



IRAQI
Academic Scientific Journals



العراقية
المجلات الأكاديمية العلمية

ISSN:1813-1646 (Print); 2664-0597 (Online)

Tikrit Journal for Agricultural Sciences

Journal Homepage: <http://www.tjas.org>

E-mail: tjas@tu.edu.iq

TJAS

Tikrit Journal for
Agricultural
Sciences

Estimating the economic efficiency of potato varieties grown in the fall season 2021 (Baghdad Governorate - Al-Nasr and Al-Salam district - an applied model)

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ABSTRACT

The research aims to estimate the economic efficiency and estimate the amount of waste and deficit in the use of production resources for potato varieties grown in the fall season 2021 within Baghdad governorate using the DEA data envelope method, The research relied on cross-sectional data collected randomly, including 181 farms, The results of the technical efficiency according to the stability of the capacity returns showed that the Redlove variety achieved the highest average efficiency (0.97), while according to the variable capacity returns the Paradise variety achieved the highest average efficiency (0.98), while the Ghalia variety achieved the highest average efficiency (0.99) according to the capacity efficiency, The results also showed that Redlove and Fuji cultivars achieved the highest average economic efficiency of (0.91, 0.90), respectively, Among the results of the study is also the existence of an excess in the use of production elements, foremost of which is the element of seeds, The study recommends the necessity of benefiting from the experience of potato farmers in cultivating the crop, especially cultivars (Redolph Hamra, Paradiso and Ghalia), and directing farmers towards the use of productive elements in the quantities that achieve economic efficiency and their components, and not to waste in the use of these elements.

KEY WORDS:

The Data Envelopment Analysis Method; Technical efficiency; optimal sizes; potato

Received: 08/06/2023

Accepted: 26/07/2023

Available online: 31/03/2024

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تقدير الكفاءة الاقتصادية لأصناف البطاطا المزروعة في الموسم الخريفي 2021 (محافظة بغداد - ناحية النصر والسلام - نموذج تطبيقي)

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الخلاصة

يهدف البحث إلى تقدير الكفاءة الاقتصادية وتقدير حجم الهدر والعجز في استخدام موارد الانتاج لأصناف البطاطا المزروعة في العروة الخريفية 2021 ضمن محافظة بغداد باستخدام أسلوب مغلف البيانات DEA، اعتمد البحث على البيانات المقطعية التي جُمعت عشوائياً متضمنة 181 مزرعة، بينت نتائج الكفاءة التقنية وفق ثبات عوائد السعة ان صنف ردلوف حمراء حقق أعلى متوسط كفاءة (0.97) أما وفق عوائد السعة المتغيرة حقق صنف براديسو أعلى متوسط كفاءة (0.98) في حين حقق صنف غالية أعلى متوسط كفاءة (0.99) وفق كفاءة السعة، كما بينت النتائج ان صنف ردلوف حمراء و فوجي حققا أعلى متوسط كفاءة اقتصادية بلغت (0.91 ، 0.90) على الترتيب، من نتائج الدراسة ايضاً وجود فائض في استخدام عناصر الانتاج وفي مقدمتها عنصر التقاوي، توصي الدراسة بضرورة الاستفادة من خبرة مزارعي البطاطا في زراعة المحصول لاسيما مزارعي الاصناف (ردلوف حمراء، براديسو و غالية) و توجيه المزارعين نحو استخدام العناصر الانتاجية عند الكميات المحققة للكفاءة الاقتصادية ومكوناتها وعدم الاسراف في استخدام تلك العناصر.

الكلمات الافتتاحية: تحليل مغلف البيانات، الكفاءة الفنية، الحجم المثلّي، البطاطا.

INTROUCTION

The cultivation of vegetables, especially the potato crop, is considered one of the important activities with high economic returns if the scientific foundations are followed. The crop belongs to the Solanaceae family under the scientific name Solanum Tuberosum, and it is one of the most important daily foods for the population (Jawad et al., 2017). It is believed that the original home of the crop is the Andes Mountains in Peru and Bolivia, as it was discovered by the Spaniards. It is also believed that the southern coast of Chile is its original home, but the first belief is prevalent (Matlob and Muhammad, 1980). The crop was transported after its discovery by the Spaniards to the United States of America and then to Europe and to the rest of the world (AL-Khazali, 2006). The crop is considered one of the important foods for humans because it contains vitamins and carbohydrates (Al Nuaimi, 2022). The crop occupies great importance in the global economy, as it is one of the cheap energy sources (Khan and Aktar, 2006). The crop occupies an important food center in most countries of the world as a result of its nutritional value and is considered the first alternative to grain crops (thalaj and Najar, 2012). The continent of Asia occupies the first place in the world in the production of potatoes, followed by the continent of Europe, then the American continent, and finally the continents of Africa and Oceania, China ranks first in the world in terms of the area cultivated with the crop, while the United States of America ranks first in the world in terms of crop productivity, As for Iraq, it ranks seventh in the Arab world in terms of the area cultivated with the crop and its productivity (FAOSTAT, 2020). The importance of the research emerges from the nutritional and economic importance of the crop, As almost no kitchen is devoid of the crop, In addition to its abundant production per unit area and it is grown with two seeds per year.

Despite the expansion of potato cultivation at the level of Iraq and Baghdad Governorate - Al-Nasr and Al-Salam district, The productivity of a dunam is still low compared to the productivity of a dunam in other countries the Farmers' lack of knowledge of high-Efficiency seed varieties and Their failure to use the Production elements in optimal quantities is one of the reasons for the low productivity of a dunum. The research aims to estimate the economic efficiency and its components according to the varieties of seeds grown in the study area for the fall harvest 2021 and estimate the amount of surplus and deficit in the use of production elements.

The research relied on the hypothesis that the farmers of the study sample do not use the production elements at the quantities at which the economic efficiency and its components are achieved, which leads to the emergence of waste or inability to use these resources, In addition to their use of a group of seed varieties that differ in their economic efficiency and components.

MATERIAL AND METHODS

The study relied on cross-sectional data collected from 181 farmers in the Al-Nasr and Al-Salam area within Baghdad Governorate, which constitute a percentage 30.2% from The total number of farmers in the study area of 599, according to the data of the Ministry of Agriculture, Used the (DEA) The Data Envelopment Analysis Method in estimating economic efficiency and its components, In addition to using the Excel program to tabulate the data, The data envelope method is a relatively new non-parametric method based on linear programming. This method does not take into account random errors, and it provides complete information about efficiency, And it is a comparative method because the measurement is by returning to a group of production units that are compared with each other. This method does not give absolute efficiency unless we assume that the units to be compared include a sufficient number of units that achieve full efficiency, and this means that when using the DEA method we may get efficient units, but in reality they need adjustments to improve the level of efficiency(Ben Kesmi, 2019). This method creates an envelope containing various data to estimate the efficiency of the production units according to the combination of the productive resources used by those units(Cooper et al., 2006).

Characteristics of the data envelope method:

- 1- It does not need the restrictions imposed on the technical functions that may affect the efficiency values.
- 2- It provides more information about the data used in the decision-making process(chien, 2009).
- 3- It provides corresponding production units, which other units can look at to improve their operations and modify the executive programs(Al-Sakka, 2009).
- 4- It is used to study the efficiency of production units, especially in small samples, By comparing each production unit separately, And then comparing it with the rest of the production units as well(Bourgaba, 2011).
- 5- No need to specify previous weights and prices for inputs and outputs(Ali, 2014).
- 6- sing multiple inputs and outputs to estimate efficiency(Bin Kesmi, 2019).

- 7- Reducing effort and time to achieve the required goals by using linear programming(Al-Obaidi, 2021).

Disadvantages of the data envelope method:

- 1- Its results are relative and not absolute, and this indicates the existence of the best practices that were compared between them, which are not the best at all.
- 2- The presence of standard errors leads to the emergence of major problems(Al-Ani, 2012).
- 3- Statistical tests and non-parametric tests are among the difficult tests.
- 4- His inability to distinguish between standard error and a case of lack of competence(Al-Obaidi, 2021).
- 5- The sensitivity of the program in relation to the quality of the data, as the presence of errors leads to a change in the results of the analysis(Al-Obaidi, 2022).
- 6- The difficulty of defining the hypothesis in this method being a non-teaching method.

RESULTS AND DISSCUSION

The technical efficiency was estimated in the event of constant and changing returns and capacity efficiency, In addition to estimating the specialized efficiency and economic efficiency according to the variable capacity returns and according to the productivity function variables of the potato crop for the autumn harvest 2021 using the data envelope method, Considering potato productivity as a dependent factor and the independent elements are the amount of seed planted estimated in kg / dunum , Urea fertilizer estimated in kg / dunum, Dab fertilizer estimated in kg / dunum, Human labor estimated in man / dunum and mechanical work estimated in hour / dunum.

Technical efficiency in case of change, constant and efficiency of scale:

Farms that achieve 100% efficiency are typical farms for farms that achieve less than 100% efficiency, Capacity efficiency was measured by dividing the technical efficiency in the case of a constant return on the technical efficiency in the case of a change in the return for the same farm, The results of the analysis showed that the average efficiency according to the stability of capacity returns, The change of capacity returns and capacity efficiency reached(0.905, 0.953 and 0.951) respectively, The technical efficiency and capacity efficiency of potato cultivars grown in autumn season are given below:

Table 1: Limits and averages of technical efficiency in case of constant and variable scale efficiency

Type	number of farms	technical efficiency								
		scale efficiency			Variable return to scale (vrs)			Fixed return to scale crs		
		average	minimum rate	highest rate	average	minimum rate	highest rate	average	minimum rate	highest rate
Arizona	18	0.910	0.795	1	0.953	0.866	1	0.867	0.781	1
Alibada	9	0.923	0.869	0.99	0.953	0.889	1	0.878	0.85	0.921
Snrgy	25	0.923	0.843	0.99	0.955	0.879	1	0.881	0.843	0.921
Fuji	3	0.949	0.911	0.981	0.958	0.936	0.989	0.909	0.896	0.931
Naima	5	0.949	0.911	0.989	0.950	0.901	1	0.902	0.881	0.94
Buren	76	0.961	0.832	1	0.950	0.817	1	0.912	0.808	1
Munda	20	0.966	0.87	1	0.954	0.846	1	0.921	0.803	1
Paradiso	2	0.973	0.947	1	0.983	0.967	1	0.958	0.916	1
Rivera	7	0.963	0.87	1	0.957	0.777	1	0.921	0.759	1
safranha	6	0.969	0.917	1	0.959	0.893	1	0.929	0.865	0.969
ghalih	2	0.994	0.99	0.998	0.894	0.892	0.897	0.889	0.883	0.896
gazelle	2	0.989	0.979	1	0.968	0.937	1	0.958	0.937	0.979
everest	3	0.956	0.9	1	0.956	0.91	1	0.912	0.9	0.928
red radlove	3	0.988	0.965	1	0.981	0.944	1	0.970	0.911	1

Source: Prepared by the researcher based on the results of the analysis of the study sample using the Deap program.

It is clear from Table (1) that the redlove red variety achieved the highest average efficiency according to fixed capacity returns followed by the rest of the seed varieties as its average efficiency was (0.970) This means the possibility of increasing production by (0.03) without increasing the use of production factors or the possibility of reducing the use of production factors by (0.03) and obtaining the amount of the previous production, According to the variable capacity returns the Paradiseo variety achieved the highest average efficiency followed by the rest of the other varieties as its average efficiency reached (0.983) This means that production can be increased by (0.017) without increasing the use of production elements or the possibility of reducing the use of production factors by (0.017) without this being accompanied by a decrease in the level of production, While the Ghalia variety achieved the highest average efficiency according to capacity efficiency followed by the rest of the other varieties as its average efficiency reached (0.994) This means that production can be increased by (0.006) without being or the possibility of reducing production inputs by (0.006) without affecting the level of production achieved.

The economic efficiency or what is known as the cost efficiency was estimated from the input side by multiplying the technical efficiency in the event of a change in capacity returns in the specialized efficiency which can be obtained from the use of the quantities of production elements and their prices, It averaged technical efficiency specialized efficiency and economic efficiency(0.953, 0.912 and 0.869) according to the order, Farms that achieve complete economic efficiency 100% operate at the point of contact between the cost line and the line of equal output, and the output quantities at this point represent the optimal maximizing quantities of production, Only the specialized and economic efficiency will be clarified because we touched on the technical efficiency previously as shown in Table (2):

Table 2: Limits and averages of economic efficiency and its components for potato varieties grown in the fall season 2021

Type	number of farms	technical efficiency								
		scale efficiency			Variable return to scale (vrs)			Fixed return to scale crs		
		average	minimum rate	highest rate	average	minimum rate	highest rate	average	minimum rate	highest rate
Arizona	18	0.889	0.756	1	0.932	0.871	1	0.953	0.866	1
Alibada	9	0.889	0.776	0.944	0.932	0.873	0.982	0.953	0.889	1
Snrgy	25	0.900	0.782	0.994	0.941	0.878	0.994	0.955	0.879	1
Fuji	3	0.907	0.863	0.95	0.947	0.922	0.961	0.958	0.936	0.98
Naima	5	0.889	0.837	0.955	0.935	0.904	0.966	0.950	0.901	1
Buren	76	0.853	0.716	1	0.899	0.804	1	0.950	0.817	1
Munda	20	0.855	0.761	1	0.896	0.834	1	0.954	0.846	1
Paradiso	2	0.882	0.837	0.928	0.898	0.837	0.959	0.983	0.967	1
Rivera	7	0.870	0.726	1	0.911	0.818	1	0.957	0.777	1
safranha	6	0.834	0.758	0.907	0.869	0.822	0.913	0.959	0.893	1
ghalih	2	0.827	0.794	0.861	0.924	0.89	0.959	0.894	0.892	0.897
gazelle	2	0.880	0.859	0.902	0.909	0.902	0.917	0.968	0.937	1
everest	3	0.851	0.812	0.875	0.890	0.875	0.905	0.956	0.91	1
red radlove	3	0.911	0.862	0.952	0.929	0.862	0.973	0.981	0.944	1

Source: prepared by the researcher based on the results of the analysis of the study sample using the Deap program.

Table (2) shows that the Fuji variety achieved the highest average specialized efficiency followed by the rest of the other varieties as its average specialized efficiency was (0.947) This means that productive resources can be reallocated and distributed in a way that leads to an increase in production by (0.053) using spending the same cost of resources or reduce the cost of production factors by a percentage (0.053) while maintaining the previous level of production, The results also showed that the farms that achieved full technical efficiency were much more than the farms that achieved full specialized efficiency, which was directly reflected in the economic efficiency This is due to the farmers' experience in growing the crop and thus achieving technical efficiency on the one hand, and to the high prices of inputs and then the high cost line, which makes it exceed the frontier efficiency curve and thus not achieving specialized efficiency on the other hand, While Redlove red variety achieved the highest average economic efficiency, followed by the rest of the other varieties, as its average efficiency was (0.911) This means the possibility of increasing production by (0.089) without increasing its production costs, or the possibility of reducing its production costs by (0.089) and obtaining the same production.

Estimating the size of the production elements that achieve economic efficiency and the amount of surplus and deficit in their use for potato farms in the study sample, The surplus and deficit is estimated through the difference between the quantities actually used and the quantities achieved for economic efficiency. If the result is positive, this means that there is a waste in the use of the productive element and its use must be reduced. If the result is negative, this means that there is a deficit in the use of the element and its use must be increased. If the result is zero This means that the productive element is used optimally.

Potato seeds: Table (3) shows that the total quantity actually used of seeds in the farms of the Arizona variety amounted to (14225 kg) with an average of (790 kg / dunum), while the total amount achieved for economic efficiency was (12600 kg) and an average of (1625 kg / dunum) and that the difference Between them, It shows that there is waste in the use of seeds with a total of (1625 kg) and an average of (90 kg / dunum), And this represents an estimated surplus rate of (11.4%), So the use of this element must be reduced by the same percentage. The number of farmers who use seeds in quantities more than optimal is 13, while farmers who use seeds optimally are only 5 farmers, while there are no farmers who achieve a deficit in the use of this element, The highest excess percentage in the use of seeds was in the farms of the Safranha cultivar, as it amounted to (28.53%), followed by the farms of other cultivars. Therefore, the use of seeds must be reduced to reach the optimal use, Perhaps the reason for the waste is that the seeds of the autumn harvest are the products of the spring harvest (meaning that the farmer does not buy them in the autumn season most of them) and therefore he tries to increase their use to increase his production. As for the farmers who achieved complete efficiency in using the seeds, their number reached (5, 3, 4, 4, 1, 1) farms for cultivars (Arizona, Alibada, Senergy, Burin, Munda and Rivera) in the same order, while the rest of the growers of other cultivars did not achieve efficiency in the use of seeds.

Table 3: the amount of surplus and deficit in the use of the seed element

Type		The Seeds Used virtually(kg)	The piety verified efficiency (kg)	Amount overflow or incapacity(kg)	rate overflow or deficit%	Number farmer same overflow	Number farmer Same Disability	Number farmer related use optimum
Arizona	Total	14225	12600	1625				
	average	790	700	90	11.39	13	0	5
Alibada	Total	7175	6300	875				
	average	797	700	97	12.17	6	0	3
Snrgy	Total	19600	17500	2100				
	average	784	700	84	10.71	21	0	4
Fuji	Total	2400	2100	300				
	average	800	700	100	12.5	3	0	0
Naima	Total	4075	3500	575				
	average	815	700	115	14.11	5	0	0
Buren	Total	70570	55245	15325				
	average	928	727	201	21.65	72	0	4
Munda	Total	19775	14775	5000				
	average	988	739	249	25.20	19	0	1
Paradiso	Total	1750	1400	350				
	average	875	700	175	20	2	0	0
Rivera	Total	6900	5150	1750				
	average	985	736	249	25.27	6	0	1
safranha	Total	6250	4465	1785				
	average	1041	744	297	28.53	6	0	0
Ghalia	Total	1900	1400	500				
	average	950	700	250	26.31	2	0	0
gazelle	Total	1900	1440	460				
	average	950	720	230	24.21	2	0	0
Everest	Total	2900	2175	725				
	average	966	725	241	24.94	3	0	0
red	Total	2850	2200	650				
	average	950	733	217	22.84	3	0	0
radlove	average	950	733	217				

Source: The researcher based on the data of the questionnaire and the results of Deap analysis.

Urea fertilizer: Table (4) shows that the number of farms that operate in quantities more than optimal (13, 6, 21, 3, 5, 72, 19, 2, 6, 6, 2, 2, 3, 3) for varieties (Arizona, Alibada, Senergy, Fuji, Naima, Burin, Munda, Paradiso, Rivera, Saffrana, Ghalia, Ghazal, Everest and Red Rose) in order, while the number of farms operating in quantities less than optimal was (7, 4, 8, 1, 2, 33, 6, 0, 2, 3, 0, 3, 2) in the same order as the varieties, while the number of farms operating at the optimal quantities of the aforementioned items reached (5, 3, 5, 1, 1, 22, 9, 2, 3, 1, 1, 1, 0, 0) respectively, That the farmers who had a waste in the use of urea should reduce the use of urea to reach the optimal use, while the farmers who had a deficit in the use of this resource should increase the use of urea to achieve economic efficiency.

Table 4: the amount of surplus and deficit in the use of urea fertilizer element

Type		Used urea virtually (kg)	Urea verified efficiency (kg)	Amount overflow or incapacity (kg)	rate overflow or deficit%	Number farmer same overflow	Number farmer Same Disabilit y	Number farmer related use optimum
Arizon a	Total	1305	1308	-3	-1.38	6	7	5
	average	72	73	-1				
Alibada	Total	670	675	-5	-1.75	2	4	3
	average	74	75	-1				
Snrgy	Total	1920	1903	17	1.29	12	8	5
	average	77	76	1				
Fuji	Total	245	245	0	0	1	1	1
	average	82	82	0				
Naima	Total	398	398	0	0	2	2	1
	average	80	80	0				
Buren	Total	8180	8297	-117	-0.92	21	33	22
	average	108	109	-1				
Munda	Total	2293	2351	-58	-2.60	5	6	9
	average	115	118	-3				
Paradis o	Total	185	185	0	0	0	0	2
	average	93	93	0				
Rivera	Total	828	819	9	0.84	2	2	3
	average	118	117	1				
safran h a	Total	678	697	-19	-2.65	2	3	1
	average	113	116	-3				
Ghalia	Total	215	210	5	2.77	1	0	1
	average	108	105	3				
gazelle	Total	210	209	1	-0.95	1	0	1
	average	105	106	-1				
Everest	Total	290	320	-30	-10.30	0	3	0
	average	97	107	-10				
red radlove	Total	290	339	-49	-16.49	1	2	0
	average	97	113	-16				

Source: The researcher based on the data of the questionnaire and the results of the Deap program analysis.

Dab fertilizer: Table (5) shows that the number of farms that operate in quantities more than optimal (15, 6, 22, 3, 5, 62, 13, 2, 5, 5, 1, 1, 3, 2) for varieties (Arizona, Alibada, Senergy, Fuji, Naima, Burin, Munda, Paradiso, Rivera, Saffrana, Ghalia, Ghazal, Everest and Red Rose) in order, while the number of farms operating in quantities less than optimal was (0, 0, 0, 0, 0, 9, 3, 0, 1, 1, 0, 1, 0, 1) and in the same order of varieties, while the number of farms operating at optimal quantities for the aforementioned items reached (3, 3, 3, 0, 0, 5, 4, 0, 1, 0, 1, 0, 0, 0,

0), The farmers who had a waste in the use of dab must reduce its use to reach the optimal use, while the farmers who had a deficit in the use of this resource must increase its use to achieve economic efficiency.

Table 5: The amount of surplus and deficit in the use of the Dab fertilizer component

Type		Dab fertilizer used virtually (kg)	Efficiency checking dab fertilizer (kg)	Amount overflow or incapacity (kg)	rate overflow or deficit %	Number farmer same overflow	Number farmer Same Disability	Number farmer related use optimum
Arizona	Total	1615	1098	517	32.22	15	0	3
	average	90	61	29				
Alibada	Total	790	573	217	27.27	6	0	3
	average	88	64	24				
Snrgy	Total	2420	1505	915	38.14	22	0	3
	average	97	60	37				
Fuji	Total	265	185	80	29.54	3	0	0
	average	88	62	26				
Naima	Total	500	295	205	41	5	0	0
	average	100	59	41				
Buren	Total	8715	6356	2359	26.95	62	9	5
	average	115	84	31				
Munda	Total	2200	1765	435	20	13	3	4
	average	110	88	22				
Paradiso	Total	200	150	50	25	2	0	0
	average	100	75	25				
Rivera	Total	775	633	142	18.91	5	1	1
	average	111	90	21				
safranha	Total	700	503	197	28.20	5	1	0
	average	117	84	33				
Ghalia	Total	250	200	50	20	1	0	1
	average	125	100	25				
gazelle	Total	175	170	5	3.40	1	1	0
	average	88	85	3				
Everest	Total	350	243	107	30.76	3	0	0
	average	117	81	36				
red	Total	240	248	-8	-3.75	2	1	0
radlove	average	80	83	-3				

Source: The researcher based on the data of the questionnaire and the results of the Deap program analysis.

Human labor: Table (6) shows that the number of farms that work with a number of workers is more than optimal (10, 5, 5, 0, 1, 39, 9, 1, 1, 4, 2, 1, 0, 0) for items (Arizona, Alibada, Senergy, Fuji, Naima, Burin, Munda, Paradiso, Rivera, Saffrana, Ghalia, Ghazal, Everest and Red Rose) in order, while the number of farms operating with fewer than optimal workers was (0, 0, 2, 0, 0, 8, 5, 0, 2, 1, 0, 1, 1, 1) and in the same order of items, while the number of farms operating with the optimal number of workers for the aforementioned items reached (8, 4, 18, 3, 4, 29, 6, 1, 4, 1, 0, 0, 2, 2), that the farmers who had a waste in the use of human labor must reduce its use to reach the optimal use, while the farmers who had a deficit in the use of this resource must increase Use it to achieve economic efficiency.

Table 6: the amount of surplus and deficit in the use of the human labor component

Type		Human labor used virtually (man)	Human labor efficiency checker (man)	Amount overflow or incapacity (man)	rate overflow or deficit%	Number farmer same overflow	Number farmer Same Disability	Number farmer related use optimum
Arizon a	Total	288	270	18	6.25	10	0	8
	average	16	15	1				
Alibad a	Total	148	136	12	6.25	5	0	4
	average	16	15	1				
Snrgy	Total	394	382	12	6.25	5	2	18
	average	16	15	1				
Fuji	Total	47	47	0	0	0	0	3
	average	16	16	0				
Naima	Total	79	78	1	0	1	0	4
	average	16	16	0				
Buren	Total	1337	1287	50	5.55	39	8	29
	average	18	17	1				
Munda	Total	345	349	-4	5.55	9	5	6
	average	18	17	1				
Paradis o	Total	34	32	2	5.88	1	0	1
	average	17	16	1				
Rivera	Total	119	121	-2	0	1	2	4
	average	17	17	0				
safranh a	Total	106	104	2	5.55	4	1	1
	average	18	17	1				
Ghalia	Total	35	32	3	11.11	2	0	0
	average	18	16	2				
gazelle	Total	34	33	1	5.88	1	1	0
	average	17	16	1				
Everes t	Total	50	51	-1	0	0	1	2
	average	17	17	0				
red radlov e	Total	49	52	-3	-6.25	0	1	2
	average	16	17	-1				

Source: The researcher based on the data of the questionnaire and the results of the analysis of the Deap program.

Mechanical work: Table (7) shows that the number of farms that work with mechanical hours is more than optimal (6, 2, 5, 1, 1, 45, 7, 0, 3, 0, 2, 0, 1, 2). for cultivars (Arizona, Alibada, Senergy, Fuji, Naima, Burin, Monda, Paradiso, Rivera, Saffrana, Ghalia, Gazelle, Everest and Red Rose) in order, while the number of farms that operate with mechanical hours less than the optimum (4, 2, 10, 2, 4, 20, 4, 2, 3, 5, 0, 1, 1,1) and in the same order as the varieties, while the number of farms operating with an optimal number of mechanical hours for the aforementioned items was (8, 5, 10, 0, 0, 11, 9, 0, 1, 1, 0, 1, 1, 0), that the farmers who had a waste in the use of mechanical work should reduce its use to reach the optimal use, while the farmers who had a deficit in the use of this resource They should increase its use for efficiency.

Table 7: the amount of surplus and deficit in the use of mechanical work

Type		Machine work actually used (hours)	Machine work efficiency checker (hour)	Amount overflow or incapacit y (hour)	rate overflow or deficit%	Number farmer same overflow	Number farmer Same Disability	Number farmer related use optimu m
Arizona	Total	38	35.62	2.38				
	average	2.11	1.97	0.14	6.63	6	4	8
Alibada	Total	17.5	17.87	-0.37				
	average	1.94	1.98	-0.04	-2.06	2	2	5
Snrgy	Total	49.5	52.75	-3.25				
	average	1.98	2.11	-0.13	-6.56	5	10	10
Fuji	Total	6	6.75	-0.75				
	average	2	2.25	-0.25	-12.5	1	2	0
Naima	Total	9.5	11.25	-1.75				
	average	1.9	2.25	-0.35	-18.42	1	4	0
Buren	Total	209	188.72	20.28				
	average	2.75	2.48	0.27	9.81	45	20	11
Munda	Total	54.5	51.35	3.15				
	average	2.72	2.56	0.16	5.88	7	4	9
Paradis o	Total	3	4.5	-1.5				
	average	1.5	2.25	-0.75	-50	0	2	0
Rivera	Total	17.5	17.62	-0.12				
	average	2.5	2.51	-0.01	-0.4	3	3	1
safranha	Total	13.5	16.34	-2.84				
	average	2.25	2.72	-0.47	-20.88	0	5	1
Ghalia	Total	5.5	4	1.5				
	average	2.75	2	0.75	27.27	2	0	0
gazelle	Total	4.5	4.9	-0.4				
	average	2.25	2.45	-0.2	-8.88	0	1	1
Everest	Total	8	7.49	0.51				
	average	2.66	2.49	0.17	6.39	1	1	1
red	Total	9	7.62	1.38				
radlove	average	3	2.54	0.46	15.33	2	1	0

Source: The researcher based on the data of the questionnaire and the results of the Deap program analysis.

CONCLUSION

The research hypothesis was achieved through the following conclusions: according to the results of the technical efficiency, According to the stability of the capacity returns, The Redlove variety achieved the highest average efficiency (0.97), while according to the variable capacity returns, The Paradise variety achieved the highest average efficiency (0.98), while the Ghalia variety achieved the highest average efficiency (0.99) according to the capacity efficiency, From it we conclude that the farmers of these varieties have a good experience in growing the crop compared to the rest of the farmers. It was also found that Redlove Red and Fuji cultivars achieved the highest average economic efficiency of (0.91, 0.90) respectively, although they did not achieve the highest average technical efficiency, From it, we conclude that Redlove Red and Fuji varieties are more desired in the local market compared to other varieties, which led to their high economic efficiency. The results of estimating the surplus and deficit in the use of production elements indicate that there is a surplus in the use of production elements, foremost of which is the seed element, From it, we conclude that farmers use the

second or third generation seeds in the fall season, In addition to the fact that the seeds are of rather large sizes compared to the first generation (imported) seeds, And they are working to increase the quantities used of these seeds per dunam to increase productivity.

Recommendations

The research recommends the need to benefit from the experience of potato farmers in cultivating the crop in the study area through dialogue with them and holding awareness seminars, especially for cultivars (Redolph Red, Bradyso and Ghalia). And the need to take the necessary measures by the decision-makers in order to reduce the discrepancy in the prices of the potato varieties produced in order to raise the economic efficiency of the varieties that achieve technical efficiency. In addition to holding guidance seminars for farmers and directing them towards the use of productive elements at the quantities achieved for economic efficiency and their components, and not to overuse the use of these elements.

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