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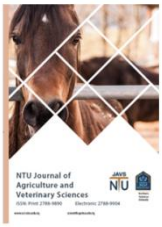

Estimating the optimal quantities of feed profit-maximizing for lambs fattening fields in Nineveh Governorate for the production year 2023 (The Northern Plain as a model)

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A B S T R A C T

The research aims to measure the effectiveness of the technical and cost-effective economic performance of the owners of lamb breeding and fattening fields in Nineveh Governorate for the production year 2023-2024 by measuring the economic efficiency and its components using the data envelopment analysis (DEA) method, and through it measuring and estimating the surplus and deficit in the amount of feed resources consumed, based on the production function represented by the daily weight gain rate and then the total weight gain in those fields. The research results showed that the technical efficiency reached 95%, the allocative efficiency reached about 75%, and the economic efficiency reached 69%, and that there is a waste in the use of resources by 5%, and that there is a surplus in the use of feed resources, which means that there is a waste in the use of feed resources. Hence, we conclude that there is a gap between technical efficiency and allocative efficiency of about 5%, which may be attributed to the high prices of feed resources, which leads to the lack of optimal use of resources and that there is waste in the use of these resources. The research concluded the necessity of setting a pricing policy for all types of feed and setting a price ceiling that serves its profits and provides them between production seasons and neutralizing black market traders in providing it and establishing feed factories for Ruminants

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Introduction

Meat, especially red meat, is one of the main products of the Iraqi consumer basket and represents a large part of its food meals. Iraq has witnessed clear and tangible economic changes represented by the increase in the rates of income available for consumption, the effects of which were reflected in the rise in living standards and the improvement of the consumption pattern of individuals, which required an increase in the food needs of the commodity, which Iraq is characterized by a deficit in its local production. [1] This requires covering it with imports, which burdens the country's general budget with cash resources of hard foreign currency, in addition to the exposure of food security to increasing political pressures that threaten the security and independence of the country. Since the practice of sheep farming and fattening lambs is one of the most important sources of providing red meat, and in order to reach the required production levels, it is necessary to make the best and most optimal use of economic resources to achieve levels of efficiency in use. Therefore, it has become necessary to study this important activity and identify the levels of technical efficiency as the most important measure of the efficiency of the performance of production units, from which the optimal volume of production and the optimal quantities of economic resources (fodder) consumed can be estimated. One of the most important studies that addressed this topic:

Researcher [2], conducted a research entitled (Productive efficiency and determinants of the chickpea crop in Nineveh Governorate for the 2019 production season). The research aimed to estimate the productive efficiency and optimal economic determinants of chickpea crop farms using the d eap program. The results of the analysis showed that the average productive efficiency reached 74% and the minimum was 54%. The maximum limit is 100%, and the farms that achieved 100% efficiency amounted to 15% of the farms out of the total research sample. It was found that there was a gap between the economic resources used and the resources achieved for economic efficiency, and that there was a waste in the use of resources, which affected the optimal use of production

[3] also conducted a research entitled (Economic Analysis of Grape Production Farms in Salah al-Din Governorate for the 2019 Production Season, Balad District as a Model). The research aimed to study and analyze the production reality of the grape production farms in the research sample. The results reached showed that the area variable had the greatest impact on The optimal production and volume of production was (5.01) tons/dunum in the farms of the research sample, while the production that achieved the highest profitability amounted to (96.6) tons/dunum, and that the farmers were close to the economic production area.

[1] Farhan et al., 2023, conducted a research entitled, Estimation of the Optimal Resource Mix for Breeding and Fattening Calves in the Northern Plain-Nineveh Governorate for the year 2021. The research aimed to measure the technical, allocative and economic efficiency of calf breeding and fattening fields, and to determine the amount of resources that achieve economic efficiency for specialized calf breeding and fattening fields, and then estimate the surplus and deficit in each of the amount of concentrated, rough and green feed, the value of veterinary medicines and the number of human workers for one season. Technical efficiency according to the production function, as the technical efficiency of the research sample fields reached an average of 90% according to the cost function, and the surplus percentage reached 47.8%, 3.77%, 16.14%, 3.03%, 55.64% and 61.05%, and in economic resources, the amount of concentrated, rough and green feed, the value of veterinary medicines and the number of human workers for one season

.**Research problem:-**

Sheep breeders, like other livestock breeders, often lack the optimal use of economic resources (scarce) due to the possibility of deviation from the optimal level of use, which results in waste and an increase in unwanted use, and thus an increase in costs at the expense of profitability, which requires conducting many studies, whether at the level of the general agricultural sector or production units (field.

Importance of the research:

The animal activity in Iraq is characterized by the inadequacy of its products to meet local demand, especially red meat. This is due to many reasons that require agricultural economic policy makers (production) to develop plans to develop production. The area under study contains a good number of lamb breeding and fattening projects that contribute to increasing production, and studying its economic reality to identify the positives and negatives in order to determine the factors that affect the lamb fattening process in the northern plain region and thus increase its production of red meat on the one hand, and improve the economic situation of breeders on the other hand, followed by their interest in this important economic product

Research hypothesis:

The research assumes that economic efficiency is affected by a gap reinforced by waste in economic resources and an increase in production costs at the field level.

Research objective:

The research aims to measure the effectiveness of the technical and cost-effective economic performance of the owners of lamb breeding and fattening fields in Nineveh Governorate for the production year 2023-2024 by measuring the economic efficiency and its components using the data envelope analysis method DEA and through it measuring and estimating the surplus and deficit in

the amount of feed resources consumed, based on the production function represented by the daily weight gain rate and then the total weight gain in those fields.

Research Methodology:
The research relied on the descriptive economic approach and the quantitative statistical economic approach to achieve its objectives by using data envelope analysis to evaluate the results obtained from thedata.

Data sources:
The primary basic data were obtained from the questionnaire form designed by the researcher and in line with the clear questions and inquiries of the periodic personal field interviews for a sample of (15) lamb breeding and fattening field owners, constituting (25%) of the research community of about (60) breeders in the Gogjali area of Nineveh Governorate for the production year 2023-2024. Secondary data were relied upon from reports issued by the Iraqi Ministry of Agriculture and the Nineveh Agriculture Directorate, in addition to other official reports, theses, dissertations, research, and Arabic and foreign books related to the research topic.

The concept of efficiency:
Efficiency in its general concept is defined as achieving the highest level of production at a given level of technology and specific resources. [4]. However, on the basis of the agricultural unit, it is the farmer's ability and skill to maximize production with quantities of scarce inputs within a specific technology, or the farmer's ability to achieve a specific level of production by reducing the amount of use of available and specific inputs[5]. Farm efficiency and the methods and ways to measure it are an important goal of agricultural development and food security for any country. Efficiency analysis can be used to determine general interventions to improve agricultural productivity and farm income [6]. Efficiency is a relative term whose value is between zero and one. It must be understood that there is no absolute efficiency, but rather it is always relative. The criterion of economic efficiency is value, and any change that leads to a decrease in value is an inefficient change. Many economic studies have been based on Pareto optimization[7]. Optimization requires many conditions, including reciprocal efficiency, which includes the impossibility of redistributing a combination of goods. And services to increase the benefit of an individual without reducing the benefit of others[8], including productive efficiency that is achieved when the elements of production cannot be distributed in any way that leads to increasing the outputs of a product without reducing the outputs of another product [9], also from the conditions of Pareto optimality are what are called the peak conditions, which require achieving exchange and production efficiency immediately as well as determining prices in a competitive market and the ratio equals the price ratio of any two goods with their marginal substitution rates when the economy is on the curve of optimal production possibilities. Whereas the concept of economic efficiency embodies technical and distributive efficiency that achieves the sustainability of economic resources by ensuring the optimal use[10] of economic resources to achieve maximum profits and to know the obstacles that cause a decrease in the level of economic efficiency, including the lack of sufficient knowledge about the technical and specialized relationships between production resources among the owners of production units, and the small amount of financing necessary for agricultural production projects (animal - plant)[11], and efficiency is defined as the technical process between inputs and outputs during a specific period of time, it is efficient when the output increases by a greater percentage than the increase in inputs or obtaining the same level of output by reducing the cost of inputs relative to the value of production[12]. Components of economic efficiency according to the concept[13] are divided into technical efficiency, which has been used by most agricultural studies[14] While[15] divided efficiency into three basic rules, which are specialized efficiency (AE), technical efficiency (TE), and economic efficiency (EE)[16]. Thus, the economic efficiency (EE) of decision-making units became described as the result of two measures, which are technical efficiency (TE) and specialized efficiency (AE), as in the following relationship: EEn = TEn×AEn, which was mentioned by [15]. If EEn = 1, this means that the production unit is economically efficient, and when EEn < 1, the production unit is economically inefficient. As for specialized efficiency, it is a determinant of economic and technical efficiency, as

$$AE_n = \frac{EE_n}{TE_n}$$

Technical efficiency in terms of inputs refers to the ability to reduce the use of physical inputs for a given level of output[17]. Technical efficiency from the point of view of outputs is the ability to obtain the highest amount of production at a certain level of inputs [18]. The value of technical efficiency lies between zero and one. When the value of technical efficiency is equal to one, the farm is technically efficient. When the value of technical efficiency is less than one, the farm is technically inefficient and has two options: either reduce the percentage of inputs that achieve the previous production, or obtain a higher production with the same percentage of previous inputs[19]. As for specialized efficiency, it means choosing the mix of inputs that achieves the specified amount of outputs at the lowest possible cost. The specialized

efficiency coefficient takes a value between zero and one, as is the case with technical efficiency. Specialized efficiency from the point of view of inputs indicates the extent to which it is possible to reduce the quantities of inputs without changing the quantities produced[20] . As for specialized efficiency from the point of view of outputs, it means the extent to which it is possible to increase the outputs without changing the quantities used from inputs [21]. Economic efficiency represents the joint effect of achieving technical efficiency and specialized efficiency[22], therefore, the economically efficient farm in terms of outputs is the farm that has the ability to increase production quantities using a certain level of inputs and technology, while the efficient farm in terms of inputs is the farm that has the ability to reduce inputs and obtain the same specified production[23] , and God willing, we will address in our research the economic criteria for technical efficiency using the data envelopment analysis program DEAp and in terms of outputs, assuming a change in returns to scale for lamb fattening fields in Nineveh Governorate for the production season between (2023-2024).

Description of the analysis model:

The description of the data envelopment analysis model DEA can be explained by assuming a change in the returns to production VRS with output orientation as in the following linear programming model:

Min Ø, Λø

St $-\theta qi + y\lambda \geq 0$, $\theta Xi - X\lambda \geq 0$, i= 1, 2…….N

Iiλ= 1 and $\lambda \geq 0$

Where $1 \leq \theta < \infty$, θ represents the relative increase in output that the production unit i can achieve without increasing the quantities of inputs, and Ø/1 represents the technical efficiency rate TE of the production unit and is also the indicator calculated by the DEAP program to evaluate efficiency from the output side. Figure (5) shows the technical framework of DEAP and the concept of efficiency from the output side of the production unit[20], as it represents the outer frame of the linear division of the production possibility curve. Figure (1) also shows that points P and Q are inefficient while point A is technically efficient, and although the proposed point P lies on the technical efficiency curve, it is possible to increase the production of commodity q1 by the amount AP without increasing the use of inputs, so the output q1 is a lagging output. Since the usage guidance models and the output guidance models work to estimate the same technical limits, we find that there is no disagreement between the two in determining the fully efficient production unit, but the difference between the two points is in calculating the efficiency index for the technically inefficient production unit, in the event that economies of scale are not stable[15] .

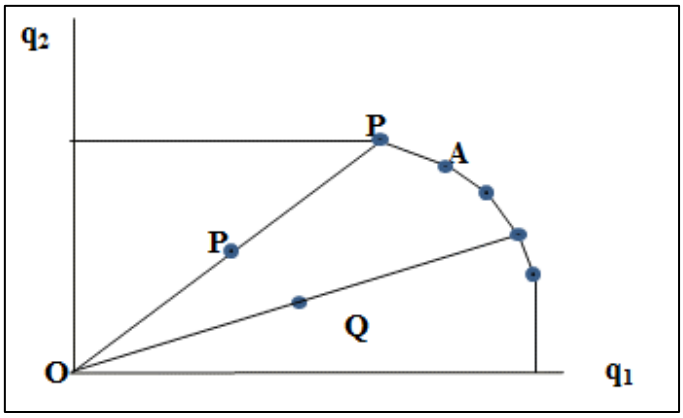

Figure 1. Technical efficiency model for variable returns to scale with output orientation using the DEA method

Source:[15] and [14]

Results and discussion:-

First: The technical efficiency values were estimated and measured from collecting and tabulating field data and analyzing them using the statistical method of the data envelopment analysis program DEAP and according to the explanatory variables of the production function and from the input side and under the assumption of changing returns to volume VRS sometimes, and other times under the stability of returns to volume CRS for a sample of lamb fattening fields in the northern plain - Nineveh Governorate for the production season between 2023 - 2024 AD as follows:

Table (1) shows the results of estimating the technical efficiency of lamb fattening fields in the research sample according to the variables of the production function and assuming a change in returns to volume (VRS) and adopting the data envelope analysis method . By reviewing the results of the data analysis, the estimates of the technical efficiency values in Table (1) came with a kind of economic optimism, which reached a peak of 100%, i.e. complete technical efficiency

(optimal) in (17) production fields, to constitute (68%) of the total studied sample fields, which amounted to (25) production fields, indicating that (68%) of the owners of the research sample fields work on the optimal production potential curve, and that they are distinguished by their experience and good administrative skill in choosing the optimal resource combinations in the actual production process. As for the remaining fields, estimated at (8) fields only, they constitute (32%) of the total sample fields, which deviate, decrease and move away from the optimal production levels on the production potential curve in a varying manner and according to the estimated technical efficiency values for them, which ranged between the lowest value of about (0.714) in field (23), which indicates that its actual or real production decreases and deviates on average by about (0.286%) of the optimal or efficient production and that from the technical point of view it bears a waste in the use of economic resources by an amount of (0.286%) compared to technically efficient fields, and that the owner of field (23) has the ability to obtain the same level of production by reducing the level of economic resources by an amount of (0.286%) without reducing the level of its actual production, or increasing its actual production level by an amount of (0.286%) without increasing the level of economic resources used in the production process, and as a maximum value it reached about (0.980) in field (16), which indicates that its actual or real production decreases and deviates on average by about (0.020%) from the optimal or efficient production and that from the technical point of view it bears a waste in the use of economic resources by an amount of (0.020%) compared to technically efficient fields, and that the owner of field (16) has the ability to obtain the same level of production by reducing the level of economic resources by an amount of (0.020%) without reducing its actual production level, or increasing its actual production level by an amount of (0.020%) without increasing the level of The economic resources used in the production process, i.e. the ability of the owners of these fields to achieve a higher production level with the same amount of inputs used, or to obtain the same production level by reducing the amount of inputs used. The average technical efficiency of the total sample fields was about (0.953), from which we can infer the ability and potential of the lamb breeders in the research sample to achieve the same level of actual production by reducing the percentage of resources used by about (0.47%) or by increasing the current real production level by about (0.47%) with the same amount and level of inputs used, and reaching the point of achieving the optimal technical efficiency. By reviewing the results and data of Table (1), it is clear that there is a clear difference and variation in the average levels of technical efficiency TE and specialized efficiency AE and their product, the total economic efficiency EE. The ratios ranged between a minimum of about (0.096, 0.115, 0.714) respectively and a maximum of one for each of TE, AE and EE (17, 5, 3) fields respectively, and a total economic efficiency for the group of fields, the number of which is (3) fields only, to constitute a percentage of (0.12) of the total lamb fattening fields in the study sample, while the average reached (0.953, 0.723, 0.695) respectively for each of TE, AE and EE for the total fields. The average level of TE for the total fields, which reached about (0.953), indicates that the real production deviates or decreases on average by about (0.47) from the optimal production, and the owners of imported calf fattening fields can increase their production. By (0.47) without increasing the level of economic resources used in the fattening process, or reducing the level of economic resources by (0.47) without reducing the level of production. The average AE for the total fields of about (0.723) reflects the possibility of the owners of fattening fields for imported calves to obtain the same current level of production with a lower level of costs by (0.277) or achieve a higher level of output than the current output using the same current costs (0.277) until reaching the level of optimal specialized efficiency that is achieved when the value of the marginal product of the production elements is equal to their marginal costs, and at the point of equality there is a saving of (0.277) of the total production costs borne by the owners of fattening fields for imported calves in the study sample, and then the selection of the optimal combination of production elements entering into the production process is achieved. While the average total economic efficiency EE for the total fields was about (0.695) to confirm the existence of economic inefficiency of (0.305) and that the owners of lamb fattening fields can achieve the optimal use of economic resources by (0.305) on the current use without increasing the use of these resources, or obtain the same real production by reducing the level of use of these resources by (0.305), and since the full economic efficiency EE is the result of the two measures (AE, TE), therefore the results of the AE, TE levels had a direct impact on the results of the EE levels, and this appeared clearly in the results of Table No. (3) The fields that achieved full specialized efficiency AE are the same fields that achieved full economic efficiency EE and its value reached the correct one and for the group of fields their number was (3) only and in sequence (12, 13, 18) and constituted a percentage of (0.12) of the total group of lamb fattening fields that were able to reach the level of achieving equality between the value of the marginal product and the marginal costs of the elements of production Used in the fattening process, its production is at the point of contact between the isoquant curve and the isocost line.

Table (2) shows that the values of the optimal technical efficiency levels under the assumption of constant returns to scale did not achieve the same economic optimism under the change in returns to

scale in Table (1), as the number of fields achieving full technical efficiency of 100% was only about (9) fields and constituted (36%) of the total fields of the research sample, which indicates that only (36%) of the owners of the fields of the research sample work on the curve of optimal production capabilities, and that (64%) of them deviate and their production levels fall short of the curve of optimal production capabilities and according to the values of technical efficiency for each of them, which amounted to about (0.445) as the lowest value in field (23), and about (0.963) as the highest value in field (16), which means that the actual production is less on average or deviates from the optimal efficient production in both fields by about (0.555) and (0.47) respectively, and each of them can obtain the same real production level by reducing the amount of resources used by about (0.555) and (0.47) respectively, or increasing the current production level by (0.555) and (0.47) respectively with the same amount of resources used during the fattening process under the production conditions of the research sample fields. The average value of technical efficiency for the total sample fields was about (0.881%), which means that the lamb breeders in the research sample can increase their actual production by about (0.119%) without any increase in the amount of resources used in the fattening process, and that the owners of these productive fields lose an amount of (0.119%) of the amount of their economic resources, and that from a cost perspective, they bear additional costs of about (0.119%) for the value of the scarce resources used in the production process if these fields were of optimal technical efficiency, and that the actual or real production deviates on average by about (0.119%) from the efficient production in which the economic resources are used in a technically efficient manner. The decrease in the average levels of technical efficiency is attributed to the production season, temperature fluctuations, the scarcity of basic fodder (barley and wheat) and their replacement with dried silage barley (waste from Turkish breweries) and bran, the scarcity of green fodder and the ineffectiveness of the vaccines used during - the study period. Economic comparison: The results of Table (1) and Table (2) show a clear difference in the values of technical efficiency in them, i.e. between using the method of variable returns to scale (VRS) and constant returns to scale (CRS). The reason is that the agricultural sector is dominated by the seasonality of production as a result of its great impact on fluctuations in uncontrolled weather conditions, with relative instability in the prices of production inputs and thus the instability of the amount of production costs, which makes the operating production units unequal in their efficiency and they cannot all work at the same time at ideal and efficient sizes. Accordingly, the credibility and validity of the results under the assumption of variable returns to scale are closer to reality and more suitable for studies in the field of the agricultural sector than the constant returns to scale widely used in industrial sector research. **Second:** Estimating the optimal amount of productive resources that achieve economic efficiency in the research sample. Based on field data extracted from the contents of the questionnaire form, including the resources and basic variables of the production function (barley, wheat, crushed corn, green fodder, herd size or number of lambs, number of workers) and tabulating and classifying them, then analyzing them using the DEAP program according to the variables of the cost function and under the conditions of variable returns to scale. The amount of resources that achieve economic efficiency was estimated at the lowest cost, and from there the surplus and deficit in the amount and size of resources was calculated through the following equation: Amount and size of surplus or deficit in resources = actual amount of resources used - the amount of optimal resources that achieve efficiency . Ratio of surplus and deficit in resources = surplus or deficit in resources / actual amount of resources * 100 [24]. Below are the results of the optimal size of resources used in the process of fattening lambs in the study sample for the production season between 2023-2024, each on its own.

The data results in Table (3) indicate that the fields (18, 13, 12) that achieved economic efficiency in Table No. (3) are the same fields that achieved the optimal use of the resource combination in an efficient manner, i.e. they are the fields that operate on the curve of optimal production capabilities and in which the actual quantities used from economic resources are equal to the optimal quantities that achieve economic efficiency, and thus the surplus or shortage quantities in them are equal to zero, and the percentage of these fields constituted (12%) of the total sample fields. Field (16) recorded the highest surplus amount in the use of barley resource estimated at about (64366) kilograms, achieving the highest surplus percentage at about (80.94%). This means that the owner of this field can obtain the same amount of production by reducing the amount of barley by (64366) kilograms, or he can increase production by (80.94%) without increasing the amount of barley resource used. While field (25) achieved the lowest surplus amount in barley use estimated at about (231.83) kg of barley, thus achieving the lowest surplus percentage at about (1.66%), which indicates a deviation of field work from the ideal quantities by about (231.83) kg of barley and an estimated percentage of about (1.66%), and the owner of the field can obtain the same amount of production by reducing the amount of the resource by about (231.83) kg, and reducing it by (1.66%) of the actual percentage used from the resource, or increasing production by about (1.66%) with the same actual amount used from the barley resource. When comparing the actual quantities

with the ideal quantities of barley used, it is clear from Table (4) that the number of fields suffering from surplus and waste in the use of the resource amounted to about (21) productive fields, representing (84%) of the total fields of the studied sample.

analysis From the data in Table (4), it is clear that there are four fields that achieve the optimal resource efficiency of wheat, which constitutes (16%) of the total fields of the research sample. This means that (16%) of the owners of lamb fattening fields are proficient in the optimal combination of using the wheat resource with the feed combination, and they do not have any surplus or deficit in using wheat, while field (16) recorded the highest amount of surplus in using wheat with an estimated quantity of about (47899) kilograms of wheat and a surplus percentage of about (82.14%), which indicates the existence of a percentage of (82.14%) surplus in actual field use over optimal use, and the field owner can obtain the same percentage of actual production by reducing the percentage of wheat use by about (82.14%). Or increase the actual production rate with the same quantity and percentage of wheat used. As for field (6), it achieved the lowest amount of surplus with an estimated quantity of about (292) kilograms over the ideal quantity, and with a surplus percentage of about (4.87%), meaning that it is far from the curve of optimal possibilities in using wheat by about (4.87%), and the breeder can obtain the same amount of production by reducing the amount of wheat (292) kilograms, or increasing production and reaching the ideal amount in proportion to the amount of surplus (292) kilograms of wheat. It is also clear from the data in Table (5) that field (9) suffers from a deficit in the use of wheat estimated at about (7008.63) kilograms and a deficit percentage of about (313.17%) over the ideal quantity, which means that the owner of field (9) can increase the actual production amount and reach the ideal production level by increasing the amount of wheat by (7008.63) kilograms and by (313.17%) over the actual quantity while reducing the amount of surplus from other resources entering the production process in proportion to And the wheat quantity deficit.

Table (5) shows that there are (4) fields (18, 13, 12, 7) that reached the point of optimal use of the crushed corn resource in production and constituted (16%) of the total fields of the research sample and that they are the fields in which the quantity and percentage of surplus were equal to the quantity and percentage of deficit, and the owners of those fields have administrative experience in the technical use of lamb fattening feed combinations. Field (23) recorded the highest quantity and percentage of surplus in use estimated at about (5807.89) kilograms and about (72.60%) of the ideal quantity and percentage in using the crushed corn resource, which indicates that the owner of field (23) works under production conditions that deviate from the ideal production with a surplus quantity of (5807.89) and a surplus percentage of about (72.60%) of the resource, which indicates the possibility of the owner of the field to obtain the same amount of actual production by reducing the quantity by (5807.89) kilograms or the percentage by about (72.60%), or increasing production by the same quantity by (5807.89) kilograms or the percentage by about (72.60%) of crushed corn. While field (5) recorded the lowest surplus in quantity and percentage of use, estimated at about (234.84) kilograms and a percentage of (6.35%) of the ideal quantity and percentage in using the crushed corn resource. This means that the work of the owner of the field deviates On average, the optimal production potential curve is estimated at an estimated quantity of about (234.84) kilograms and a percentage of (6.35%), meaning that he can obtain the same quantity and percentage of actual production by reducing the quantity or percentage of crushed corn by about (234.84) kilograms and a percentage of (6.35%), or increase the actual production and reach the optimal quantity and level of production with the same quantity and percentage of actual real use of crushed corn. As shown in Table (5), there are (7) fields operating under production conditions characterized by a deficit in the quantity and percentage of use of the crushed corn resource, which means that there are two options for the owners of the fields above: either obtaining the same quantity and level of actual production by increasing the quantity and percentage of crushed corn, or increasing the actual production and reaching the optimal or efficient quantity and level of production by increasing the quantity and percentage of actual real use of crushed corn and in proportion to reducing the quantity and percentage of surplus from other resources, and each field according to the amount and percentage of the deficit and surplus from corn and other resources involved in the fattening process. The reasons for the deficit in the use of crushed corn resources are likely to be: the limited and lack of experience of breeders with the nutritional importance of corn as a feed rich in proteins necessary for fattening lambs, the small quantities available in local markets, and the yellow color rash that is not palatable to the Iraqi consumer when used, making its use limited and dispensing with it easy. By reviewing Table (6), it becomes clear that there are (4) fields (18, 13, 12, 7) that achieve full economic efficiency and operate under conditions of using and employing the optimal size of the resource, and that they are the productive fields operating on the curve of optimal production potential, and they do not have a surplus or deficit (quantity and percentage of surplus = quantity and percentage of deficit) in using the green fodder resource. It is clear that field (17) has the highest quantity and percentage of surplus estimated at about (4133.6) kilograms and a percentage of (76.55%) of the green fodder resource, which

indicates that this field can obtain the same quantity and percentage of production by reducing the quantity and percentage of use by about (4133.6) kilograms and a percentage of (76.55%), or increasing production by the same quantity by (4133.6) kilograms or a percentage of about (76.55%) of the green fodder resource, while field (24) recorded the lowest surplus in the quantity and percentage of use, estimated at about (293.31) kilograms and a percentage of (10.48%) of the ideal quantity and percentage of use of the green fodder resource. This means that the work of the field owner deviates on average from the trend of optimal production capabilities by an estimated quantity of about (293.31) kilograms and a percentage of (10.48%), i.e. he can obtain the same quantity and percentage of actual production by reducing the quantity or The percentage of green fodder is about (293.31) kilograms and a percentage of (10.48%), or increasing the actual production and reaching the optimal production quantity and level with the same actual real use quantity and percentage of green fodder.

Reviewing the results, it is clear from Table (6) that there are (5) fields operating under production conditions characterized by a deficit in the quantity and percentage of use of the green fodder resource, which means that there are two production paths before the owners of the five fields: either obtaining the same quantity and level of actual production by increasing the quantity and percentage of green fodder, or increasing the actual production and reaching the optimal or efficient production quantity and level by increasing the quantity and percentage of actual use of green fodder and in proportion to reducing the quantity and percentage of the surplus of other resources, and each field according to the amount of the quantity and percentage of the deficit and surplus of green fodder and other resources involved in the fattening process. The reasons for the deficit in the use of green fodder resources are likely due to the scarcity of green fodder and its high prices compared to the availability and prices of other fodders, and the use of green fodder in some seasons causes intestinal problems and excessive diarrhea in lambs, and this is what happened during the study period in the research sample From.

the data in Table (7), it is clear that there are (4) four fields represented by fields (18, 13, 12, 7) that achieve the optimal resource efficiency for the herd size (number of lambs) and constitute (16%) of the total research sample fields. This means that (16%) of the owners of lamb fattening fields are good at the optimal combination in choosing the herd size in a manner that is consistent with the production conditions. These do not have any surplus or deficit in using the number of lambs, while field (23) recorded the highest amount of surplus in the number of lambs estimated at about (332) lambs and a surplus percentage of about (67.74%), which indicates the presence of a (67.74%) surplus in the actual field use over the optimal use. The field owner can obtain the same actual production percentage by reducing the number of lambs by about (332) lambs, since the actual number reached about (490) lambs, while the ideal number recorded about (158) lambs, or increasing the actual production percentage by the same The number and percentage of free-range lambs entering the fattening process was about (332) lambs, representing (67.74%) of the actual number. As for field (16), it achieved the lowest amount of surplus with an estimated quantity of about (3) lambs approximately from the ideal number, and a surplus percentage of about (0.41%), meaning that it is far from the curve of the optimal production potential in using the herd size by about (0.41%), and the breeder can obtain the same amount of production by reducing the numbers by about (3) lambs, or increasing production and reaching the level of work that falls on the curve of the ideal quantity in proportion to the amount of surplus that does not exceed (3) lambs. It is worth noting that there are (15) fields operating under production conditions characterized by a deficit in the number of lambs estimated at different deficit values according to the production conditions of each field, and they constitute (60%) of the total number of fields in the research sample, which means that the owners of the (15) fields can obtain the same quantity and level of actual production by increasing the quantity and percentage of the herd size, or increasing the actual production and reaching the optimal or efficient quantity and level of production by increasing the quantity and percentage of actual actual use of the herd size and in proportion to reducing the quantity and percentage of the surplus of other resources, and each field according to the amount of the quantity and percentage of the deficit and surplus it has from the number of lambs and other resources involved in the fattening process. The reasons for the deficit in the number of lambs are attributed to the high prices of free-range lambs, the high costs of production, the high percentage of risk and uncertainty, the difficulty of determining the ceiling of expectations for future profits, and consequently the weak size of financial investments and the small amount of capital employed in this sector by the private sector, the sole financier of these fields. The production units (fields) are forced to work with a herd size less than the required size that achieves efficiency and less than the actual field capacity of the field owner.

From the results of data analysis and when comparing the actual quantities with the optimal quantities of labor used, it is clear from Table (8) that the number of fields suffering from surplus and waste in the use of the resource amounted to about (12) productive fields, representing (48%) of the total fields of the studied sample, while the number of fields suffering from deficit and deficiency in the use of the resource amounted to about (9) productive fields, representing (36%) of the total

fields of the studied sample, while the fields (18, 13, 12, 7) that achieved economic efficiency are the same fields in Tables No. (8, 7, 6, 5, 4, 3) and they are the same fields that achieved the optimal use of the resource combination in an efficient manner, i.e. they are the fields that operate on the curve of optimal production capabilities and in which the actual quantities used from economic resources are equal to the optimal quantities that achieve economic efficiency, and thus the surplus or deficiency quantities in them are equal to zero, and the percentage of these fields constituted (16%) of the total fields of the sample. Field (4) recorded the highest surplus in the use of the number of workers estimated at approximately (260), achieving the highest surplus percentage of approximately (34.65%). This means that the owner of this field can obtain the same amount of production by reducing the number of workers by (260) workers, or he can increase production by (34.65%) without increasing the number of workers used. While field (19) achieved the lowest amount of surplus in the use of labor by approximately (19) workers, achieving the lowest surplus percentage of approximately (2.94%), which indicates that the field's work deviated from the optimal quantities by approximately (19) workers and by an estimated percentage of approximately (2.94%). The owner of the field can obtain the same amount of production by reducing the quantity of the resource by approximately (19) workers, and reducing it by (2.94%) from the actual percentage used from the resource, or increasing production by approximately (2.94%) with the same actual quantity used from the labor resource. By reviewing the results, it is clear from Table (8) that there are (9) fields operating under production conditions characterized by a deficit in the quantity and percentage of use of the labor resource, which means that there are two production paths before the owners of the nine fields: either obtaining the same quantity and level of real production by increasing the quantity and percentage of labor, or increasing the actual production and reaching the optimal or efficient quantity and level of production by increasing the quantity and percentage of actual real use of labor and in proportion to reducing the quantity and percentage of surplus from other resources, and each field according to the amount of quantity and percentage of deficit and surplus from labor and other resources involved in the fattening process. The percentage of surplus and deficit in the number of workers is attributed to the size of the breeder's family, the number of male and female workers in the field, and the extent of the breeder's conviction in determining the field's needs for labor and the social, living, functional and seasonal conditions that the breeder experiences during the period of fattening the lambs in the research sample.

Conclusions:

1- Feed [wheat, barley, fodder corn, bran, roughage (straw), green fodder] and its fluctuation between production seasons, and the control of black market traders in providing it and setting a ceiling for its prices in a way that serves their profits. The number of feed factories for ruminants and their scarcity, which does not exceed (9) specific factories in all of Nineveh Governorate[25] .

2- The high costs of treatments, vaccines and veterinary medicines due to the ineffectiveness of the medicines and the lack of quality control over them at border crossings and their import under an illegal cover and at profitable prices determined by traders regardless of local demand, especially during epidemic times, in a manner commensurate with the seriousness of the sudden and chronic epidemic diseases attacking various production seasons and the lack of local production of veterinary medicines and animal vaccines, which paved the way for drug traders to exploit the local market and import from sources that are not reliable in their effectiveness and may not be licensed by the government or legally.

Most of the breeders in the fields and projects of raising and fattening lambs in the northern plain of Nineveh Governorate use large quantities of treatments that may reach four treatment cycles during one production cycle, causing an increase in the level of production costs.

3- The decrease in the number of farmers practicing the profession of raising and fattening lambs, after the number of breeders in the nineties of the last century was about (3000) breeders specialized in raising and fattening lambs in the village of Kokjali - Mosul District, decreased to reach about (60) lamb fattening fields during the study period.

4-High costs of marketing lambs, as the average internal transportation costs are about (17-20) thousand/lamb to enter the field for fattening and about (15-17) thousand/fattened lamb to market them to the rest of the governorates

5-The dominance of the traditional feeding system and the difficulty of breeders responding to modern feeding systems in using technical feeds containing proteins and substances that stimulate muscle cell growth. In addition to the small area of land allocated for natural pastures in the research area. And the breeder's inability to artificially control weather fluctuations and high temperatures in summer and cold in winter by providing cooling in summer and heating in winter had a negative impact on increasing the consumption of the

resources used. And the scarcity of guidance awareness, agricultural seminars and scientific research in the research area.

6- Random import of free lambs (not fattened) and fattened lambs without health control increased its negative impact on breeders' profits and their reluctance to practice the profession

Recommendations:

1- Establish a pricing policy for all types of feed and set a price ceiling to serve their profits and provide them between production seasons, neutralize black market traders in providing them, and establish feed factories for ruminants.

2- Support and provide treatments, vaccines and veterinary medicines with high therapeutic efficacy and establish quality control over them at border crossings and import them from reliable sources with their effectiveness and legal cover and at profitable prices in line with local demand during epidemic times during the attack of sudden and chronic epidemic diseases in various production seasons.

3- Encourage breeders who own lamb fattening fields to use modern feeding systems in using feed rich in proteins and materials that stimulate muscle cell growth.

4- Increase the area of land for natural pastures in the research area and the country in general.

5- Following a feasible economic policy in the import process, especially fattened lambs or their fresh meat, with strict health control to encourage local production and producers to practice the profession.

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Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publishing of this article.

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Table 1. Results of estimating technical, allocative and economic efficiency assuming a change in returns to Scale(VRS)

The farm	TE%	AE%	EE%	The farm	TE%	AE%	EE%
1	1.000	0.791	0.791	14	0.860	0.663	0.570
2	1.000	0.756	0.756	15	0.908	0.895	0.812
3	1.000	0.518	0.518	16	0.980	0.319	0.313
4	0.816	0.712	0.581	17	0.795	0.681	0.542
5	0.834	0.115	0.096	18	1.000	1.000	1.000
6	1.000	0.260	0.260	19	0.924	0.784	0.725
7	1.000	1.000	1.000	20	1.000	0.738	0.738
8	1.000	0.754	0.754	21	1.000	0.764	0.764
9	1.000	0.893	0.893	22	1.000	0.855	0.855
10	1.000	1.000	0.713	23	0.714	0.623	0.445
11	1.000	0.531	0.531	24	1.000	0.793	0.793
12	1.000	1.000	1.000	25	1.000	0.913	0.913
13	1.000	1.000	1.000	Average	0.953	0.723	0.695
				Maximum	1.000	1.000	1.000
				Minimum	0.714	0.115	0.096

Source: Prepared by the researcher based on the questionnaire form and the results of the DEA program analysis

Table 2. Results of estimating technical efficiency (Scale) assuming constant and variable returns to scale

The farm	TE% in case of CRS	TE% in case of VRS	SE% Scale efficiency	Scale yield	**The farm**	TE% in case of CRS	TE% in case of VRS	SE% Scale efficiency	Scale yield
1	1.000	1.000	1.000	--	14	0.757	0.860	0.844	irs
2	0.891	1.000	0.819	irs	15	0.905	0.908	0.997	irs
3	0.906	1.000	0.906	irs	16	0.963	0.980	0.983	drs
4	0.772	0.816	0.947	irs	17	0.794	0.795	0.999	drs
5	0.833	0.834	0.998	irs	18	1.000	1.000	1.000	--
6	0.850	1.000	0.850	irs	19	0.864	0.924	0.936	irs
7	1.000	1.000	1.000	--	20	0.906	1.000	0.906	irs
8	1.000	1.000	1.000	--	21	0.690	1.000	0.690	irs
9	1.000	1.000	1.000	--	22	1.000	1.000	1.000	--
10	1.000	1.000	1.000	--	23	0.445	0.714	0.624	irs
11	0.859	1.000	0.859	drs	24	0.872	1.000	0.872	irs
12	1.000	1.000	1.000	--	25	1.000	1.000	1.000	--
13	0.794	1.000	0.794	irs	Average	0.881	0.953	0.922	
					Maximum	1.000	1.000	1.000	
					Minimum	0.445	0.714	0.624	

Source: Prepared by the researcher based on the questionnaire form and the results of the DEA program analysis

Table 3. Actual, Optimal, surplus and deficit barley quantity for the research sample farms

The farm	X_1 barley				The farm	X_1 barley			
	Actual quantity	Optimal quantity	surplus or deficit	Surplus or deficit %		Actual quantity	Optimal quantity	surplus or deficit	Surplus or deficit %
1	27900	15780.00	12120.00	43.44	14	33750	14172.05	19577.95	58.01
2	20160	13420.24	6739.76	33.43	15	20500	13909.53	6590.47	32.15
3	15000	13340.48	1659.52	11.06	16	79522	15156.00	64366.00	80.94
4	30000	13950.73	16049.27	53.50	17	50100	15052.00	35048.00	69.96
5	400000	14656.70	385343.30	96.34	18	15000	15000.00	0.00	0.00
6	100000	13281.02	86718.98	86.72	19	18812	14057.35	4754.65	25.27
7	13500	13500.00	0.00	0.00	20	15000	13340.48	1659.52	11.06
8	23500	14677.71	8822.29	37.54	21	17800	13203.83	4596.17	25.82
9	27000	14462.84	12537.16	46.43	22	19850	13768.17	6081.83	30.64
10	30000	14670.09	15329.91	51.10	23	30500	13403.95	17096.06	56.05
11	50300	17340.00	32960.00	65.53	24	18000	13461.12	4538.88	25.22
12	21500	21500.00	0.00	0.00	25	14000	13768.17	231.83	1.66
13	13000	13000.00	0.00	0.00					

Source: Prepared by the researcher based on the questionnaire form and the results of the DEA program analysis

Table 4. Actual, Optimal, surplus and deficit wheat quantity for the research sample farms

The farm	X2 Wheat				The farm	X2 Wheat			
	Actual quantity	Optimal quantity	surplus or deficit	Surplus or deficit %		Actual quantity	Optimal quantity	surplus or deficit	Surplus or deficit %
1	20000	10080.00	9920.00	49.60	14	16500	8568.12	7931.88	48.07
2	7780	6529.42	1250.58	16.07	15	10300	7955.57	2344.43	22.76
3	8000	6058.83	1941.17	24.26	16	58315	10416.00	47899.00	82.14
4	14400	8051.70	6348.30	44.09	17	22300	10472.00	11828.00	53.04
5	16824	9698.98	7125.02	42.35	18	10500	10500.00	0.00	0.00
6	6000	5708.01	292.00	4.87	19	16740	8300.49	8439.52	50.42
7	7000	7000.00	0.00	0.00	20	8000	6058.83	1941.17	24.26
8	20100	9747.98	10352.02	51.50	21	9500	5252.60	4247.40	44.71
9	2238	9246.63	-7008.63	-313.17	22	8500	7625.74	874.26	10.29
10	10300	9793.22	506.79	4.92	23	20200	6433.28	13766.72	68.15
11	21100	9240.00	11860.00	56.21	24	8000	6770.61	1229.39	15.37
12	7000	7000.00	0.00	0.00	25	9800	7625.74	2174.26	22.19
13	4050	4050.00	0.00	0.00					

Source: Prepared by the researcher based on the questionnaire form and the results of the DEA program

Table 5. Actual and Optimal crushed corn quantity, surplus and deficit for the research sample farms

The farm	X3 Crushed corn				The farm	X3 Crushed corn			
	Actual quantity	Optimal quantity	surplus or deficit	Surplus or deficit %		Actual quantity	Optimal quantity	surplus or deficit	Surplus or deficit %
1	2000	4032.00	-2032.00	-101.60	14	7500	2851.27	4648.74	61.98
2	3000	2159.52	840.48	28.02	15	2500	2518.74	-18.74	-0.75
3	7247	2319.04	4927.96	68.00	16	2000	3926.40	-1926.40	-96.32
4	4009	2570.92	1438.08	35.87	17	3750	3908.80	-158.80	-4.23
5	3700	3465.16	234.84	6.35	18	3900	3900.00	0.00	0.00
6	4000	2437.97	1562.04	39.05	19	5022	2705.98	2316.02	46.12
7	2000	2000.00	0.00	0.00	20	7247	2319.04	4927.96	68.00
8	2500	3491.76	-991.76	-39.67	21	3000	2592.34	407.66	13.59
9	1500	3219.60	-1719.60	-114.64	22	3500	2339.69	1160.31	33.15
10	2800	3516.32	-716.32	-25.58	23	8000	2192.11	5807.89	72.60
11	8340	4296.00	4044.00	48.49	24	6800	2077.76	4722.24	69.44
12	5000	5000.00	0.00	0.00	25	3000	2339.69	660.31	22.01
13	3000	3000.00	0.00	0.00					

Source: Prepared by the researcher based on the questionnaire form and the results of the DEA

Table 6. Actual, Optimal, surplus and deficit quantities of green fodder for the research sample farms

The farm	X4 green fodder				The farm	X4 green fodder			
	Actual quantity	Optimal quantity	surplus or deficit	Surplus or deficit %		Actual quantity	Optimal quantity	surplus or deficit	Surplus or deficit %
1	1000	2196.00	-1196.00	-119.60	14	3750	1972.75	1777.25	47.39
2	2300	2408.58	-108.58	-4.72	15	2700	2217.77	482.23	17.86
3	30451	2217.15	28233.85	92.72	16	1767	1399.20	367.80	20.81
4	4500	2179.32	2320.68	51.57	17	5400	1266.40	4133.60	76.55
5	5000	1520.41	3479.59	69.59	18	1200	1200.00	0.00	0.00
6	1802	2074.44	-272.44	-15.12	19	1255	2079.81	-824.81	-65.72
7	2600	2600.00	0.00	0.00	20	3045	2217.15	827.85	27.19
8	2365	1500.81	864.19	36.54	21	5000	1889.19	3110.81	62.22
9	5670	1701.35	3968.65	69.99	22	1000	2349.70	-1349.70	-134.97
10	4500	1482.71	3017.29	67.05	23	4000	2369.47	1630.53	40.76
11	9000	4188.00	4812.00	53.47	24	2800	2506.69	293.31	10.48
12	9500	9500.00	0.00	0.00	25	3000	2349.70	650.30	21.68
13	1400	1400.00	0.00	0.00					

Source: Prepared by the researcher based on the questionnaire form and the results of the DEA

Table 7. Number of actual, Optimal, surplus and deficit lambs for the research sample farms

The farm	X5 Number of lambs				The farm	X5 Number of lambs			
	Actual quantity	Optimal quantity	surplus or deficit	Surplus or deficit %		Actual quantity	Optimal quantity	surplus or deficit	Surplus or deficit %
1	300	539.60	-239.60	-79.87	14	500	312.33	187.67	37.53
2	150	158.41	-8.41	-5.60	15	200	252.83	-52.83	-26.41
3	140	156.81	-16.81	-12.01	16	510	507.92	2.08	0.41
4	200	262.17	-62.17	-31.08	17	420	502.64	-82.64	-19.68
5	230	422.19	-192.19	-83.56	18	500	500.00	0.00	0.00
6	150	155.62	-5.62	-3.75	19	300	286.33	13.67	4.56
7	160	160.00	0.00	0.00	20	140	156.81	-16.81	-12.01
8	240	426.95	-186.95	-77.89	21	180	154.08	25.92	14.40
9	200	378.24	-178.24	-89.12	22	157	220.79	-63.79	-40.63
10	185	431.34	-246.34	-133.16	23	490	158.08	331.92	67.74
11	290	618.80	-328.80	-113.38	24	160	159.22	0.78	0.49
12	830	830.00	0.00	0.00	25	200	220.79	-20.79	-10.39
13	150	150.00	0.00	0.00					

Source: Prepared by the researcher based on the questionnaire form and the results of the DEA

Table 8. Actual and Optimal number of workers, surplus and deficit for the research sample farms

The farm	X6 Number of workers				The farm	X6 Number of workers			
	Actual quantity	Optimal quantity	surplus or deficit	Surplus or deficit %		Actual quantity	Optimal quantity	surplus or deficit	Surplus or deficit %
1	450	800.00	-350.00	-77.78	14	500	634.41	-134.41	-26.88
2	600	492.02	107.98	18.00	15	600	581.91	18.09	3.02
3	725	484.04	240.96	33.24	16	990	800.00	190.00	19.19
4	750	490.15	259.86	34.65	17	600	800.00	-200.00	-33.33
5	960	731.34	228.66	23.82	18	800	800.00	0.00	0.00
6	380	478.10	-98.10	-25.82	19	630	611.47	18.53	2.94
7	500	500.00	0.00	0.00	20	725	484.05	240.95	33.23
8	570	735.54	-165.54	-29.04	21	385	470.38	-85.38	-22.18
9	620	692.57	-72.57	-11.70	22	550	553.64	-3.63	-0.66
10	860	739.42	120.58	14.02	23	580	490.40	89.61	15.45
11	900	800.00	100.00	11.11	24	440	496.11	-56.11	-12.75
12	800	800.00	0.00	0.00	25	590	553.64	36.37	6.16
13	450	450.00	0.00	0.00					

Source: Prepared by the researcher based on the questionnaire form and the results of the DEA