is the price outside government silos.

From the table it appears to us that price and quantities move in the same direction, that is, the supply curve of output has a positive slope. This indicates that by changing the price by (5% or 10%), it leads to a change in the quantity supplied of output by a greater percentage. As for the elasticity coefficient of the wheat crop supply function, which has an important role in drawing and determining the direction of agricultural policy, and whose value is greater than the correct one (1.5126), this leads us to the conclusion that the crop supply is elastic towards any change in the price of the wheat crop. Through flexibility,

agricultural policy can determine support, whether in supporting output prices, or providing and supporting production requirements.

(6) The optimal quantities of (labor and capital) at the sample production volume:

We extract the optimal quantities from the suppliers of labor and capital and the quantity of production as an average in the studied sample by equating the marginal substitution rate for the two components of production, labor and capital, with their inverse price ratio. By substituting the results reached into the estimated production function, we obtain the optimal quantities of the two components of production.

$Y = 1.661\ L^{0.121}\ K^{0.481}$ Production function:

C subject up $C^* = wL + rK$ Cost equation

$426945 = 15000\ \text{L} + 1.1\ \text{K}$

By linking the above two equations using Langrangea:

$M = 1.661\ L^{0.121}\ K^{0.481} + \lambda\ (426945 - wL - rK)$

By taking the first partial derivative of ((λ, K, L), we find the following:

$\frac{\partial M}{\partial \text{L}} = 1.661 * 0.121\ L^{-0.879}\ K^{0.481} - 15000\lambda = 0..1$

$\frac{\partial M}{\partial \text{K}} = 1.661 * 0.481\ L^{0.121}\ K^{-0.519} - 1.1\ \lambda =$

0…...2

$\frac{\partial M}{\partial \lambda} = 15000L + 1.1\ K - C = 0$…….3

By dividing equation (1/2), we find the following

$RTS = \frac{a\ K}{b\ L} = \frac{r}{W}$

$\frac{\partial y}{\partial L} = \frac{0.201\ K}{0.7989\ L} = \frac{1.1}{15000}$

So $0.87879\ \text{K} = 3014.7\ \text{L}$

$\text{K} = \frac{3014.7\ \text{L}}{0..8788} = (3430.9)\ \text{L}$

By substituting the K values for the crop into the corresponding production function, since Y is known and is the sample production volume.

Thus, we will obtain the values of L, after which we substitute the value of L in K to find the optimal value of K as follows:

$Y = 1.661\ \text{L}^{0.121}\ K^{0.481}$

By substituting the quantity of production in the sample (905.39 kg) and the value of capital (3430.9 L), we obtain:

$905.39 = 1.661\ \text{L}^{0.121}\ (3430.9)^{0.481}$

$905.39 = 83.349\ \text{L}^{0.602}$

$L^{0.602} = \frac{905.39}{83.349}$

$L = (10.863)^{1.6611}$

$L = 52.577$

L=52.577/8=day/man 6.572 The amount of work needed to achieve production of the wheat crop for the sprinkler 60

Substituting the value of L into the value of K, we obtain the value of K as follows:

$K = 3430.9 * (52.577)$

K = One thousand dinars/dunam 180386 The amount of capital required to achieve production for the workshop 60

$Y = 1.661\ 52.577^{0.121}\ 180386^{0.481}$

Y =kg/ dunam 905 Spray production volume is 60 dunums

Calculating the profits achieved when producing the sample and the optimal production size for the sprayers is 60 dunums.

The greatest profit at optimal production can be calculated from the profit function as follows:

$Y = 1.661\ L^{0.121}\ K^{0.481}$ Production function

C= $wL + rK$ Cost function

$\pi = P_y.Y - wL - rK$

$\pi = 1028.6\ (820) - \{(15000(6.3143) + (1.1(237579)$

π= 843452 - 356051

π= 487401 the profit achieved by farmers at optimal production is one thousand dinars/dunum

Calculating the profit for the farmers of the research sample is as follows:

$$\pi = P_y.Y - wL - rK$$

$$\pi = 820 * 905.36 - (9.1 * 15000) + (1.1 * 264041.34)$$

π= 742395 – 385160

π= 357235

One thousand dinars/dunam, the profit achieved by the farmers of the research sample.

It appears from Table (2) that the optimal quantities used from the two components of production, labor and capital, amounted to (6,314 men/day, 237,579 thousand dinars).

While the optimal production reached (1,028.6) kg/dunum. Farmers achieved a net revenue of 487,401 thousand dinars per dunam. While the amounts of labor and capital used in the research sample amounted to (9.1 men/day, 264,041.3 thousand dinars), and a production of 905.36 kg/dunum was achieved. The net profit amounted to 357,235 thousand dinars. This means that farmers obtained a higher net profit from using the optimal amounts of labor and capital compared to the amounts used by the sample farmers.

Table (2) the optimal quantities of labor, capital, production volume, and net revenue when producing the sample and optimal production.

crop	Optimum amount of work man/day	The amount of capital is one thousand dinars	The optimal production volume is kg/acre	Net revenue at the optimal production volume per dunum	Quantity of work for the research sample man/day	The amount of capital for the research sample is one thousand dinars	Sample production volume: kg/acre	Net revenue At the sample production volume kg/acre
Wheat	6.3143	237579	1028.6	487401	9.1	264041.3	905.36	357235

Source: Prepared by the researcher based on the estimated profit functions for the wheat crop for the 60-dunum sprayer.

CONCLUSIONS:

(1) Through the results, it was shown that farmers do not reach the production volume that achieves optimal production that maximizes profits.

(2) The optimal amounts of labor and capital for the pivot sprinkler were (60) dunums (6) men/day. (237579) thousand dinars/dunam, respectively. While the quantities of labor and capital used in the sample were (9.1, 264041.3), from which we conclude that farmers are moving away from the optimal quantities of production resources.

(3) The sample's production volume reached (1028.6) kg/dunum. While the optimal yield reached (1045.35) kg/dunum, respectively. From this we conclude that farmers in Salah al-Din Governorate are moving away from the volume of production that maximizes profits.

(4) The high value of the elasticity of substitution between labor and capital, amounting to (3.423), leads us to the conclusion that the production of the wheat crop is highly capital intensive compared to the amount of labor used.

RECOMMENDATIONS:

1- Urging wheat farmers in Salah al-Din Governorate to follow recommendations related to the optimal use of labor, seeds, fertilizers, and pesticides from the relevant authorities.

2- Encouraging farmers to grow wheat and follow modern methods of cultivation, in order to increase the contribution of Salah al-Din Governorate's local production.

3- Providing electrical power to the study area as much as possible, with fuel support for farmers to reduce costs and encourage them to continue growing the crop in the study area.

4- The study recommends that wheat farmers use the optimal amounts of labor and capital resources in pivot sprinklers (80) dunums, with (8.95) men, and capital (219,073) thousand dinars. In order to achieve the optimal output.

5- Providing the necessary production requirements, including seeds with improved characteristics and high production, chemical fertilizers, and pesticides, according to the recommended optimal quantities, at appropriate prices and on appropriate dates. That is, working to support production requirements that reduce overall costs.

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