Estimating the optimal resource quantities of economic resources for tomato production farms in Nineveh Governorate, Rabia District, for the year 2024

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Abstract
The research aims to estimate the technical, allocative and economic efficiency and estimate the optimal size of resources for the farmers of the research sample through data envelope analysis. And to estimate the volumetric efficiency of the farmers of the research sample through data envelope analysis DEAP. The research sample included 61 farmers out of the total research sample of (225). The research results showed that the average technical efficiency reached 95%, the average allocative efficiency reached 86%, the average economic efficiency reached 82%, and the average volumetric efficiency reached 53%. We conclude from the research results that there is a gap between technical efficiency and allocative efficiency of 9%. This is attributed to the high prices of production requirements, which affected the allocative efficiency, and that farmers did not make optimal use of the cultivated area for this crop, which affected the capacity efficiency of this crop. Therefore, it is necessary to provide production requirements at subsidized prices and work on optimal use of the cultivated areas for the tomato crop. The economic resources constituted the largest proportion by the amount of surplus, and the surplus amounted to 10.4, 117.6, 5.8, 0.018, 13, and 0.03 for the resources of seeds, organic fertilizers, chemical fertilizers, pesticides, human labor, and mechanical labor, while the largest proportion by the amount of surplus for the resource was formed by organic fertilizers and the amount of seeds, which constituted a percentage of 117.6 -10.4, respectively. Thus, we conclude confirms that there is waste in the use of economic resources in tomato production farms, and this was confirmed through the results obtained that there is waste in economic resources at the level of optimal use of resources. Summary

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Keywords: Tomatoes , Rabia , Surplus and deficit , Economic resources
Research from the master's thesis of the first researcher

Introduction

Tomato is one of the vegetable crops that contribute a significant percentage to the agricultural economy in Iraq, as it provides a national income ranging between (25-30) million dinars annually, as it has become possible to provide the tomato crop to the consumer throughout the year through protected agriculture inside greenhouses and plastic, after the tomato crop was seasonal in production. Protected agriculture is one of the important and advanced means of production in terms of the use of scientific methods and technological equipment that ensure the provision of suitable climatic conditions for the growth and development of the crop outside its production times, as the increase in demand for the tomato crop requires providing the crop out of season, as large areas are

planted in protected agriculture, in addition to agriculture in open fields in order to provide the crop throughout the year. The importance of the study comes from the fact that the tomato crop is one of the main vegetable crops in Iraq due to its nutritional and economic importance, short life span and abundant profits, as it provides more income compared to other crops planted in the same area of land and within a short period of time. Recently, there has been an increase in the trend towards tomato cultivation in the Rabia district, which requires the provision of supplies The necessary tomato production hinders many farmers from cultivating the areas available to them to grow this crop, which forces farmers to buy production requirements from local markets (plastic covers - fertilizers - seeds - pesticides) at high prices, which leads to higher production costs and thus lower profits for farmers. Therefore, the state must provide production requirements to farmers at the appropriate time, place and time to grow the crop. One of the most important studies that dealt with
this crop.

Research objective: The research aims to:

Estimating the economic efficiency in its two branches: technical and specialized efficiency of the farmers in the research sample.

Estimating the surplus and deficit in the economic resources of the farmers of the research sample.

Research hypothesis: It is assumed that there is a great waste in the use of economic resources in the research sample.

Research problem: The farmers of the research sample suffer from a decrease in net farm income (agricultural return) due to the high prices of production requirements in the production process, in addition to the lack of government support for these farms, which led to a reluctance or decrease in the areas planted with tomato crops in the research sample.

Al-Najjar and Al-Thallaj [2013][1] conducted a study entitled "Economic Analysis of Potato Production Efficiency in Telkaif Area/Nineveh Governorate for the Spring Season 2011". The study aimed to study the potato crop grown in Telkaif area. The results showed that the optimum size of potatoes was 23.54 tons, while the actual size of the study sample was 15.06 tons. Therefore, farmers in this crop sample were only able to achieve 63% of the economies of scale, and the optimum area available to obtain the optimum size was 13 dunums.

Ajapnwa Akamin et al. 2017 [2] conducted a study on the efficiency and productivity of vegetable farming under root and tuber-based systems in the humid tropics of Cameroon. The study aimed to analyze the technical efficiency of vegetable farmers in root and tuber-based farming systems in the humid tropics of Cameroon. The results showed that the most productive factor was fertilizer, followed by agricultural machinery and labor. The average technical efficiency level was 67 percent, revealing a gap in productivity and indicating that productivity could be significantly improved with current input levels. Females and highly educated farmers were found to be significantly more productive than their peers. The study also showed that technical efficiency decreases with the increase in the size of farming households.

Nigar and Khaled 2023 [3] research on an economic analysis of the economic and technical efficiency of tomato crops using the traditional agricultural method (open areas) in

Sulaymaniyah Governorate for the agricultural season 2021-2022. The study aims to conduct an economic analysis of the economic and technical efficiency of tomato cultivation using the traditional agricultural method (open areas) in Sulaymaniyah Governorate for the agricultural season (2021-2022), which represents the fruitful economic relationships between inputs and outputs and determines the level of profits and losses and attempts to determine the optimal level for the best exploitation of economic resources. The study concluded that the economic resources used in the tomato production process were not optimally invested, which led to a decrease in the efficiency of tomato production. The results show that at the level of a sample of tomato farmers who use the traditional method (open). In Sulaymaniyah Governorate, the value of the economic efficiency index ranged between a minimum of (0.497) units as a maximum. (One correct) and an average of about (0.803) in light of the fixed return on capacity.

Al-Jubouri and Alihbabi (2020) [4] published a research entitled (A study of the economic efficiency of the tomato crop for the 2019 production season in Nineveh Governorate, Zummar District, as an applied model). The study included 124 farmers who were randomly selected from the crop farmers. The data were obtained through a personal interview and filling out a questionnaire prepared for this purpose. The independent variables that were relied upon in the study were (family work, family work, fertilizers, pesticides, seeds). The quantities of tomatoes produced were represented by the dependent variable. Through the study, three farms were reached, with a percentage of (2.4%), that achieved technical, distributional and economic efficiency (100%), and the average economic efficiency was (50.8%), meaning that these farms can reach the same level of production while reducing production costs. The study recommended the necessity of farmers using economic resources according to what the crop needs from these resources and in a way that reduces costs and maximizes profits.

2-Materials and methods of work

Description of the model used to estimate the economic efficiency and its components for tomato production farms for the research sample for the 2024 production season using data envelopment analysis in light of the availability of information on input prices and the suitability of the hypotheses to reduce the cost. To describe the economic behavior of the production unit, the technical efficiency and the allocative efficiency of this unit can be calculated based on input prices, which are represented by the prices of economic resources used in tomato production. To achieve this, the DEA model is applied twice, once to measure the technical efficiency TE and the other to measure the allocative efficiency AE of the unit. Then, the economic efficiency is calculated from the product of AE × TE. Under the assumption of cost reduction with the presence of variable economies of scale VRS, the DEA model with a use orientation is known as Stevens, 2004: 5 by the equations:

Min_λixi Wi*Xi*

subject to:

- yi + y_λ ≥ 0,

Θxi* - Xλ ≥ 0,

N1 λ = 1 and

λ ≥ 0

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Where
Wi* is the value of the prices of
inputs used for farm i
Xi* is the vector of quantities
of inputs used in field
i.The economic efficiency EE of the field is calculated using the following equation:
EE = (W_i^* X_i^*)/(Wi Xi)

That is, economic efficiency equals the lowest possible cost of the actual cost of the production unit. To calculate the allocative efficiency, the DEA model is applied without the assumption of cost-minimizing behavior to calculate the technical efficiency TE and then calculate the allocative efficiency according to the following equation:
AE = EE/TE
In the event that the components of economic efficiency are known, both technical efficiency and allocative efficiency, then economic efficiency can be obtained (Cercheye, 2008:96).
EE = TE * AE

By relying on the model of technical efficiency and economic efficiency according to the variables of the cost function, it becomes possible to identify efficient and inefficient fields, with determining the amount of inefficiency in inefficient units, and determining the amount of economic resources that achieve economic efficiency and thus estimating the quantities used of these resources in order to reach the optimal use that achieves economic efficiency, in addition to calculating the amount of surplus and deficit in the economic resources used in the production of chicken meat by comparing the amount of resources that achieve economic efficiency and the amount actually used, as:

The amount of surplus or deficit in resources = the amount of resources actually used in each field - the amount of resources at the lowest point of the average total costs. If the difference is positive, it represents the surplus of the resources used, and the fields must reduce the quantities used of these resources in order to reach the optimal use that achieves economic efficiency. If the difference is negative, the difference represents the amount of the deficit in the amount of resources that must be provided to reach the optimal use of economic resources. The percentage of surplus or deficit in the use of resources is also calculated, at the field level, according to the following:
Percentage of surplus or deficit = (Economic resources in the decrease or increase amount) / (Economic resources from actual use amount)

3- Results and discussion
Estimation of technical, allocative and economic efficiency
Table (1) shows the estimated economic, technical and allocative efficiency of the study sample, where the highest technical efficiency (TE) was (100%) and the lowest (75.5%) with an average value of (94.8%), meaning that farmers can reduce their use of production factors by (5.2%) while achieving the same level of production, while (30) farmers achieved a technical efficiency of (100%) at a rate of (49.2%) of the total sample size, and (28) other farmers achieved a technical efficiency ranging between (80%) and less than (100%), i.e. (45.9%), and (3) farmers achieved a technical efficiency ranging between (70%) and less than (80%), i.e. (4.9%). The values of the allocative efficiency (AE) of the study sample ranged between the maximum (100%) and the minimum (54.7%)

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and the average (86.0%) of the total cost used. This means that reallocating the production factors used in tomato cultivation saves (14.0%) of the total production costs, i.e. there is a surplus of (14.0%) of the resources used. Tomato farmers can achieve the same production using (86.0%) of the total costs used. There are (3) farmers who achieved full specialized efficiency, i.e. (100%), i.e. (4.9%) of the total sample, (43) farmers achieved specialized efficiency ranging between (80%) and less than (100%), i.e. (70.5%) of the total sample, and (15) farmers achieved specialized efficiency ranging between (50%) and less than (80%), i.e. (24.6%) of the total sample.

As for economic efficiency, the results of technical efficiency and specialized efficiency were reflected on it, as they ranged between the maximum (100%), the minimum (54.7%) and the average (81.6%). The number of farmers who achieved full economic efficiency, i.e. (100%), was (3) farmers, and they are the same farmers who achieved full specialized efficiency, i.e. (4.9%) of the total sample. (36) farmers achieved economic efficiency between (80%) and less than (100%), i.e. (59.0%) of the total sample. Also, (22) farmers achieved economic efficiency between (50%) and less than (80%), i.e. (36.1%) of the total study sample.

Table (1) Results of economic, technical and specialized efficiency

The farm	Technical efficiency %	Specialized competence %	Economic efficiency %	The farm	Technical efficiency %	Specialized competence %	Economic efficiency %
1	1.000	0.733	0.733	33	0.909	0.944	0.858
2	0.882	0.918	0.810	34	1.000	0.969	0.969
3	1.000	0.962	0.962	35	0.859	0.828	0.711
4	0.755	0.865	0.653	36	0.900	0.651	0.586
5	1.000	0.846	0.846	37	1.000	1.000	1.000
6	0.944	0.961	0.908	38	0.880	0.778	0.685
7	1.000	0.925	0.925	39	1.000	1.000	1.000
8	1.000	0.983	0.983	40	0.941	0.874	0.822
9	0.988	0.958	0.946	41	1.000	0.985	0.985
10	0.779	0.899	0.701	42	1.000	0.949	0.949
11	1.000	0.802	0.802	43	0.980	0.963	0.944
12	0.816	0.784	0.640	44	1.000	0.924	0.924
13	0.870	0.822	0.715	45	0.897	0.768	0.688
14	1.000	0.573	0.573	46	1.000	0.787	0.787
15	1.000	0.650	0.650	47	1.000	0.839	0.839
16	0.943	0.885	0.835	48	1.000	0.855	0.855
17	1.000	0.635	0.635	49	0.933	0.741	0.691
18	0.943	0.904	0.853	50	0.793	0.880	0.697
19	0.910	0.754	0.687	51	1.000	0.826	0.826
20	0.935	0.744	0.696	52	1.000	0.900	0.900
21	0.812	0.814	0.661	53	0.908	0.939	0.852
22	0.870	0.890	0.774	54	1.000	0.991	0.991
23	1.000	0.908	0.908	55	0.950	0.833	0.791

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The farm	Technical efficiency %	Specialized competence %	Economic efficiency %	The farm	Technical efficiency %	Specialized competence %	Economic efficiency %
24	1.000	0.974	0.974	56	0.908	0.781	0.709
25	1.000	0.921	0.921	57	0.876	0.964	0.845
26	1.000	0.994	0.994	58	0.940	0.894	0.841
27	0.987	0.970	0.958	59	0.853	0.879	0.750
28	0.960	0.885	0.850	60	1.000	0.887	0.887
29	1.000	0.918	0.918	61	1.000	1.000	1.000
30	1.000	0.547	0.547	Average	0.948	0.860	0.816
31	1.000	0.583	0.583	Highest value	1.000	1.000	1.000
32	0.923	0.806	0.744	Minimum value	0.755	0.547	0.547

Source: Prepared by the researcher based on the questionnaire data and the statistical program (DEAP)

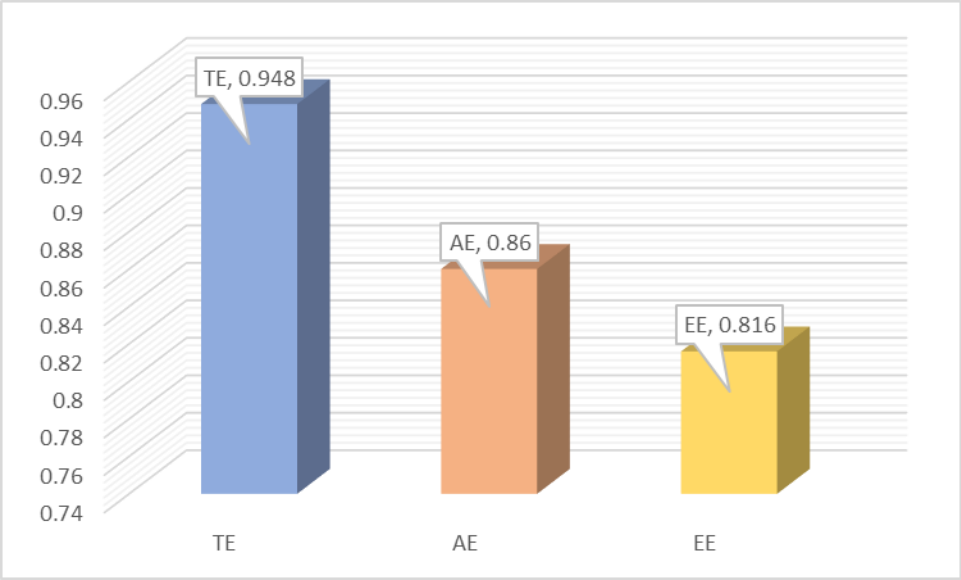

Figure (1) Average levels of technical efficiency, specialized efficiency and economic efficiency
Source: Prepared by the researcher based on data in Table (1(

Estimating economic efficiency and the amount of surplus and deficit in it:

Using the DEAP statistical program and cost functions, the amount of economic resources (the amount of seeds, fertilizers, pesticides, mechanical labor, and human labor) in one dunum that provides economic efficiency (the amount of resources at the lowest cost) in the study sample was estimated, and by comparing the amount of resources actually used in each dunum for each farm with the amount of resources that provide economic efficiency, and calculating the amount of surplus (waste) or shortage in the quantities of these resources by comparing the amount of resources actually used in each farm with the amount of resources proportional to economic

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efficiency, the rate of surplus or shortage is calculated by dividing the amount of surplus or shortage in resources by the amount of resources actually used and multiplying it by 100 to calculate the amount of surplus or shortage for each resource in the study sample.

First resource: seeds:

The total amount of seeds used per dunum in the total study sample was (2430) grams, with an average use per dunum of (39.8) grams. Table (2) shows that there was a surplus of (10.4) grams and a percentage of (26.1%) in the amount of seeds used, meaning that farmers used seeds in quantities greater than the quantities that achieve economic efficiency, which indicates the absence of optimal planning in accurately calculating the amount of seeds based on the area of land and its needs. The analysis shows that (5) farms reached full economic efficiency, meaning that the deficit or surplus in the amount of seeds was zero, (45) farms achieved a surplus and (11) farms achieved a deficit

Table (2) The amount of deficit or surplus in the quantity of seeds for the study sample

The farm	Seeds/gram				The farm	Seeds/gram			
	Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %		Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %
1	40	22	18	45	32	32	40	-8	-25
2	40	22	18	46	33	52	29	23	44
3	23	26	-3	-12	34	40	29	11	27
4	50	29	21	42	35	49	25	24	48
5	25	26	-1	-5	36	25	40	-15	-60
6	44	29	15	33	37	30	30	0	0
7	50	29	21	42	38	44	40	4	9
8	32	26	6	20	39	25	25	0	0
9	37	29	8	22	40	33	29	4	12
10	63	40	23	37	41	22	40	-18	-82
11	70	36	34	49	42	20	29	-9	-45
12	76	25	51	67	43	29	29	0	0
13	40	29	11	27	44	40	26	14	35
14	63	25	38	60	45	40	29	11	27
15	40	29	11	27	46	58	29	29	50
16	62	29	33	53	47	40	29	11	27
17	50	26	24	48	48	23	29	-6	-26
18	64	29	35	55	49	40	29	11	27
19	37	26	11	29	50	38	40	-2	-5
20	50	29	21	42	51	40	40	0	0

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The farm	Seeds/gram				The farm	Seeds/gram			
	Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %		Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %
21	50	26	24	48	52	40	20	20	50
22	32	25	7	22	53	40	29	11	27
23	32	29	3	9	54	25	29	-4	-16
24	36	29	7	19	55	31	29	2	6
25	40	29	11	27	56	30	29	1	3
26	29	32	-3	-10	57	40	29	11	27
27	33	25	8	24	58	31	29	2	6
28	40	29	11	27	59	36	29	7	19
29	46	29	17	37	60	33	29	4	12
30	56	25	31	55	61	40	40	0	0
31	14	25	-11	-79	Average	39.8	29.4	10.4	26.1

Source: Prepared by the researcher based on the questionnaire data and the statistical program (DEAP.(

The second resource: the amount of organic fertilizers

The total amount of fertilizers used per dunum for the total study sample is (72710) tons with an average use per farm of (1191.9) tons. Table (3) shows that the average amount of fertilizers that achieve economic efficiency is (1074.3) tons. The surplus in the use of organic fertilizers was (7.172) tons, i.e. an average of (117.6) tons. The analysis shows that (9) farms reached full economic efficiency and there is no deficit or surplus in the amount of fertilizers, (39) farms achieve a surplus, and (13) farms achieve a deficit. The reason for the waste in the use of organic fertilizers is due to the relative decrease in prices compared to chemical fertilizers. As for the deficit in some farms, the reason for this is due to farmers' fear of the side effects that accompany these types of fertilizers if they do not decompose well, and this is due to the lack of experience of some farmers in using these fertilizers correctly.

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Table (3) The amount of deficit or surplus in the quantity of organic fertilizers used for the study sample

The farm	Organic fertilizers/kg				The farm	Organic fertilizers/kg			
	Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %		Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %
1	1000	1463	-463	-46	32	1000	1000	0	0
2	1300	1458	-158	-12	33	1250	1036	214	17
3	1140	1151	-11	-1	34	1250	1049	201	16
4	1400	1026	374	27	35	1230	1138	92	7
5	1100	1161	-61	-6	36	1250	1000	250	20
6	1000	1087	-87	-9	37	1250	1250	0	0
7	1200	1030	170	14	38	1000	1000	0	0
8	1330	1143	187	14	39	1130	1130	0	0
9	1200	1005	195	16	40	1430	1006	424	30
10	1250	1000	250	20	41	1000	1000	0	0
11	1000	560	440	44	42	1500	1006	494	33
12	1180	1130	50	4	43	1140	1015	125	11
13	1000	1036	-36	-4	44	1000	1150	-150	-15
14	1200	1137	63	5	45	1000	1026	-26	-3
15	1100	1030	70	6	46	1250	1006	244	20
16	1500	1053	447	30	47	1000	1047	-47	-5
17	1400	1152	248	18	48	1120	1019	101	9
18	1290	1000	290	22	49	1300	1038	262	20
19	1470	1161	309	21	50	1250	1000	250	20
20	1430	1000	430	30	51	1000	1000	0	0
21	1270	1152	118	9	52	1250	1500	-250	-20
22	1200	1130	70	6	53	1000	1036	-36	-4
23	1000	1000	0	0	54	1170	1026	144	12
24	1000	1000	0	0	55	1250	1036	214	17
25	1170	1038	132	11	56	1500	1026	474	32
26	1000	1330	-330	-33	57	1130	1036	94	8

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The farm	Organic fertilizers/kg				The farm	Organic fertilizers/kg			
	Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %		Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %
27	1170	1134	36	3	58	1250	1038	212	17
28	1000	1026	-26	-3	59	1430	1029	401	28
29	1250	1000	250	20	60	1250	1036	214	17
30	1290	1136	154	12	61	1000	1000	0	0
31	1290	1130	160	12	Average	1191.9	1074.3	117.6	9.9

Source: Prepared by the researcher based on the questionnaire data and the statistical program (DEAP.(

The third resource: chemical fertilizers

The total use of chemical fertilizers per dunum for the total study sample was (8265) kg with an average use per dunum of (135.5) kg. Table (4) shows that the average amount of fertilizers that achieved economic efficiency was (129.7) kg. There is a surplus in the use of chemical fertilizers of (352) kg. The analysis shows that (7) farmers achieved full economic efficiency and there was no shortage or surplus in fertilizers, (30) farmers achieved a surplus, and (24) farmers achieved a deficit. That is, there is a surplus in the use of chemical fertilizers of (5.8) kg. The reason for the waste and deficit in the quantities used and the failure to adhere to the recommendations of specialists regarding the optimal quantities is due to the lack of stability in fertilizer prices, which prompts farm owners to reduce the quantities used to reduce costs

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Table (4) The amount of deficit or surplus in the quantity of chemical fertilizers used for the study sample

The farm	Fertilizers / ton				The farm	Fertilizers / ton			
	Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %		Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit%
1	100	100	0	0	32	135	150	15-	11-
2	120	100	20	17	33	150	121	29	19
3	135	141	6-	4-	34	100	120	20-	20-
4	150	122	28	19	35	200	148	52	26
5	150	137	13	9	36	200	150	50	25
6	125	116	9	7	37	100	100	0	0
7	100	122	22-	22-	38	175	150	25	14

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8	100	144	44-	44-	39	150	150	0	0
9	140	124	16	11	40	125	124	1	1
10	150	150	0	0	41	180	150	30	17
11	100	130	30-	30-	42	100	124	24-	24-
12	125	150	25-	20-	43	200	124	76	38
13	125	121	4	3	44	200	142	58	29
14	150	147	3	2	45	150	122	28	19
15	100	122	22-	22-	46	120	124	4-	3-
16	125	120	5	4	47	150	120	30	20
17	100	141	41-	41-	48	100	123	23-	23-
18	125	125	0	0	49	150	121	29	19
19	125	137	12-	10-	50	175	150	25	14
20	130	125	5	4	51	180	150	30	17
21	140	141	1-	1-	52	100	100	0	0
22	130	150	20-	15-	53	200	121	79	40
23	100	125	25-	25-	54	150	122	28	19
24	100	125	25-	25-	55	160	121	39	24
25	100	121	21-	21-	56	180	122	58	32
26	125	100	25	20	57	120	121	1-	1-
27	125	148	23-	18-	58	125	121	4	3
28	110	122	12-	11-	59	150	122	28	19
29	100	125	25-	25-	60	125	121	4	3
30	125	148	23-	18-	61	150	150	0	0
31	135	150	-15	-11	Average		135.5	129.7	5.8	4.3

Source: Prepared by the researcher based on the questionnaire data and the statistical program (DEAP.(

Fourth resource: pesticides

From Table (5), we note that the amount of pesticides used per dunum for the total study sample was (53.42) liters with an average of (0.875) liters. The table also shows that the average amount of pesticides used that achieved economic efficiency amounted to (0.857) liters, with a surplus in the quantities used of (0.018) liters and a percentage of (2.05%). The analysis shows that (9) farms achieved full economic efficiency, i.e. the deficit or surplus in the amount of pesticides used in them equals zero, (21) farms achieved a surplus, and (31) farms achieved a deficit. The waste in the use of pesticides is due to the farmers' belief that large quantities of pesticides will help get rid of pests more quickly, while the reason for the deficit is due to the lack of scientific knowledge about the use of these pesticides, which leads to insufficient or incorrect use, in addition to the fact that some farms did not show infections that require the use of pesticides

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Table (5) The amount of deficit or surplus in the quantity of pesticides used for the study sample

The farm	Pesticides / liter				The farm	Pesticides / liter			
	Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %		Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %
1	0.800	1.000	0.200-	-25	32	0.400	0.800	0.400-	-100
2	0.800	1.000	0.200-	-25	33	0.800	1.000	0.200-	-25
3	0.500	0.586	-0.086	-17	34	0.800	1.000	0.200-	-25
4	0.800	1.000	0.200-	-25	35	0.700	0.533	0.167	24
5	0.700	0.630	0.070	10	36	0.900	0.800	0.100	11
6	2.200	1.000	1.200	55	37	1.000	1.000	0	0
7	0.600	1.000	0.400-	-67	38	2.400	0.800	1.600	67
8	0.500	0.556	-0.056	-11	39	0.500	0.500	0	0
9	0.800	1.000	0.200-	-25	40	0.700	1.000	0.300-	-43
10	1.900	0.800	1.100	58	41	0.300	0.800	0.500-	-167
11	1.900	0.880	1.020	54	42	1.000	1.000	0	0
12	1.500	0.500	1.000	67	43	1.070	1.000	0.070	7
13	1.050	1.000	0.050	5	44	0.150	0.583	-0.433	-289
14	1.500	0.531	0.969	65	45	0.800	1.000	0.200-	-25
15	0.800	1.000	0.200-	-25	46	0.600	1.000	0.400-	-67
16	1.300	1.000	0.300	23	47	0.600	1.000	0.400-	-67
17	0.800	0.593	0.207	26	48	1.000	1.000	0	0
18	1.100	1.000	0.100	9	49	0.700	1.000	0.300-	-43

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The farm	Pesticides / liter				The farm	Pesticides / liter			
	Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %		Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %
19	0.700	0.627	0.073	10	50	1.000	0.800	0.200	20
20	0.900	1.000	0.100-	-11	51	0.600	0.800	0.200-	-33
21	0.600	0.593	0.007	1	52	1.000	1.000	0	0
22	0.900	0.500	0.400	44	53	0.800	1.000	0.200-	-25
23	0.300	1.000	0.700-	-233	54	0.800	1.000	0.200-	-25
24	1.100	1.000	0.100	9	55	1.000	1.000	0	0
25	0.600	1.000	0.400-	-67	56	1.000	1.000	0	0
26	0.700	0.750	0.050-	-7	57	1.100	1.000	0.100	9
27	0.500	0.519	-0.019	-4	58	0.900	1.000	0.100-	-11
28	0.500	1.000	0.500-	-100	59	0.800	1.000	0.200-	-25
29	1.250	1.000	0.250	20	60	0.700	1.000	0.300-	-43
30	0.400	0.524	-0.124	-31	61	0.800	0.800	0	0
31	0.50	0.50	0	0	Average	0.875	0.857	0.018	2.057

Source: Prepared by the researcher based on the questionnaire data and the statistical program (DEAP.(

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The fifth resource: human labor

From Table (6), we note that the total human labor used per dunum for the total study sample amounted to (4006) workers/day, i.e. an average rate of (66) workers/day. We also note that the amount of human labor that achieved economic efficiency amounted to (3199) workers/day, i.e. there are (807) workers/day surplus in the total study sample, i.e. a rate of (20.1%). We also note from the analysis results that (6) farmers achieved full economic efficiency, i.e. there was no surplus or deficit in human labor, and (53) farmers achieved a surplus and two farmers achieved a deficit. The reason for the surplus in the use of labor is due to the crop's need for a large number of workers during harvest times and the farmer's desire to harvest his crop quickly.

Table (6) The amount of deficit or surplus in human labor used for the total study sample

The farm	Human labor: man/day				The farm	Human labor: man/day			
	Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %		Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %
1.	73	51	22	30	32.	73	67	6	8
2.	61	51	10	16	33.	55	50	5	9
3.	53	50	3	6	34.	51	50	1	2
4.	84	50	34	40	35.	71	50	21	30
5.	67	50	17	25	36.	76	67	9	12
6.	56	50	6	11	37.	50	50	0	0
7.	55	50	5	9	38.	74	67	7	9
8.	50	50	0	0	39.	50	50	0	0
9.	51	50	1	2	40.	64	50	14	22
10.	71	67	4	6	41.	51	67	-16	-31
11.	69	60	9	13	42.	51	50	1	2
12.	80	50	30	38	43.	51	50	1	2
13.	82	50	32	39	44.	53	50	3	6
14.	96	50	46	48	45.	93	50	43	46

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The farm	Human labor: man/day				The farm	Human labor: man/day			
	Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %		Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %
15.	91	50	41	45	46.	65	50	15	23
16.	53	50	3	6	47.	61	50	11	18
17.	89	50	39	44	48.	66	50	16	24
18.	53	50	3	6	49.	78	50	28	36
19.	80	50	30	37	50.	68	67	1	1
20.	78	50	28	36	51.	63	67	-4	-6
21.	81	50	31	38	52.	54	51	3	6
22.	68	50	18	26	53.	59	50	9	15
23.	62	50	12	19	54.	50	50	0	0
24.	53	50	3	6	55.	67	50	17	25
25.	55	50	5	9	56.	74	50	24	33
26.	50	50	0	0	57.	62	50	12	19
27.	51	50	1	2	58.	62	50	12	19
28.	64	50	14	22	59.	69	50	19	28
29.	51	50	1	2	60.	58	50	8	14
30.	99	50	49	50	61.	67	67	0	0
31.	95	50	45	47	Average	66	53	13	19.7

Source: Prepared by the researcher based on the questionnaire data and the statistical program (DEAP.(

The sixth resource: mechanical work

From Table (7), we note that the amount of mechanical labor used per dunum for the total farm sample was (29) hours with an average usage per dunum of (0.47) minutes. We also note that the amount of mechanical labor that achieved economic efficiency was (27) working hours with an average of (0.44), meaning that there is a surplus in the amount

of mechanical labor used per dunum by two hours. The analysis also showed that (9) farms achieved full economic efficiency, meaning there was no surplus or deficit in usage, and that (33) farms achieved a surplus, and (19) farms achieved a deficit. The reason for the surplus and deficit is due to the use in an unstudied manner or the selection of machines that are not suitable for the area of agricultural land. Sometimes, the rental cost is high, which prompts farmers to reduce working hours

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Table (7) The amount of deficit or surplus in mechanical human labor for the total study sample

The farm	Mechanical work/hour				The farm	Mechanical work/hour			
	Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %		Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %
1.	0.40	0.42	-0.02	-5	32.	0.60	0.40	0.20	33
2.	0.60	0.42	0.18	30	33.	0.50	0.44	0.06	12
3.	0.50	0.46	0.04	8	34.	0.40	0.44	-0.04	-10
4.	0.70	0.44	0.26	37	35.	0.46	0.45	0.01	3
5.	0.40	0.46	-0.06	-15	36.	0.50	0.40	0.10	20
6.	0.50	0.45	0.05	10	37.	0.50	0.50	0.00	0
7.	0.45	0.44	0.01	2	38.	0.40	0.40	0.00	0
8.	0.38	0.46	-0.08	-20	39.	0.45	0.45	0.00	0
9.	0.40	0.43	-0.03	-7	40.	0.43	0.43	0.00	0
10.	0.50	0.40	0.10	20	41.	0.50	0.40	0.10	20
11.	0.50	0.44	0.06	12	42.	0.40	0.43	-0.03	-7
12.	0.71	0.45	0.26	36	43.	0.43	0.43	0.00	0
13.	0.50	0.44	0.06	12	44.	0.45	0.46	-0.01	-2
14.	0.33	0.45	-0.12	-35	45.	0.40	0.44	-0.04	-10
15.	0.40	0.44	-0.04	-10	46.	0.42	0.43	-0.01	-3
16.	0.50	0.45	0.05	10	47.	0.53	0.44	0.09	18
17.	0.47	0.46	0.01	1	48.	0.44	0.44	0.00	0

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The farm	Mechanical work/hour				The farm	Mechanical work/hour			
	Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %		Actual quantity	Economic efficiency achieved quantity	Surplus or deficit amount	Surplus or deficit %
18.	0.50	0.43	0.07	14	49.	0.40	0.44	-0.04	-10
19.	0.53	0.46	0.07	13	50.	0.50	0.40	0.10	20
20.	0.36	0.43	-0.07	-20	51.	0.40	0.40	0.00	0
21.	0.60	0.46	0.14	23	52.	0.60	0.40	0.20	33
22.	0.57	0.45	0.12	21	53.	0.50	0.44	0.06	12
23.	0.47	0.43	0.04	8	54.	0.40	0.44	-0.04	-10
24.	0.43	0.43	0.00	0	55.	0.38	0.44	-0.07	-17
25.	0.50	0.44	0.06	12	56.	0.40	0.44	-0.04	-10
26.	0.43	0.38	0.05	11	57.	0.50	0.44	0.06	12
27.	0.53	0.45	0.08	16	58.	0.40	0.44	-0.04	-10
28.	0.47	0.44	0.03	6	59.	0.43	0.44	-0.01	-3
29.	0.56	0.43	0.13	24	60.	0.33	0.44	-0.11	-32
30.	0.57	0.45	0.12	21	61.	0.40	0.40	0.00	0
31.	0.59	0.45	0.14	23	Average	0.47	0.44	0.03	6.4

Source: Prepared by the researcher based on the questionnaire data and the statistical program (DEAP.(

Conclusions

-1The research hypothesis was confirmed, which is that there is a waste in the use of economic resources in tomato production farms. This was confirmed through the results obtained, which indicated that there is a waste in economic resources compared to the level of optimal use of resources.

-2There is a surplus in the use of all inputs by comparing the amount of actual economic resources used with their counterparts that achieve efficiency,

-3Organic fertilizers constituted the largest percentage of the surplus by an amount of 117.6, which may be attributed to the low prices of these fertilizers, in addition to the

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quality of these fertilizers in the fertilization process.

-4The components of economic efficiency, with its two aspects, technical and specialized efficiency, have a gap represented by their inconsistency during the study, as the gap was estimated at about 9%. This is due to the high prices of production inputs and the lack of optimal use of the areas planted with tomato crops, which led to a decrease in the efficiency of the capacity to produce tomato farms in the research sample.

-5We conclude from the results of the technical efficiency analysis that the percentage of fields that did not achieve 100% technical efficiency amounted to 31% of the total number of fields prepared for the study sample. This means that these fields did not exploit the available resources in the optimal way.

Recommendations

.1Maximize the amount of surplus achieved in economic resources in tomato production farms of various sizes in establishing good production projects.

.2The need to focus on investing in large production fields because they contribute a large financial abundance that contributes to increasing the national income and thus achieving self-sufficiency in this product.

.3Owners of productive farms that have not achieved 100% technical efficiency should benefit scientifically from the experiences of owners of productive farms that have achieved 100% technical efficiency and that this should be a reference for them in the production process and then optimal exploitation of available resources.

.4The need to focus on investing in large production farms because they contribute a large financial abundance that contributes to increasing the national income and thus achieving self-sufficiency in this product.

.5Supporting production elements for local farmers so that they can achieve profitable profits and increase their production capacities with the entry of new producers into the production process, thus reducing imports.

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