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THE PRODUCTION EFFICIENCY AND DETERMINANTS OF THE CHICKPEA CROP IN NINEVEH GOVERNORATE FOR THE PRODUCTION SEASON 2019

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ABSTRACT

The research aimed to estimate the production efficiency and the optimum economic determinants of chickpea crop farms and a sample of 40 farms in Sheikhan district and for the production season 2019, using the data envelope method and the statistical program DEAP and adopting the production quantity as a reliable variable and (cultivated area, quantity of seeds, human work hours, mechanical work hours, amount of control materials). The results showed that the average production efficiency of the research sample farms amounted to (74.8), with a minimum of (54%) and a maximum of (100%), and six farms achieved full production efficiency, which constituted (15%) of the total farms It was found that there is a discrepancy in the quantities of resources used compared to the quantities of resources that achieved economic efficiency, and this resulted in a surplus in some economic resources, and the variable size of the square occupied the largest proportion. . The researcher recommends improving the efficiency of the farmer through the optimal use of the resources used and the use of fertilizers to maintain the fertility of the agricultural soil. The researcher also recommends the need to follow scientific guidelines and results of research and practical studies, especially in Amounts of seeds used per unit area.

INTRODUCTION

Agricultural production in Iraq is still not sufficient to secure the country's need for food, and import is still the master of the situation in securing the basic needs for feeding the Iraqi individual, especially grains, meat, oils, sugar, eggs and legumes (AOAD,2006) and Leguminous crops are considered one of the pillars of sustainable food security. Chickpea is one of the important food crops and is the second largest Leguminous crops in the world, occupying an area of 11.98 million hectares, producing 10.92 million tons, occupying the third place in terms of area and second in terms of production among the legumes cultivated globally, due to its wide spread and its multiple agricultural, food and medical uses (Jukanti *et al*., 2012) Through the identification of efficiency indicators in agricultural production, which are important in the development of the agricultural sector, it became clear that the global demand for this crop has grown, as it is imported by more than 140 countries, and its cultivation has expanded to include more than 50 countries due to its agricultural, food and

medical importance, especially in light of the changes The climatic occurrence as one of the legume crops most tolerant of drought and high temperatures (Muehlbauer and Sarker, 2017). Statistics indicate that 92% of the area and 89% of the total production of chickpea crop in the world is concentrated in the countries of the semi-arid region, where India is the largest producer of chickpea Chickpea in the world, which produces approximately 77% of the global production, as well as Pakistan and Turkey are also countries with high production of the chickpea crop As for Iraq, its cultivation is concentrated in the governorates of (Nineveh, Erbil, Dohuk, Sulaymaniyah) and it is planted during the spring (the spring lug), where it is planted in the first half of March As for the "autumn lug" it is planted during the month of November, when research and experiments proved that the production of winter cultivars is better than the production of spring cultivars, as it gave a double production of seeds in addition to an increase in plant height, which facilitates automated harvesting (Al-Falahi,1998). The local chickpea varieties (Sulaimaniya local) and (Dohuk local) are low-yielding varieties and are not suitable for mechanized harvesting, as they are highly sensitive to disease (Babker, 2002). While the winter cultivars that were developed by the International Center for Agricultural Research in the Dry Areas (ICARDA) were of high productivity and suitable for mechanized harvesting. They are two strains (ILC3279) and (ILC482), where it is preferable to cultivate them in the clay soils .The reality of chickpea production indicates the low productivity of one dunum in Iraq compared to the productivity of one dunam in Arab and international countries, especially neighboring countries, including Syria and Turkey. This is an indication that the use of agricultural resources has deviated from the optimum use and consequently a decrease in the productive efficiency of chickpea production farms, and this requires work to increase the productivity of the dunum by exploiting economic resources more efficiently and redirecting resources towards optimal use. Here lies the research problem. There is no doubt that The actual deviation of agricultural resources from their optimal use means a shortage of production and waste of resources. Therefore, the study and analysis of the productive efficiency of chickpea crop and the economic factors that determine this efficiency and the optimization of the use of these resources is the goal of the research. Low production efficiency of chickpea crop. Therefore, productivity efficiency studies have the importance of being able to show the possibility of increasing production by improving the efficiency of the farm in the use of available resources and production methods, and accordingly, many researchers and specialists gave priority and attention to studying all aspects related to economic efficiency, including the productive efficiency of agricultural crops.

In a study (Abu Zaid, *et al*.,2013) measuring the efficiency of using agricultural resources in some farms in Sohag Governorate in Egypt and using the random border production function, the technical efficiency of the production of some crops, including the bean crop, was estimated, where the average technical efficiency was (87%), and the study found that There is an excessive use of some inputs, especially phosphate fertilizers and manual labor. The researchers recommended following the technical recommendations related to

the use of fertilizers and irrigation and relying more on the human element in the production process of these crops.*(*Siregar, 2013) determined the technical efficiency in the Branc River basin in Indonesia. The research showed that the technical efficiency of soybean production in the research sites was low, amounting to about 23%, and the analysis was not possible to distinguish the determinants of technical efficiency because the study variables were not significant. As for the study of(Hassan, 2004) in which he explained that wheat farmers were working at fixed capacity returns, and the factors responsible for increasing wheat, including the cultivated area, pesticide costs and the number of plows, showed that technical inefficiency could reduce the cultivation of the crop. (Bakh *et al*., 2005) Estimating the technical and distributional efficiency of wheat production in the northeastern regions of Bangladesh. The border production model for technical efficiency was used, and the boundary condition was used to maximize profits to estimate the distributional efficiency. The researchers concluded that the frontier farmers had a high yield by increasing the time of sowing and human labor.

(Kibaara, 2005)used the production function random limits to estimate the technical efficiency of maize production in Kenya, where the average technical efficiency of maize farmers was 49% and concluded that the use of tractors increases technical efficiency by 26% and additional years of study also increases technical efficiency by 0.84% As for (Nygaka *et al.,* 2009), he studied the economic efficiency of potato producers and analyzed the factors affecting the economic efficiency of small farmers in Kenya, where the results showed a decrease in capacity returns in potato production, and the average economic efficiency was 0.39 with a range ranging from (0.12-0.66) and the study confirmed on the adoption of modern agricultural technologies.

The research (Darwish,2019) He explained through his study measuring the efficiency of the use of productive resources by estimating the agricultural production function of the research sample and estimating the optimum volume of production by statistical estimation of cost functions, where he concluded with regard to the productivity indicators of the bean crop in Egypt that the cultivated area and the total production decreased during the period (2000-2017) about 55%, 52%, respectively, in addition to the fluctuation of productivity , Therefore, it is recommended to expand the cultivation of the bean crop in the new and reclaimed lands with the varieties actually derived. As indicated by (*Rahman*, 2002) in his study, there is a significant variation in the efficiency of farmers in the different studied areas, where it is possible to increase the efficiency of the least efficient farms without the need for external intervention and their role in increasing the efficiency of potato production. While (Ambali *et al*., 2012) indicated in a study to analyze the production efficiency of food crop farmers in Ogun state in Nigeria that the results of the random analysis stochastic showed that the farm output increases with the increase in the size of the farm, rented work, family work and planting materials and decreases with herbicides. The technical efficiency of farmers increases By years of education, agricultural experience, extension communication, and it decreases with the age of farmers, and the average technical, economic and distributive efficiency was 76%, 61%,

80%, respectively. Al-Jubouri *et al*.,2020, studied the economic efficiency of the tomato crop in Nineveh Governorate using the data envelope method. The results of the study showed that the average economic efficiency of the research sample farms reached 50.8% ,the study recommended the need for farmers to use economic resources according to the needs of the crop and in a way that minimizes costs and maximizes profits and studied (Al Douri *et al*.,2020) estimated and analyzed the factors affecting the production and productivity of some cash grain crops in Iraq and Egypt for the period 1995-2016The research aimed to identify the determinants that contribute to the growth of production and productivity and the optimal use of economic resources. The study recommended the need to adopt effective agricultural policies, including a stimulating and encouraging price policy for the product .

By studying the reality of production, productivity and the cultivated area of chickpea crop in Iraq during the period 2000-2016, it was found that there is a clear fluctuation in Each of the cultivated area, production, and productivity, as shown in Table (1), where the table data indicates that the cultivated area reached a minimum level in 2004 and amounted to 32800 ha, while the largest was in 2010, reaching. As for production, its maximum reached 1333kg/ha during 2013, while the lowest production It was in 2007 and amounted to 5000 tons.

Table (1): Area production and productivity of chickpea crop in Iraq (2000-2016)

Production 1000 ton	Yield Kg/Ha	Area 1000 Ha	Years
149	70	470	2000
311	230	470	2001
203	150	710	2002
196	80	390	2003
268	88	328	2004
266.8	126	473	2005
374	150	404	2006
113	50	459	2007
8.80	846	10.40	2008
1.00	91	11.00	2009
4.80	453	10.60	2010
1.00	1000	1.00	2011
1.00	571	1.75	2012
1.00	1333	0.75	2013
1.158	940.6	1.231	2014
1.31	794.92	1.65	2015
1.16	804.30	1.44	2016

Source: Ministry of planning and development cooperation - central agency for statistics and information technology - annual statistical totals, 1987-2005 and (2006-2007). arab organization for agricultural development, annual statistical totals (2017, 2018).

MATERIALS AND METHODS

To achieve the objectives of the research, a random sample of chickpea farmers was selected for some villages in the district of Sheikhan (Taq Harb, Kendala, Mahd, Narkazliya), which amounted to 40 farms and constituted about 30% of the research community It has 116 farms ,In order to show the extent of the optimal use of economic resources, the analysis and interpretation of the results depended on the data envelope method in calculating the production efficiency and optimizing the use of the determinants of chickpea production by calculating the distributional efficiency and using the statistical program (DEAP), The study focused on the most important economic factors determining the production of the crop, especially (cultivated area X1, quantity of seeds X2, human work hours X3, mechanical work hours X4, quantity of control materials X5). This was based on primary data and from its original sources that were collected using a questionnaire and personal interviews. For the farmers of the research sample and for the 2019 production season.

First: A description of the resources identified for chickpea production

The chickpea crop is grown in the northern regions of Nineveh Governorate (Al-Shekhan, Al-Qosh and Fayda) and depends on the amounts of rain falling in the first place and a number of other economic factors, namely (cultivated area X1, quantity of seeds X2, human labor hours X3, mechanical work hours X4, quantity of control materials X5). During the agricultural season During the 2019 agricultural season for the research sample farms 126990 (kg) with an average of 3174,75 kg/farm, while the average production of a dunum was (123,77) kg/dunum.The following is a simplified description of the most important economic determinants used in the cultivation of chickpea crop in the farms of the research sample:

- **Cultivated area**: the cultivated area in the farms of the research sample ranges between a minimum of 11 dunums and a maximum of 44 dunums, and the total cultivated area is 1026 dunums, with an average of 25.65 dunums for each farm.
- **Quantity of seeds**: Most of the chickpea crop farmers in the farms of the research sample depend on local (soft) seeds and some on foreign seeds, especially Turkish seeds called (coarse beef chickpeas), and about 20 kg) of seeds are planted per acre, according to chickpea quality and size, where the total The quantities of seeds used in the farms of the research sample are 20535 kg, with an average of 513.37 kg/farm.
- **Hours of human work**: work in the cultivation of the chickpea crop is primarily focused on operations on seeding operations, and in this process, a special skill is required to ensure the regular distribution of seeds over the cultivated area, and each dunum needs about 28 working minutes, and the total hours of human work in The research sample farms (472) hours and an average of (11.8) hours/farm.

-Mechanical work hours: chickpea crop cultivation requires many mechanical operations, especially in the plowing, smoothing and sowing operations. The total hours of mechanical work in the farms of the research sample is about 955.34) hours and an average of 23.88 minutes / donum.

- **Quantity of insecticides**: the chickpea crop is exposed to insect and fungal infections that need special pesticides to combat them, as farmers depend on the private sector for people specialized in the preventive aspect of crops and on the farmers' accumulated personal experiences, and it was found that the total quantities of control materials used in the production season in the farms of the research sample amounted to (188) liters and an average of (4.7) liters / farm.

Second: Concepts of Economic Efficiency: As long as the research aims to study productive efficiency and determinants, as well as using the data envelope analysis method, it is necessary to identify the concepts of economic efficiency and its components, as follows:

1- Economic Efficiency(EE): Economic efficiency expresses the amount of decrease in production costs that is achieved when using the optimal combination of resources, that is, it means the use of economic resources in a way that maximizes the economic return from that use to reach the greatest level of output by fulfilling the most important conditions for achieving economic efficiency, which is the full use of resources. Economic, the efficient allocation of economic resources. Economic efficiency includes both Allocative Efficiency and Technical Efficiency (Farrel, 1957)).

A- Technical Efficiency: It is one of the elements of overall economic efficiency, and for the farm to be economically effective, it must be technically efficient, that is, technical efficiency is a measure of the farm's success in producing maximum energy from a certain set of inputs at a level of technology. It refers to the relationship of inputs used in the process Production and how to enable the facility or farm to use the best available technological variables in production processes (Chavas *etal*., 1993). Technical efficiency is also considered the operational state of the production unit compared to the maximum limits of production, as the unit that produces at the level of the maximum limits is technically efficient (*Babaker,*2002), which is the highest levels of production that can be achieved from certain amounts of inputs, in addition to avoiding economic loss in the use of these resources .

B- Allocative Efficiency (AE) : It means choosing the input mix so that the total cost of a particular level of production is as low as possible. The allocative efficiency reflects the unit's ability to use the optimal mix of inputs, taking into account the input prices and available technologies (Coelli *et al*., 2005). It also reflects the profit-maximizing resource combination, and this is achieved. When the value of the marginal product of the factors of production is equal to their marginal costs, as the unit can choose a variety of inputs for the purpose of reducing cost, but in terms of maximizing outputs, the unit needs a variety of outputs for the purpose of increasing incomes, i.e. taking at the same time the price, so it is sometimes called price efficiency .

Data Envelopment Analysis (DEA) method: This method is a non-parametric method that depends on linear programming to measure the technical efficiency and economic performance of the facilities, as well as specifying the optimal mix for the input group and the output group of identical units (Bahurms, 1996). Inefficient if another unit or a combination of units can produce the same amount of output with less quantity or input without an increase in any resource (Charnes

et al., 1985). Which represents the equal output curve. The first trend of the data is to use the data envelope analysis method according to the concept of Constant Returns to Scale Model (CRS) and Variable Returns to Scale Model (VRS), which allows estimating technical efficiency and capacity efficiency. The second trend is Using the prices of production resources, and by applying the same method, cost efficiency and allocative efficiency (AE) can be estimated, and the economic efficiency of both types can be calculated either by using the economic efficiency y Inward-directed or output-directed economic efficiency.

RESULTS AND DISCUSSION

The analysis and interpretation of the results was based on the data envelope analysis method, which is a method for measuring the efficiency of the use of agricultural economic resources and thus the possibility of comparing the efficiency of productive farms in their use of agricultural economic resources by applying this method to the data collected through a random sample of some farms in Sheikhan district and for the productive season 2019.

First: The results of estimating the production efficiency of the research sample farms: To achieve the goal of the research and to estimate the production efficiency (technical) from the input side and assuming an estimate of the returns to scale (VRS) for chickpea crop farms and using the data obtained from the questionnaire and a random sample of 40 farms that constituted about 30% of the size of the research community and for the 2019 agricultural season and using the statistical program (DEAP) and based on the economic determinants of chickpea production, which were determined by the independent variables (cultivated area x 1, quantity of seeds x 2, human labor hours x 3, mechanical labor hours x 4, quantity of control materials x 5), and considering production as a depended variable, the following results were obtained.

By reviewing these results, it became clear that the level of productivity (technical) efficiency of the research sample farms ranged between a minimum of (54%) and for the farm (3) and a maximum of (100%) and for a group of farms that amounted to six farms and constituted (15%) of the total research sample farms The amount of 40) farms, and the level of full productive efficiency (100%) indicates that the farms work on the curve of the optimum production capabilities, while the farms that have achieved less productive efficiency, their production moves away from the curve of the optimum production capabilities, and table (2) shows that the estimate of production efficiency According to the Data Envelope Analysis (DEA) method, and based on the economic determinants of the chickpea crop, it has been proven that the redistribution of the used economic resources will provide a percentage of the quantities of these resources, on average (25.2%), and that the farms, under the prevailing technological conditions on them, achieve the same level of production using large quantities Less than economic resources. The average productive efficiency of the research sample farms (74.8%) indicates that there is a deviation in the real production level from the optimum production level that is achieved with the optimal use of resources and a full level of efficiency is achieved except productivity and at an amount of (25.2%), as shown in Table (2).

Table (2): The productive efficiency of chickpea crop in the farms of the research sample for the 2019 agricultural season.

No.	The Production efficiency	No	The Production efficiency	No	The Production efficiency	No	The Production efficiency
1	0.653	11	0.842	21	0.898	31	1.000
2	0.955	12	1.000	22	0.897	32	0.744
3	0.540	13	0.758	23	1.000	33	0.667
4	0.988	14	0.677	24	0.857	34	0.677
5	0.586	15	0.891	25	0.737	35	0.741
6	0.705	16	0.898	26	0.961	36	0.800
7	0.944	17	0.740	27	0.943	37	0.739
8	0.910	18	1.000	28	0.800	38	0.897
9	0.952	19	0.887	29	1.000	39	0.762
10	0.833	20	0.728	30	0.625	40	0.714
Mean							0.748

Source: Prepared by the researcher based on the results of the (DEAP) program.

The results of estimating the economic efficiency indicate a difference in the level of productive efficiency between the farms of the research sample. The reason for this lies in the difference in the experience and administrative skill of the farmers, the lack of control over sowing dates, the poor diagnosis of diseases, insect and fungal infections on the farm, and the confirmation of control operations.

While the results of Table (3) indicate that the farms that achieved a level of production efficiency ranging between (90-99) formed a percentage of (25%), while the farms that achieved a level of production efficiency that ranged between (80-89) numbered eight farms that constituted a percentage of (20%), while the number of farms whose production efficiency level ranged between (70-79) reached nine farms, which constituted (22.5) of the total number of farmers in the research sample. Five farms accounted for (12.5) and the farms that achieved a level of production efficiency less than (60%) numbered two farms and constituted (5%) of the number of farms in the research sample

Table (3): Estimation of production efficiency according to the Data Envelope Analysis (DEA) method.

Percentage	Number of farms	Level of Production efficiency	No.
5%	2	%60 Less than	1
12.5%	5	69 -60	2
22.5%	9	79-70	3
20%	8	89 -80	4
25%	10	90- 99	5
15%	6	%100	6

Source: Prepared by the researcher based on DEAP program.

Second:The results of optimizing the economic determinants of chickpea production in the farms of the research sample:

To calculate the optimum use of the specified resources for the production of chickpea crop in the farms of the research sample, which represents the level of resources at the lowest point of the mean ,Costs based on the data envelope method (DEAP) was estimated distributional efficiency (AT) and using input prices, and then estimate the optimization of the resources used and determine the size and quantities of waste and shortage of resources used.

Table (4): The first determinant of the actual and achieved area for economic efficiency in the farms of the research sample for the productive season 2019

The amount of waste or surplus	The area achieved for economic efficiency	The actual area	No.	The amount of waste or surplus	The area achieved for economic efficiency	The actual area	NO.
4.80	35.20	40	21	10.03	16.97	27	1
5	22	27	22	3	22	25	2
3.42	23.57	27	23	13.12	11.88	25	3
7.85	25.14	33	24	7.85	25.14	33	4
0	11	11	25	15.40	17.60	33	5
1.57	9.42	11	26	4.08	6.91	11	6
1.25	20.74	22	27	2.40	17.60	20	7
6.42	23.57	30	28	0.60	26.40	27	8
7.85	25.14	33	29	0.62	10.37	11	9
1.14	18.85	20	30	5.48	24.51	30	10
1.28	15.71	17	31	7.71	17.28	25	11
4.42	12.57	17	31	0	22	22	12
11	22	33	33	6.57	20.42	27	13
14.85	25.14	40	34	12.25	20.74	33	14
12.57	31.42	44	35	2.40	17.60	20	15
2.20	8.80	11	36	2.71	17.28	20	16
4.42	12.57	17	37	9.42	23.57	33	17
4.40	17.60	22	38	9.42	34.57	44	18
7.85	25.14	33	39	1.91	15.08	17	19
6.28	15.71	22	40	4.08	28.91	33	20
227.78		798.22			1026	Total	
5.69		19.95			25.65	Average	

Source: Prepared by the researcher based on DEAP program

Optimizing the actual cultivated area, achieving economic efficiency and the volume of waste and shortage

By noting the results obtained and shown in Table (4), it was found that the actual cultivated area and for all the farms of the research sample was wasted compared to the area achieved for economic efficiency, and the results did not show any level of deficiency in the size of the actual cultivated area, where the highest amount of waste in the farm was (34) It amounted to (14.58) dunums, and the minimum amount of waste was (0.6) in the farm (8) and there are two farms that have optimized the use of this resource (cultivated area x1), which are the farms (12) and (25).

2- Optimizing the actual quantity of seeds that achieve economic efficiency and the amount of waste and shortage:

By noting Table (5), it has been proven that there are surplus quantities in the quantities of seeds used in the farms of the research sample and other farms that did not use optimal quantities of seeds, meaning that there is a shortage in the quantities used. It was found that the farm (26) achieved the least waste of (7.14) kg and the farm (35)) achieved the largest wastage of (257.14) kg, while one farm achieved a decrease in the quantities of seeds used, which amounted to (15) kg per farm (8), and one farm achieved an optimum use of the quantities of seeds, which is the farm (12).

3-Optimizing the actual human working hours that achieve economic efficiency and the volume of waste and shortage:

By noting the results of Table (6), it was found that there is a discrepancy between the actual working hours used and the working hours that achieved economic efficiency. Human work-hours and the farm (17) achieved the highest waste amounted to (13.42) man-hours, while the farms that achieved the least shortage were (11) and (16) amounted to (0.28) man-hours, and the farm that achieved the greatest shortage is the farm (20) 2.51) an hour of human labor.

Table (5): The second determinant: the actual quantity of seeds and the quantity of seeds that achieved economic efficiency in the farms of the research sample for the production season 2019.

The amount of waste or surplus	The amount of seeds that achieve economic efficiency	The actual amount of seeds	No.	The amount of waste or decrease	The amount of seeds that achieve economic efficiency	The actual amount of seeds	No.
80	720	800	21	177.85	347.14	525	1
50	450	500	22	75	450	525	2
42.85	482.14	525	23	357	243	600	3
85.71	514.28	600	24	115.71	514.28	630	4
25	225	250	25	270	360	630	5
7.14	192.85	200	26	58.57	141.42	200	6
25.71	424.28	450	27	20	360	380	7
117.85	482.14	600	28	-15	540	525	8
135.71	514.28	650	29	7.85	212.14	220	9
14.28	385.71	400	30	98.57	501.42	600	10
28.57	321.42	350	31	246.42	353.57	600	11
92.85	257.14	350	31	0	450	450	12
225	450	675	33	132.14	417.85	550	13
235.71	514.28	750	34	225.71	424.28	650	14
257.14	642.85	900	35	40	360	400	15
70	180	250	36	96.42	353.57	450	16
92.85	257.14	350	37	167.85	482.14	650	17
40	360	400	38	92.85	707.14	800	18
185.71	514.28	700	39	41.42	308.57	350	19
128.57	321.42	450	40	58.57	591.42	650	20
4207.71		16327.29			20535	Total	
105.19		408.18			513.37	Average	

Source: Prepared by the researcher based on DEAP program.

Table (6): The third determinant of the actual and achieved human working hours for economic efficiency in the farms of the research sample for the productive season 2019.

The amount of waste or shortage	The human labor hours achieved for economic efficiency	Actual human labor hours	No.	The amount of waste or shortage	The human labor hours achieved for economic efficiency	Actual human labor hours	No.
3.20	12.80	16	21	9.82	6.17	16	1
2	8	10	22	4	8	12	2
1.42	8.57	10	23	3.68	4.32	8	3
6.85	9.14	16	24	-1.14	9.14	8	4
0	4	4	25	5.60	6.40	12	5
0.57	3.42	4	26	-1.48	2.51	4	6
4.45	7.54	12	27	3.60	6.40	10	7
11.42	8.57	20	28	10.40	9.60	20	8
10.85	9.14	20	29	4.22	3.77	8	9
-0.85	6.85	6	30	3.08	8.91	12	10
-1.71	5.71	4	31	-0.28	6.28	6	11
1.42	4.57	6	31	0	8	8	12
10	8	18	33	6.57	7.42	14	13
10.85	9.14	20	34	8.45	7.54	16	14
12.57	11.42	24	35	3.60	6.40	10	15
0.80	3.20	4	36	-0.28	6.28	6	16
3.42	4.57	8	37	13.42	8.57	22	17
1.60	6.40	8	38	11.42	12.57	24	18
4.85	9.14	14	39	2.51	5.48	8	19
10.28	5.71	16	40	-2.51	10.51	8	20
181.73		290.26			472	Total	
4.54		7.25			11.80	Average	

Source: Prepared by the researcher based on DEAP program

4 - Optimizing the actual machinery working hours that achieve economic efficiency and the volume of waste and shortages

Table (7) shows that there is a difference between the actual automated working hours used and the optimal automated working hours that achieve economic efficiency. It reached (1.2) hours of automated work on the farm (8), and the lowest level of shortage was (0.42) hours of automated work on the farm (31).

Table (7): The fourth determinant, the actual and achieved automated working hours for economic efficiency in the farms of the research sample for the production season 2019.

The amount of waste or shortage	Automatic working hours achieved for economic efficiency	Actual automated working hours	No.	The amount of waste or shortage	Automatic working hours achieved for economic efficiency	Actual automated working	No.
16.40	25.60	42	21	3.65	12.34	16	1
17	16	33	22	3	16	19	2
21.85	17.14	39	23	8.36	8.64	17	3
23.71	18.28	42	24	20.71	18.28	39	4
3	8	11	25	25.20	12.80	38	5
10.14	6.85	17	26	7.97	5.02	13	6
12.91	15.08	28	27	4.20	12.80	17	7
4.85	17.14	22	28	-11.20	19.20	8	8
-2.28	18.28	16	29	1.45	7.54	9	9
3.28	13.71	17	30	17.17	17.82	35	10
-0.42	11.42	11	31	4.42	12.57	17	11
4.85	9.14	14	32	0	16	16	12
11	16	27	33	-7.51	14.85	7.3	13
26.71	18.28	45	34	20.91	15.08	36	14
18.14	22.85	41	35	1.20	12.80	14	15
7.60	6.40	14	36	4.42	12.57	17	16
12.85	9.14	22	37	21.85	17.14	39	17
1.20	12.80	14	38	13.85	25.14	39	18
20.71	18.28	39	39	3.02	10.97	14	19
8.57	11.42	20	40	9.97	21.02	31	20
374.81		580.52			955.34	Total	
9.37		14.51			23.88	Average	

Source: Prepared by the researcher based on DEAP program

5- Optimization of the actual control materials that achieve economic efficiency, the volume of waste and shortages in the control materials

It is clear from Table (8) that there are discrepancies between the actual quantities of materials used and the optimum amount of materials achieved for economic efficiency, where the highest amount of waste materials reached (5.57) liters in the farm (34), while the lowest level of waste materials reached (0.17) liters in the farm (27 While the highest level of deficiency of control materials reached (0.71) liters in the farm (18) and the lowest level of shortage of control materials was (0.21) liters in the farm (23), and there are two farms that achieved optimum use of the control materials, which are (2) and (12).

Table (8): The fifth determinant of the actual control materials that achieve economic efficiency in the farms of the research sample for the 2019 production season.

The amount of waste or shortage	materials that achieve economic efficiency	Actual insect control materials Insect control	No.	The amount of waste or shortage	materials that achieve economic efficiency	Actual insect control materials Insect control	No.
1.20	4.80	6	21	3.68	2.31	6	1
2	3	5	22	0	3	3	2
-0.21	3.21	3	23	1.38	1.62	3	3
0.57	3.42	4	24	0.57	3.42	4	4
0.50	1.50	2	25	1.60	2.40	4	5
0.71	1.28	2	26	4.05	0.94	5	6
0.17	2.82	3	27	0.60	2.40	3	7
1.78	3.21	5	28	5.40	3.60	9	8
-0.42	3.42	3	29	2.58	1.41	4	9
1.42	2.57	4	30	2.65	3.34	6	10
1.85	2.14	4	31	1.64	2.35	4	11
1.28	1.71	3	31	0	3	3	12
2	3	5	33	2.21	2.78	5	13
5.57	3.42	9	34	1.17	2.82	4	14
2.71	4.28	7	35	3.60	2.40	6	15
5.80	1.20	7	36	3.64	2.35	6	16
4.28	1.71	6	37	1.78	3.21	5	17
2.60	2.40	5	38	-0.71	4.71	4	18
3.57	3.42	7	39	0.94	2.05	3	19
3.85	2.14	6	40	1.05	3.94	5	20
79.15		108.85			188	Total	
1.97		2.72			4.70	Average	

Source: Prepared by the researcher based on DEAP program

The research reached a set of conclusions, including that the farms of the research sample can achieve full productivity efficiency by using less economic resources than the resources used, at a rate of 24.8%, where the average production efficiency of the research sample farms reached 74.8%. The dependence of crop cultivation on the amounts of rain falling. Another conclusion is that there are quantities in excess of the quantities achieved for economic efficiency and in most of the determinants of crop production, and the percentage of shepherds that achieve productive efficiency is low, estimated at about 15% of the total farms of the research sample. Therefore, the researcher recommends the need for optimal use of resources and Taking advantage of the

surplus resources, especially the resource of the cultivated area, and transferring the resource of surplus human working hours to other agricultural activities

The economics used and following the results of research and practical studies in the use of resources, especially the seeds used per unit area. The researcher also recommends the need to add all kinds of fertilizers to increase the quantities produced and raise the productive efficiency.

الكفاءة الانتاجية ومحدداتها لمحصول الحمص في محافظة نينوى للموسم الانتاجي 2019

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الخلاصة

استهدف البحث تقدير الكفاءة الانتاجية وأمثلية المحددات الاقتصادية لمزارع محصول الحمص ولعينة بلغت 40 مزرعة في قضاء الشيخان وللموسم الانتاجي 2019 ,وباستخدام اسلوب مغلف البيانات والبرنامج الاحصائي DEAP واعتماد كمية الانتاج كمتغير معتمد و (المساحة المزروعة ,كمية البذور, ساعات العمل البشري, ساعات العمل الميكانيكي, كمية مواد المكافحة) . وأظهرت النتائج أن متوسط الكفاءة الانتاجية لمزارع عينة البحث بلغت(74.8)وبين حد ادنى بلغ (54 %) وحد أعلى (100 %) وحققت ستة مزارع كفاءة انتاجية كاملة شكلت(15 %) من مجموع المزارع وتبين هناك تباين في كميات الموارد المستخدمة مقارنة مع كميات الموارد المحققة للكفاءة الاقتصادية وترتب على ذلك وجود فائض في بعض الموارد الاقتصادية واحتل متغير حجم الساحة النسبة الاكبر , واستنتج الباحث وجود هدر في الكميات المستخدمة وباستطاعة المزارعين انتاج نفس الكميات باستخدام موارد أقل وبنسبة (24.2 %) . ويوصي الباحث تحسين الكفاءة للمزارع من خلال الاستخدام الامثل للموارد المستخدمة واستخدام الاسمدة للمحافظة على خصوبة التربة الزراعية.

الكلمات المفتاحية: الكفاءة الانتاجية , الامثلية ,مغلف البيانات , الحمص

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