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Estimation and Analysis of the Economic Efficiency of melon Production in Nineveh Governorate for the 2024 Growing Season

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A B S T R A C T

The research aims at achieving a set of objectives, which together constitute an agricultural policy linked to the measurement of economic efficiency (EE) and overall productivity of elements (TFP) using data envelope analysis (DEAP).As for the watermelon crop, the size of the community reached 480 farmers and the cultivated area reached 2,300 dunums.Then a random sample of watermelon farmers was taken, amounting to (60) farms, amounting to (12.5%).The cultivated area of the sample amounted to (646) dunums, representing a percentage of (28%) of the total cultivated area.For the watermelon crop, the spring button was chosen because it is used in the region to produce the two crops, and all of them were included in the study plan . The results of the economic efficiency assessment of the melon crop showed that (2) farms have achieved optimal full economic efficiency (100%) and equivalent to (3.4%) of the study sample farms and adult (60) Farms with earmarked efficiency, while being the lowest value for economic efficiency at the farm No. (22) The value was (0.642) So this farm has to reduce its production input by (35.8%) to optimize economic efficiency , economic efficiency has averaged 85.7%, and this level is low compared with the technical efficiency ratio, which indicates the possibility of reducing costs by farms by a percentage (85.7%) achieved the same level of production, and the amount of resources achieved for the economic efficiency of the Dunum was estimated assuming a change in capacity returns (VRS) for the study sample farms specifically for the main study variables which are six variables (X1 Seeds, X2 Organic Fertilizer, X3 Chemical Fertilizer, X4 Pesticides, X5 Number of Workers, X6 Machine Work) , The method of analysis of the DEAP data envelope has been adopted according to the cost function and estimate the supplier's quantity at the lowest cost at which economic efficiency is achieved of which surplus or deficit in different resources has been calculated by comparing the actual resources of each farm with its economically efficient counterpart and then calculating the proportion of such surplus or deficit; Some farms have shown a lack of use of resources or surplus use of other resources, and by analysing the overall productivity of factors it averaged (99.3%), the research therefore recommends that optimal quantities should be used through production and according to the crop's need for

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Introduction

A melon crop of summer crops rich in vitamins, salts, proteins and sugars, is grown in fields and large farms and needs an average of 100 to 120 days from the start of the seed to harvest. Melon seeds require a soil temperature of at least 18 ° C (65 ° F) To sprout, melon seeds sprout easily from (6-10) days depending on weather conditions, the appropriate soil for the crop is sandy soil. For the cultivation of melon in Nineveh governorate, the local varieties grown in the Nineveh plain are Al-Qushi, Mluki and Hafez are cultivated in the Central Region, particularly in Baghdad, Diyala and Samaria, as well as hybrid items currently under cultivation in Iraq, with a production rate of 201 thousand tons per year. Factors affecting economic efficiency and the growth of the elements' overall productivity had to be highlighted by relying on the descriptive and quantitative method of economic analysis, and through previous studies (Samurai 2009) Comparative Study of Economics of Size and Efficiency of a Sample of Samarra Melon and Sophistication Crop Farmers for the Production Season (2007), where the total long-term cost function was estimated by relying on sample data from crop farmers, and by deriving the average long-term total cost equation, the optimal volume of production estimated at approximately (12299.54 kg/dunum) for thickness, (10262 kg/dunum) for melon, and this production requires cultivation (19) dunums of sophistication and (22) dunums of melon depending on the volume of production achieved and the study showed that actual production volume is less than optimal production volume, It must increase production by expanding the space to achieve cost reductions as well as economies of scale achieved for crop plantations, The economic efficiency achieved, which amounted to about 88%, was calculated for slavery farms and 92% for melon farms from sample farms. The study showed the heel height of melon farmers on slave farmers by the concentration of farmers in the savings area, it was (77%) in melon farms, and (70%) in slave farms, which means the possibility of expanding the spaces until the optimal size of the study is achieved. Another study (Al Obaidi 2023) estimated the amount of resources achieved for the economic efficiency of melon farms in Samarra district for the 2023 production season, where the research aims to estimate the optimal quantities of resources used in the production of a crop through which economic efficiency can be achieved in the research sample farms. The data were obtained through the design of a random sampling questionnaire from field farms, as the sample size depends on the community's proportion of 30 farms. The research relied on a descriptive and quantitative analysis methodology based on the logic of economic theory, using DEAP to analyze data and estimate the surplus and deficit in resources used to produce the melon crop The results of the research showed that there was a waste in the amount of resources used. The supplier of fertilizer ranked first in the quantities used while the supplier of pesticides ranked last in the amount of waste The reason for this is the increased use of the resource beyond the quantities
recommended by the competent authorities for the cultivation of one dunum, as well as the absence of guidance and agricultural consultations to be provided which in turn has had a negative impact on the use of this resource and research. He recommended that the role of the extension system in raising farmers' awareness of the optimal use of crop resources to enable them to achieve economic efficiency on farms should be operationalized. Ibrahim and other 2014 studied the technical competence of melon in Borno State in Nigeria. The preliminary data was collected through the use of a questionnaire form and using the random sample selected (120) melon farms from six villages. The indiscriminate border production function was used to analyze the technical efficiency of melon farmers. The analysis showed that average technical efficiency levels were 86%, meaning that 14% of farmers did not achieve technical efficiency because economic resources were not used efficiently.
The study recommends the efficient use of economic resources and adequate training of farmers through their entry into cooperative societies and the use of such societies to rationalize the use of loans, improved seeds, seeds and chemical fertilizers with good suspicion.:

Research Problem :
The problem of the research is summarized in the high prices of raw materials and low levels of production, the lack of efficient use of available resources, which reduces profits in production or in the size of the farm, as well as the reluctance of some farmers in recent years to grow the crop due to their belief in the lack of revenue achieved from this type of crop and the lack of government support for farmers In Nineveh, such as tax exemptions and soft loans

Research Objectives:
The research aims to:
1. Estimate the economic efficiency and technical and customized components of melon crop according to the method of data envelope (DEAP), in Nineveh governorate for the year 2024.
2. Estimate the total productivity of the melon crop in Nineveh governorate for the year 2024.

Research hypothesis:
The research is based on the premise that most farmers have not had access to the economic efficiency of melon crop cultivation resulting in inaccessibility of optimal volume of production, as well as that there is a waste in the use of inputs for melon crop cultivation resulting in lower overall productivity and the research seeks to prove the hypothesis valid if not.

The importance of research:
The importance of the melon crop is reflected in the fact that it is one of the crops in increasing demand, especially in the hot summer, which leads to an increase in the productivity of this crop in Iraq in general and the Nineveh Governorate in particular if farmers go to produce at optimal production rates and use optimal areas for agriculture.

Materials and methods of research:

The mathematical model will focus on measuring economic efficiency in the method of data envelope (Deap) in order to achieve the goal of research.

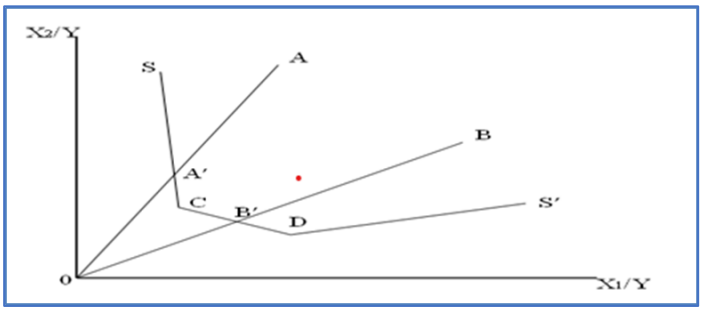
Description of the economic efficiency measurement model by:
Data envelope analysis model if volume returns (VRS) are assumed to change
Volume yield stability hypothesis is only appropriate when all farms operate at their optimal volume level. But there are many obstacles that prevent farms from achieving these volumes, such as incomplete competition, funding constraints, etc. and the assumption of constant volume returns in the data envelope analysis model is used when not all farms or enterprises operate at their optimal volume level and result in the mixing of technical efficiency indicators with volume efficiency and to separate the impact of the technique from the impact of volume on efficiency measurement. (Fraser and Cording, 1999) VRS and modifies the CRS model to the VRS model in the matter of linear programming by adding a volume restriction = 1 and takes the following formula: -

$$Min_{\theta,\lambda}\theta^{VRS} \dots\dots\dots\dots\dots\dots\dots (1)$$

The template for analysis of the usage-oriented data envelope (input) can be shown graphically and through figure (3). It is well known that the issue of written programming seeks to reduce the input vector for farms or enterprises (Xi) proportionate to minimize while maintaining the possibility of achieving output level at (i) It is perfectly identical to Varel theore- and shape (1) Represents projected radial-oriented dots (A O) and (OH) and the possibility of reducing inputs (Xi) to the extent that they can occur in both a broken production direction as:

SS = Both Production Orientation

Points (C and D) represent the performance of two technically efficient enterprises. These points define the internal framework for the direction (SS). Points (A and B) represent the performance of two technically inefficient enterprises.



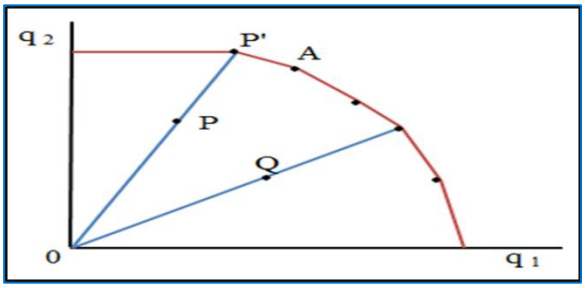
Form 1. Economic efficiency using DEAP by input side
Source: (Coelli, 1996:13)

The directive DEAP model occurs when the farm's objective is to increase production outputs using a certain level of input. This is achieved through the use of output-oriented efficiency measurement models. The technical efficiency rate of the farm is defined using the output model as the proportional increase in production with input volumes holding at a specific level.

Output-guided data envelope analysis models are very similar to input-guided data envelope analysis models as evidenced by the following model and assuming the output-guided volume returns change.

$$Max_{\theta,\lambda}\theta \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

Graphically, DEAP's output-oriented model can be illustrated by figure (2), which represents the external framework of linear fragmentation of the production potential orientation as evidenced by the two points (P, Q) are technically inefficient and point A is technically efficient, as it turns out that although the point occurred, (P) On the technical efficiency curve, but we can increase the production level of the commodity (q1) By amount (AP) without increased input use (Coelli & Battese, 2005:367).



Form 2. Economic efficiency using (DEAP) by output side
Source: Coelli & Battese, 2005, 187

Since use guidance models and exit guidance models are used to assess technical boundaries, there is no dispute between the two models in identifying fully efficient installations, but the difference lies in the calculation of the efficiency index of technically inefficient enterprises in the event of unstable economics of scale (Babaker, 2002: 25), from the applied point of view, the model is selected to

analyze the envelope of data with usage and directive guidance when measuring efficiency rates depending on the degree of control of installations in determining the input and output (Mashhad, 2021:68).

Results and discussion:

Firstly, the results of the evaluation of the economic efficiency of its components (technical and specialized) for watermelon growers in the study sample for the 2024 production season using an analysis method (DEAP)

Economic efficiency (E E) has been estimated with its technical components (TE) Customization (AE) for melon crop plantations in study sample for productive season (2024) Using a closed data analysis method (DEAP), by cost function variables, using resource quantities and prices, assuming capacity returns change, and reviewed the results of the economic efficiency assessment (E E), Technical (TE) and Customization (AE) in Table (1). The results reached and presented in the table below show that there are (36) The farm was for optimal technical efficiency (TE) and adult (100%) and it was 60% of the study sample farmers in this analysis, which means that these farms were able to reach the maximum melon crop production with a specific number of inputs, so these farms are on an equal output curve. (Isoquant - Curve) These farms must follow the same method used to preserve their resources and productivity, The lowest value of technical efficiency was at the farm number (12) It has reached about (0.817) so this farm must produce the current amount of melon or more using (81.7%) only or less of the current inputs used to optimize efficiency, while the average technical efficiency has reached (96.9%) This means that farmers can reduce the quantities used for production elements by (3.1%) while achieving the same level of production. The allocation efficiency (AE) of melon farms in the sample study estimated in the light of the resource prices used is shown in the table (1) The number of farms that have managed to achieve the highest efficiency value is (2) A farm and equivalent to (3.4%) of the sample farms, this proportion is small if compared to the proportion of farms achieved for technical efficiency and this has the effect of decreasing the number of farms achieved for economic efficiency , The lowest value for allocation efficiency was at the farm number (13) It is (0.742) so this farm has to reduce production inputs by about (25.8%) of production costs and maintaining the production quantity ratio to enable optimal customization efficiency, the average allocation efficiency is about (88.5%) So this sample farmer has to reduce production costs by (11.5%) using (88.5%) or less inputs while maintaining the same quantity of crop produced, and the results of the estimate (TE) and (AE) obtained economic efficiency (EE) was extracted by multiplying the estimate results for both technical efficiency in estimating the allocation efficiency of each farm s For economic efficiency (EE), farms with the highest efficiency value (100%) melon farms are the same farms that achieved full specialized efficiency by reaching (2) farms and equivalent to (3.4%) From the study sample farms, the lowest value for economic efficiency was at the farm number (22) The value was (0.642), so this farm has to reduce its production input by about (35.8%) to optimize economic efficiency, averaging economic efficiency (85.7%), this level is low if compared with technical efficiency averages and indicates the possibility of reducing costs by farms by a percentage (85.7%) and achieve the same level of production. The number of farms that have achieved the best output with a specific number of inputs is the same that have achieved both technical efficiency and customization efficiency, which are within the limits of the equal output curve, so they must continue to produce according to the same method.eparately.

Second: Estimate the amount of resources achieved for economic efficiency

Estimate the amount of resources that achieve economic efficiency for each melon farm per dunum and assuming a change in the yields of productive energy (VRS) also relied on the analysis of the data envelope (DEAP) and based on the cost function of estimating the size of civil resources for costs and economic efficiency, thus extracting the total actual quantities as well as optimal quantities for each supplier and the research sample farms (Jasim and Zanzal, 2022, 16) with an area of (946) dunum and extraction of waste amounts in resources by subtracting the total optimal quantities of actual quantities, as in table (2) , Also extracting the number of farms that have achieved optimal efficiency or where it has been (surplus) or where there was (deficit) in the use of resources and their proportion of the total sample, table (2) shows that the total actual seed quantities were (7521) g, whereas the total optimal quantities (6425.4) g was that there was a surplus of (1095.6) g For the total sample farms, for the farms that achieved efficiency in the use of the seed supplier, (2) was a farm and accounted for (3.4%) of the total sample.

Farms where there was a surplus of (45) and accounted for (75%) of the total sample, and farms where there were deficits amounted to (13) and accounted for (21.6%) of the total sample. For organic fertilizer, the surplus was (1,396) kg. The farms that achieved economic efficiency were only one farmer, at (1.7%) of the total sample. Farms with a surplus stood at (32) and accounted for (53.3%) of the total sample. The number of farms with deficits stood at (27) farmers, at (45%) of the total sample. Chemical fertilizer has excess amounts of total farms of about)243(kg. Farms with resource efficiency accounted for)2(farmers and accounted for (3.4%) of the total sample. The number of farms with surplus was (40) and accounted for (66.6%) of the total sample. The number of farms with deficits

was (18) and accounted for (30%) of the total sample. With regard to pesticides, waste amounted to (1.69) kg. The farms that achieved economic efficiency were only (3) farms, at (5%) of the total sample. Farms where there was a surplus amounted to (24) and accounted for (40%) of the total sample. The number of farms with deficits was (33), accounting for (55%) of the total sample. The number of workers in surplus was (239). The farms that achieved economic efficiency were (6) farms, at (10%) of the total sample , Farms where there was a surplus of (53) have accounted for (88.3%) of the total sample. The number of farms with deficits was only one, at (1.7%) of the total sample. As far as working is concerned, the disability is (9.44) hours. The farms that achieved economic efficiency were only (2) farms, at (3.4%) of the total sample. Farms where there was a surplus amounted to (20) and accounted for (33.3%) of the total sample. The number of farms with deficits was (38) at (63.3%) of the total sample.

conclusions and recommendations

conclusion:

1. The results of the Economic Efficiency Assessment (EE) and its components showed both Technical Efficiency (TE) and Customization Efficiency (AE) in the data envelope analysis method DEAP Mayati

The results of the Economic Efficiency Assessment (EE) showed that the number of farms with the highest 100% efficiency value for watermelon farms is the same as the full specialized efficiency of 2 farms and equivalent to 3.4% of the study sample farms watermelon crop, while the lowest value for economic efficiency was at the farm number (22) The value was (0.642) So this farm has to reduce its production input by (35.8%) to optimize economic efficiency

B. Economic efficiency has averaged 85.7%, and this level is low compared to average technical efficiency. This indicates the possibility of reducing costs by farms by 85.7% and achieving the same level of production.

The analysis showed the success of watermelon crop cultivation in Nineveh governorate in general and the Gosh district in particular, owing to high rainfall rates, which helped to cultivate and succeed the melon crop and achieve acceptable levels of profit as well as meet the local market's need for the product.

The results of the research indicated a surplus or deficit in the volume of resources achieved for the economic efficiency of watermelon farms.

There is a waste in the use of resources involved in the productive process and high costs at the farm level.

Recommendations:

1- Expansion of melon crop cultivation because it is economically relevant to optimal areas recommended in the study for economic efficiency

2- The need to provide government support to farmers with respect to production supplies, seeds, fertilizers and pesticides, resulting in higher variable costs beyond the limits of the support provided. This has a negative impact on the farms of the study area

3. To guide and raise awareness of farmers with a view to optimizing the resources available to reach the optimal volume of production, which achieves their highest economic efficiency and maximizes profits.

4. To guide and emphasize farmers by increasing the areas grown with watermelon crops to improve soil properties and achieve self-sufficiency from this crop at the governorate level and export more of it to other governorates.

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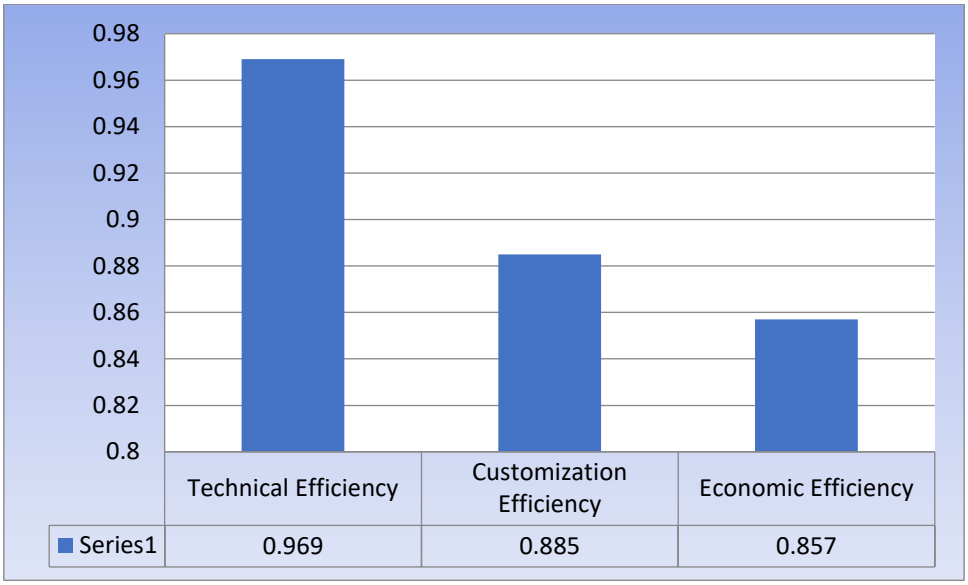
Table 1. Technical, Customization and Economic Efficiency Assessment as Capacity Yields Change in Search Sample Farms

Number of farms	(TE)	(AE)	(EE)	Number of farms	(TE)	(AE)	(EE)
1	1.000	0.945	0.945	31	1.000	0.899	0.899
2	1.000	0.842	0.842	32	0.986	0.843	0.832
3	1.000	0.782	0.782	33	0.919	0.936	0.859
4	1.000	1.000	1.000	34	1.000	0.983	0.983
5	1.000	0.974	0.974	35	1.000	0.917	0.917
6	1.000	0.938	0.938	36	0.884	0.938	0.829
7	0.966	0.885	0.855	37	1.000	0.963	0.963
8	1.000	0.989	0.989	38	1.000	0.928	0.928
9	0.998	0.942	0.940	39	0.941	0.922	0.868
10	1.000	0.768	0.768	40	1.000	0.962	0.962
11	0.986	0.873	0.861	41	0.993	0.834	0.827
12	0.817	0.979	0.800	42	1.000	0.841	0.841
13	0.899	0.742	0.667	43	1.000	0.932	0.932
14	1.000	0.928	0.928	44	1.000	0.805	0.805
15	0.875	0.864	0.756	45	0.912	0.936	0.854
16	1.000	0.879	0.879	46	1.000	0.898	0.898
17	0.905	0.957	0.866	47	1.000	0.893	0.893
18	1.000	0.896	0.896	48	1.000	0.903	0.903
19	0.850	0.943	0.801	49	1.000	1.000	1.000
20	1.000	0.880	0.880	50	1.000	0.930	0.930
21	0.884	0.950	0.840	51	1.000	0.828	0.828
22	0.857	0.749	0.642	52	1.000	0.944	0.944
23	1.000	0.746	0.746	53	1.000	0.759	0.759
24	1.000	0.794	0.794	54	0.887	0.915	0.811
25	1.000	0.803	0.803	55	0.979	0.911	0.892
26	0.975	0.823	0.803	56	1.000	0.898	0.898
27	0.906	0.778	0.705	57	0.900	0.915	0.824
28	1.000	0.690	0.690	58	1.000	0.932	0.932
29	0.970	0.926	0.899	59	0.975	0.836	0.815
30	1.000	0.798	0.798	60	0.891	0.831	0.741
Average	0.969	0.885	0.857				
Lowest Value	0.817	0.742	0.642				
Highest Value	1.000	1.000	1.000				

Source: According to the researcher based on the data of the questionnaire according to the DEAP data closure program.



Form 3. Average technical, customization and economic efficiency as VRS capacity yield changes for melon crop in search sample farms
Source: Researcher's preparation based on table (1) data

Table 2. Total optimal and actual resource quantities, surplus ratios and resource deficits for sample farms

Variables	Total actual quantities of the resource	Total optimal quantities of the resource	Amount of surplus or deficit in the resource	Number of farms achieving the optimal quantity of the resource	Their percentage %	Number of farms with a surplus in using the resource	Their percentage %	Number of farms with a deficit in using the resource	Their percentage %
Seeds(gram) **X1**	7521	6425	1096	2	3.4	45	75.0	13	21.7
Organic fertilizer(kg) **X2**	66422	65025	1397	1	1.7	32	53.3	27	45.0
Chemical fertilizer(kg) **X3**	3432	3189	243	2	3.4	40	66.7	18	30.0
Pesticides(liter) **X4**	53.93	52.24	1.69	3	5.0	24	40.0	33	55.0
Number of workers(man) **X5**	813	574	239	6	10.0	53	88.3	1	1.7
Mechanized work(hours) **X6**	206.65	216.09	-9.44	2	3.4	20	33.3	38	63.3

Source: Researcher's preparation based on data from the Data Envelope Program (DEAP)