Estimating Sustainable Efficiency of Wheat Crop in Baghdad Governorate for the Agricultural Season 2024

تقدير الكفاءة المستدامة لمحصول القمح في محافظة بغداد للموسم الزراعي 2024

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Abstract:
The objective of this study is to assess the sustainability of wheat production in Baghdad governorate and to measure its economic efficiency during the 2023-2024 agricultural seasons. The study sample consisted of 165 farmers in the study governorate. The data envelopment analysis (DEA) method was used and the explanatory variables were area, seed quantity, fertilizer quantity, pesticide quantity, hired labor, and irrigation frequency. The dependent variable was the value of agricultural production of wheat. The result showed that the sustainability efficiency was about (-0.7), indicating that farmers were not actively and efficiently producing , mainly due to resource wastage .On the other hand, the average economic efficiency was 64.12%, indicating that wheat farmers in Baghdad governorate with in the study sample are not achieving full economic efficiency, which is 100%. There are clear variations in the achievement of these levels, and there is a need to change the use of production inputs to improve agricultural efficiency.
Farmers shoulder allocates resources and minimize waste by arriving at the optimal combination that maximizes profits and reduces costs. This can be accomplished by consulting experienced farmers and experts in the field .In addition, it is important to conduct more research on how revenues relate to costs and resource use in order to assess sustainability.
Keywords: increased productivity, optimal use of resources, Agricultural production, Major grains.

المستخلص
يهدف البحث الى تقييم كفاءة الاستدامة لمحصول القمح في محافظة بغداد وايضاً قياس الكفاءة الاقتصادية للموسم الزراعي 2023-2024 ،شملت عينة البحث (165) مزارعاً من المحافظة المدروسة .باستخدام اسلوب تحليل مغلف البيانات DEA، وأن المتغيرات التوضيحية هي (المساحة ، كمية البذور ، كمية الاسمدة ، كمية المبيدات ، العمل المؤجر، عدد الريات) أما المتغير التابع هو قيمة الانتاج الزراعي لمحصول القمح . اوضحت النتائج أن كفاءة الاستدامة بلغت بنحو (-0.7) هذا يدل على أن المزارعين لاتوجد لديهم انتاجية موجبة وجيدة والسبب في ذلك وجود الهدر في استغلال الموارد ، في حين بلغ متوسط الكفاءة الاقتصادية (64.12)% يتضح من ذلك أن مزارعي محصول القمح في محافظة بغداد ولعينة البحث لم يتمكنوا من تحقيق الكفاءة الاقتصادية الكاملة وهي 100% إذ يوجد هنالك تبايناً واضحاً في تحقيق هذه المستويات مما يتطلب ذلك ضرورة إحداث تغيير لاستخدام المدخلات الانتاجية لرفع الكفاءة الزراعي ، يوصي البحث بأنه يجب على المزارعين إعادة توزيع الموارد بشكل يقلل من الهدر وذلك من خلال الوصول إلى التوليفة المثلى التي تعظم الأرباح وتقلل التكاليف ويمكن تحقيق ذلك من خلال الاستعانة بالمزارعين ذوي الخبرة والمختصين في هذا المجال ،والاهتمام بإجراء المزيد من البحوث حول كيفية تباين العائد الى الكلفة واستخدام الموارد لتقييم الاستدامة.
الكلمات المفتاحية : زيادة الإنتاجية، الاستخدام الأمثل للموارد، الإنتاج الزراعي، الحبوب الرئيس

Introduction

Achieving sustainability in wheat cultivation due to increased demand compared to other crops like rice and yellow maize [**Yang& others,2009:539-546**], farmers undertake several reforms and improvements. One of these reforms is the production of new wheat varieties adapted to local farming conditions, increasing crop productivity and resistance to pests and diseases. Additionally, promoting organic wheat farming, which utilizes environmentally-friendly agricultural practices and reduces the use of pesticides and chemical fertilizers can also be enhanced.

Technology plays a role in enhancing the sustainability of wheat crops by increasing efficiency and reducing resource consumption, such as water and pesticides. Consequently, improving water management is carried out through the use of optimized and cost-effective irrigation systems to efficiently direct water to wheat fields [**Barlebo& others ,2007**], However, crop resources are limited because the inputs required for their production are limited, such as fertilizers (organic or inorganic), fuel for machinery, labor, and available land. In order to address the sustainability of crop production, the concept of sustainability has multiple definitions, all of which revolve around ensuring resources for future generations. Many sustainability assessments take into account energy balances and material flows without qualifying to what extent inputs are from renewable or non-renewable resources [**Danish,2003**]. The term sustainability is applied to all aspects of life that need to be preserved and prevented from depletion, such as natural resources [**FAO, 2011**]. From an environmental perspective, this means preserving the ecological systems of lands and biodiversity, increasing productivity, and improving the efficiency of input use [**Rigby,1997:1-9**]. Therefore, sustainable farming systems are those that can be productive while also maintaining their contribution to meeting society's needs in the long term. Such agricultural systems use natural resources efficiently, are competitive in commercial markets, and protect the environment [**Ministry of Planning,2018-2022**]. To address future challenges such as food demand, climate change, and associated desertification and water scarcity, sustainable intensification can be an important option for agriculture in Iraq in general and in Baghdad Province in particular. Sustainable intensification is the more efficient use of natural resources, production inputs, and modern technology to increase production while at the same time reducing negative environmental impacts. In Iraq, agriculture, especially vegetable cultivation, faces several challenges. Vegetable production ranks sixth among Arab countries, and vegetables are an important agricultural activity for many Iraqi farmers. It is the second most important source of income after cereals and plays an important role in achieving food security, especially self-sufficiency in many vegetable crops, whether summer or winter crops.

Vegetables are also a major food source and are essential to a variety of food industries, including tomato paste, jams, pickles, and dried vegetables. Many development plans therefore emphasize the importance of increasing interest in vegetable cultivation and providing the necessary support to increase both the quantity and quality of production and to meet the dietary needs of local communities [**Mwongera&others,2017:151-193**]. 2022 saw a significant decline in the production of several cereal crops, especially wheat. Production in Baghdad governorate in the same year was 59,034 tons, and the area under cultivation also decreased to about 79,277 dun. This decrease resulted in a productivity decline of about 744.7 kg/dunam [**Ministry of Agriculture,2022**]. Meanwhile, in 2021, wheat production was 116,225 tons, cultivated area was about 154,520 dunams, and productivity was about 752.2 kg/dunam [**Ministry of Agriculture,2021**]. This decrease is attributed to the lack of water and high temperatures, which resulted in drought conditions on most of the arable land. Therefore, one of the main challenges to achieve sustainability in all crops, whether cereals or vegetables, is the development of climate change adaptation models through smart farming practices [**Mwongera&others,2017:151-193**]. It is critical to identify the obstacles wheat farmers face in implementing agricultural practices that mitigate the effects of climate change. Given the rapidly increasing pace of climate change, one of the most important strategies to address climate change and achieve sustainable development is the adoption of smart agriculture [**Long&others,2017:5**]. However, given the continuous population growth and the depletion of limited resources, it is not realistic to reduce the negative environmental impacts of agriculture by limiting food production. Therefore, the only viable solution is to reduce the negative impacts of agricultural production by introducing more environmentally friendly production technologies [**Ikerd,2020**],[**Pretty,2008:447-465**].One way to increase sustainability is through eco-efficiency. This concept seeks production solutions that significantly reduce the use of natural resources while maintaining or increasing production levels, meaning producing more with less resources or providing greater value from agricultural products with fewer inputs [**WBCSD,2006:4**]. Sustainable agricultural intensification can provide excellent solutions to increase agricultural productivity, increase farmers' incomes, improve the livelihoods of rural households, and at the same time preserve the natural environment [**Teklewold&otherrs,2020:10**]. Furthermore, increased sustainability can be achieved by replacing agricultural practices that use resources non-sustainably with technologies that use limited resources more sustainably. Thus, policy makers can use sustainability findings to make important decisions by selecting the most appropriate criteria to achieve agricultural goals and achieve sustainability [**Van Passel&others,2007:149-161**].

Research methodology

1-1-1Research Problem:

Farmers in the Iraqi countryside face several problems and obstacles that lead to reduced production of grain crops, especially wheat. The most important of these problems are the high cost of purchasing production inputs and the inefficiency of farmers in the utilization of production resources, which leads to waste and suboptimal utilization. Deteriorating environmental and climatic conditions will adversely affect the future sustainability of wheat cultivation. If environmental and climatic problems intensify and affect the availability of natural resources for the agricultural economy, such as rising temperatures and water shortages, while at the same time reducing the economic efficiency of farmers, this will adversely affect the achievement of sustainability.

1-1-2 Objectives of the Study:

The objectives of the study are to:

1. To assess the sustainability efficiency of wheat production in Baghdad governorate.
2. To measure the economic efficiency of wheat farmers.

1-1-3 Research Hypothesis:

This study assumes that there are a number of obstacles preventing wheat farmers from adopting modern agricultural practices to achieve sustainability of an important and strategic crop.

MATERIALS AND METHODS

The Baghdad governorate was chosen as the study site because of the diversity of agricultural activities in the region, especially in cereal cultivation. The sample size consisted of 165 farm households from various districts, including Al Yusufiya, Al Latifiya, Al Mahmudiya, Al Ridwaniya East, Al Nasr, and Al Salam. A random sample was drawn from each district and the data envelopment analysis (DEA) method was used for analysis. The Cobb-Douglas production function was assumed as the frontier function in this study, with constant yield to scale and variable yield to scale. The greatest advantage of using the frontier method is that production relations are taken into account. This is because the production function estimated using the frontier method reveals the relationship between the amount of production and the resources used, including environmental and social resources [**Steven,2009:3057-3069**].

There are two main theories for estimating frontiers and measuring production. One theory relies on parametric estimation for standard economic models that allow for the existence of random disturbances (stochastic frontiers). The other theory is based on nonparametric estimation using linear programming in the framework of data envelopment analysis (DEA).
The nonparametric theory assumes that all deviations from the frontier are due solely to technical inefficiency (the random variable Ui represents only technical inefficiency). Stochastic frontier theory, on the other hand, takes into account measurement error in the production variable (Vi) and inefficiencies due to weather and pest effects. Stochastic frontier theory establishes a relationship between production and independent variables and uses an error term consisting of both conventional error (with mean and constant variance) and technical inefficiency. The technical efficiency is then estimated through maximization of production possibilities subject to error bounds (Vi-Ui), which allows the function due to the stochastic frontier to be separated from the traditional production function [18]: **Ei=Vi – Ui**
. As it represents.
Measurement error (Vi): represents the error due to variables over which the farm has no control, such as weather.
Technical inefficiency random variable (Ui). This represents a non-negative random variable due to technical inefficiency and is calculated for each farm included in the study or for each year within a given time series.

$$\boldsymbol{yi = f(xi, B)\,\mathbf{exp}(Vi - Ui)} \ldots\ldots\ldots\ldots\ldots\ldots..(\mathbf{1})$$

Where:
yi: represents the production level of product(i).
f(xi,B): represents the appropriate exponential function of the production factor of product(i) with respect to resource(xi), where B is the sequence of unknown parameters that need to be estimated.
Vi: represents the random error of the normal distribution, with zero mean and constant variance.
Ui: Represents the non-negative random variable due to production inefficiency of product (i).
Assuming the previous model with the original production unit, the production efficiency (TEi) of the farmer or producer (i) is defined by the following ratio 2 .

$$\boldsymbol{TEi = y/y^{*}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(\mathbf{2})$$

Where: $y*$ This represents the estimated output, and the following equation takes the form:

$$\boldsymbol{y^{*} = \mathbf{f}(xi, B)\,\mathbf{exp}(Vi)} \ldots\ldots\ldots\ldots\ldots..(\mathbf{3})$$

Substituting equations (1) and (3) into equation
: (2), we obtain the following equation4:

$$\boldsymbol{TEi = \frac{f(xi, B)\,\mathbf{exp}(Vi - Ui)}{f(xi, B)\,\mathbf{exp}(Vi)}} \ldots\ldots\ldots\ldots.(\mathbf{4})$$

From equation (4) we obtain equation (5)

$$\boldsymbol{TEi = f(xi, B) * \frac{\frac{\mathbf{exp}(Vi)}{\mathbf{exp}(Ui)}}{f(xi, B)\,\mathbf{exp}(vi)}} \ldots\ldots\ldots..(\mathbf{5})$$

$$\boldsymbol{TEi = \frac{1}{exp(Ui)}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(\mathbf{6})$$

$$TE = \exp(-Ui) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.(7)$$

Equation (7) gives the value of the efficiency level for the number of farms (i) by computing an estimate of the random variable ui. The error in technical inefficiency can be estimated as the ratio of the expected bounded output to the expected value of output conditional on the value of ui. Efficiency is generally measured by calculating the output relative to the quantity produced. The amount of inputs actually used in the production process usually takes the value of technical efficiency between zero and the correct one, according to Farrell's opinion. For economic efficiency, it is the product of multiplying the technical efficiency by the allocated efficiency.[Ahmed,2023:4].

Sustainable value

Farm sustainability efficiency was also developed by Figge and Hahn**[Figge,2004:173-187]** and van Passel; Parikh also estimates economic efficiency by considering the cost of resources used (c) and determining their minimum (C*) to determine the optimal inputs, which can be expressed mathematically.

$$EE = \frac{C^*}{C} = \frac{E\left(\frac{C_i}{U_i}\right) = 0, Y_i, P_i}{E\left(\frac{C_i}{U_i}, Y_i, P_i\right)} \ldots\ldots\ldots\ldots\ldots(8)$$

$$EE = E[exp\left(\frac{U_i}{e_i}\right) \ldots\ldots\ldots\ldots\ldots(9)$$

Frontier cost efficiency analysis depends on economic efficiency. Therefore, economic efficiency can be calculated as the inverse of marginal cost efficiency, as in Equation (10).

$$EE = \frac{1}{(CE)^*} \ldots\ldots\ldots\ldots\ldots(10)$$

For total production costs, the values represent the production inputs used in the production of crops, and these values can be formulated in equation (11):

$$C = \sum_{I=1}^{n} P_i X_i \ldots\ldots\ldots\ldots\ldots\ldots.(11)$$

Represents the

Xi : Resources used in the production process.

Pi : Supplier's price.

From equations (9) and (11), economic efficiency was calculated as in equation (12).

$$EE = \frac{C^*}{C} = \frac{\sum_{I=1}^{n} P_i X_i^*}{\sum_{I=1}^{n} P_i X_i} \ldots\ldots\ldots\ldots.(12)$$

Thus, economic efficiency represents both the value and price of a resource

Economic efficiency follows equation (13):

$$EE = \frac{X^*}{X} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(13)$$

Thus, in light of the aforementioned equation, the actual economic use of resources follows equation (14):

$$X^{efficent} = X^* = EE * X_i \ldots\ldots\ldots\ldots\ldots\ldots(14)$$

The value of resources used (SV) can be formulated as in Equation 15 according to the approach of Figge and Hahn, van Basel, and it can be formulated according to Equation 15 taking into account the different resources involved in the production process(15):

$$\mathbf{SV} = \frac{1}{N}\sum_{I=1}^{n} r_i X_i \left[\left(\frac{VA}{r_i}\right) - \left(\frac{VA}{r}\right)_{benchmark}\right] \dots\dots\dots..(15)$$

Represents the

VA: farm agricultural production value.

ri: economic, environmental, and social farm resources.

The criterion in equation (15) can be calculated according to equation (16):

$$\left(\frac{VA}{r}\right)_{benchmark} = \frac{VA}{{r_i}^{efficient*}} \dots\dots\dots\dots(16)$$

Therefore, substituting equation (16) into equation (15) yields equation (17), which is the resource value of farm i.

$$\mathbf{SV}_i = \frac{1}{N}\sum_{I=1}^{n} r_i X_i \left[\left(\frac{VA}{r_i}\right) - \left(\frac{VA}{{r_i}^{efficient*}}\right)\right] \dots\dots\dots\dots(17)$$

In this study, economic, social and environmental resources were characterized as agricultural inputs X_i

As for the actual inputs${X_i}^*$ and the value of agricultural production for wheat farms R For the resource efficiency of wheat farmers, Six variables are used and calculated according to equations such as Equation (18):

$$\mathbf{SV}_i = \frac{1}{6}\left[X_{i1} * \left(\frac{R_i}{X_{i1}}\right) - \left(\frac{R_i}{{X_{i1}}^*}\right)\right] + X_{i2} * \left[\left(\frac{R_i}{X_{i2}}\right) - \left(\frac{R_i}{{X_{i2}}^*}\right)\right] + X_{i3} * \left[\left(\frac{R_i}{X_{i3}}\right) - \left(\frac{R_i}{{X_{i3}}^*}\right)\right] + X_{i4} * \left[\left(\frac{R_i}{X_{i4}}\right) - \left(\frac{R_i}{{X_{i4}}^*}\right)\right] + X_{i5} * \left[\left(\frac{R_i}{X_{i5}}\right) - \left(\frac{R_i}{{X_{i5}}^*}\right)\right] + X_{i6} * \left[\left(\frac{R_i}{X_{i6}}\right) - \left(\frac{R_i}{{X_{i6}}^*}\right)\right] \dots\dots\dots\dots\dots\dots..(18)$$

The explanatory variables for resource sustainability efficiency are:

X1=cultivated area/dunam.

X2=amount of seed (kg/dunam.)

X3=amount of fertilizer (kg/dunam).

X4=amount of pesticides (liters/dunam)

X5=Number of workers employed (per day)

X6=Number of irrigations

Dependent variable Y: farm's agricultural output / dinar.

Thus, the value of the farmer's sustainable efficiency is also calculated as in equation (19) in light of the Rtc equation developed by Figge and Hahn:[**Figge,2005:47-58**]

$$\textit{Sustainable Efficiency} = \mathbf{Rtc} = \frac{R_i}{R_i - \mathbf{SV}_i} \dots\dots\dots\dots(19)$$

Thus, if Rtc is 1, the farm is using its resources very efficiently; if Rtc is less than 1, the farm is not using its production resources efficiently.

Results and Discussion:

The first is the socioeconomic characteristics of the study sample.

A. Education Level of the Study Sample Table 1 shows that the majority of the farmers in the study sample had primary education, 42.42% or 70 people. Next, 24.24% had secondary education and 20.61% were literate but had no formal education. The percentages of those with bachelor's degrees and diplomas were low: 3.03% and 0.61%, respectively.

Table 1. Education level of sample farmers in 2022-2023 season

Education level	Number of farmers	Relative importance
Reading and writing	34	20.61
Primary	70	42.42
Meddle	40	24.24
middle school	15	9.09
Bachelor's	5	3.03
Institute	1	0.61
Total	165	100

Source: Prepared by the researchers based on the results of the questionnaire.

B. Age: Table 2 shows that farmers ranged in age from 19 to over 50 years old. The highest age group was between 40 and 49 years old, accounting for about 39.39%. On the other hand, the lowest age group was between 19 and 29 years old, accounting for about 3.30%; farmers over 50 years old accounted for 30.30% of the total.

Table 2. Ages of sample farmers for the 2023-2024 season

Age categories	Number of farmers	Relative importance
19- 29	5	3.03
30- 39	45	27.27
40- 49	65	39.39
50 or more	50	30.30
Total	165	100

Source: Prepared by the researchers based on the results of the questionnaire.

T - Family size: Table 3 shows that the family size of farmers ranged from 4 to 14 or more, with (4-8) being relatively the most important (57.58%), followed by the least important (14 or more) at about (9.09%).

Table 3. Family size of sample farmers for the 2023-2024 season

Categories of individuals	Frequencies	Relative importance
4- 8	95	57.58
9- 13	55	33.33
14or more	15	9.09
Total	165	100

Source: Prepared by the researchers based on the results of the questionnaire.

D - Experience Table 4 shows that the farmers' farming experience ranged from more than 6 years to more than 21 years, with the highest percentage (more than 21 years) accounting for about (60.61%) of the total. The proportion of (6-10) was about (3.64)%.

Table 4. Experience of sample farmers for the 2023-2024 seasons.

Experience	Frequencies	Relative importance
6- 10	6	3.64
11- 15	14	8.48
16-20	45	27.27
21or more	100	60.61
Total	165	100

Source: Prepared by the researchers based on the results of the questionnaire.

C - Sources of Income

Table 5 shows that the main source of income for farmers is from wheat harvest and sale of hay waste, with the relative importance of this source reaching about (93.94)%, while the secondary source of income is non-agricultural income from labor. Non-agricultural income sources accounted for (6.06)%.

Table 5. Sources of Income for sample farmers for the 2023-2024 seasons.

Income	Frequencies	Relative importance
Agricultural income	155	93.94
Non-agricultural income	10	6.06
Total	165	100

Source: Prepared by the researchers based on the results of the questionnaire.

Second, The Economic Efficiency Results for The Wheat Crop:

Table 6 shows the results of the estimation of economic efficiency using the Data Envelopment Analysis (DEA) method. The levels of economic efficiency for the research sample varied, with a maximum of 100% and a minimum of 26%, with an average of approximately 64.12%. The highest relative importance was about 36.36%, where the number of farmers whose economic efficiency ranged from 76% to 85% was 60 farmers. The lowest relative importance was about 4.84% for economic efficiency between 26% and 35%. It is evident that wheat farmers in Baghdad Governorate, Full economic efficiency could not be achieved for the crops under study, which is 100%. Even those who did achieve it represented a small percentage. This indicates a significant variation in achieving these levels, necessitating changes in the use of production inputs to improve agricultural efficiency. Additionally, alternative plans should be developed to enable farmers to optimize resource utilization and minimize losses to approach or achieve acceptable levels of economic efficiency.

Table 6. Estimates (E.E)of economic efficiency of wheat farmers in the 2023-2024 agricultural season

E. E	Number of farm	Percentage
26-35	8	4.84
36-45	11	6.67
46-55	10	6.06
56-65	9	5.45
66-75	40	24.24

76-85	60	36.36
86-95	15	9.09
100	12	7.27
Sum	**165**	**100**
Mean	64.12	
Max	100	
Min	26	

Source: Prepared by researchers based on the results output DEP.

Thirdly: Resource Efficiency for Wheat Farmers (SV):

The data was analyzed using sustainability value and resource efficiency was determined using economic efficiency criteria.

The results of the economic efficiency analysis were used to determine the actual and optimal use of resources. Table 7 shows the actual use and the amount of economic efficiency achieved. The actual use of resources was greater than the amount achieved by economic efficiency. Thus, an efficient farm can either maintain or increase production using the same amount of resources.

Table 7: Actual efficiency and amount of efficiency achieved by sample farmers

Productive resources	Actual (r_i^{actual})	Efficiency $r_i^{efficient}$
X1=cultivated area/dunam.	1200	859
X2=amount of seed (kg/dunam.)	50	30
X3=amount of fertilizer (kg/dunam).	200	150
X4=amount of pesticides (liters/dunam)	15	5
X5=Number of workers employed (per day)	150	100
X6=Number of irrigations	30	24

Source: Prepared by researchers based on the results output DEP

The value of agricultural production amounted to (1604822700) million dinars. Using Equation 17, Actual resources are used to measure and calculate the resource efficiency value (SV) in Equations 17 and 18, as it amounted to approximately (3881857682), and thus the resource sustainability efficiency can be calculated as in Equation 19. Also, the resource sustainability efficiency (SE or (Rtc) for wheat crop farms is about (- 0.7) which is negative and less than the correct one. Therefore, sustainability efficiency indicates the weak efficiency of farmers in using productive resources and thus the lack of improvement in the productivity level of the wheat crop.

Conclusions:

- A good and efficient tool for assessing farmers' efficiency and improving the sustainable use of limited inputs while enhancing agricultural output value is sustainability efficiency.
- Efforts to enhance sustainability for limited resources are crucial to enable farmers to achieve better outcomes, leading to increased income and improved livelihoods for farming families.

- Various internal and external factors influence optimal resource use, leading to economic efficiency, as revealed by the research based on direct information from farmers. These factors include collaboration with research centers and water scarcity, among others.
- Delayed marketing negatively impacts the quantities sold and their prices, particularly for perishable crops. Consequently, the value of agricultural production is affected, potentially leading to losses that farmers may incur due to marketing delays, which can obscure the true growth in productivity.
- 5. Increase production either by increasing inputs at a lower cost or by increasing production while maintaining the same level of cost
- 6. Despite variations in the amount of production inputs used, farmers manage to achieve economic efficiency.

Research Recommends:

- To achieve economic development, it can be achieved in several interconnected and interrelated ways, including horizontal expansion in production, i.e. increasing the number of economic units (or agricultural areas) in light of adding new capital components, expanding the available ones, and increasing the number of workers in them, especially agricultural engineers. In contrast, vertical expansion in production by continuously improving the level and degree of exploitation of economic resources by raising the productivity of the resources used in existing economic.
-Through education and awareness: Farmers must be encouraged to learn about the latest sustainable technologies and practices and directed towards using them.
- Supporting research and development: Research in the field of wheat cultivation and the development of new technologies and strains that contribute to increasing productivity and reducing environmental impacts must be supported.
- Encouraging local agriculture: Wheat cultivation can be promoted on a local scale to reduce costs and rely on local sources instead of relying on imports.
- Promoting sustainable marketing and distribution: Efforts must be directed towards developing sustainable supply chains that reduce product waste and maintain its quality.
- Conduct further research to diagnose the determinants of total productivity and ways to improve it, taking into account social factors.
- Establish policies to limit imports, especially when grain crops are sold.
- Establish modern silos in or near grain-growing areas so as not to delay the receipt of produce from farmers.
- Farmers must reallocate resources in a waste-free manner by reaching full utilization that increases production and productivity. And do this with the help of experienced farmers and experts in this field.

- There is interest in conducting more research on how revenues and resource use change in order to assess sustainability.

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