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Measuring The Technical And Economic Efficiency Of Both: Sequencing The Rice-Wheat Crops System, And Fallow-Rice System, Using Data Envelopment Analysis Method In Iraq 2017

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Abstract:*The steady development of population growth along with incomes, on the one hand, and lower production, have led to a decline in self-sufficiency in rice and wheat yields, and the importation of large quantities of them to fill the widening food gap, so the research's interest in using a crop sequencing model is on the same The land is season-by-season instead of leaving the land of Fallow throughout the winter season after the summer rice planting season, which means no full exploitation of productive resources. A random sample of 204 rice growers was covered in the governorates of Najaf and Diwaniyah distributed 100 forms to farmers using a system of wheat after rice, 104 forms for farmers leaving the land after planting rice, and use of Data Envelopment Analysis method to estimate production efficiency Technical, economic efficiency and allocative efficiency in the direction of change of capacity, stability of the yield of the input capacity under the production function variables, and according to cost function variables. The research concluded from the research that the extent to which farmers of rice and wheat crops are more likely to be on the farmers of the fallow system is in total revenue and profit for the single dunum. This means that the sequencing-planting system is better than the fallow system. Assuming their loss of the winter season and the lack of full use of resources compared to the farmers of the rice and wheat crop system. average technical efficiency is almost halved when the capacity returns for the farmers of the Bor system are stable, and the average technical efficiency of the grain of rice for the fallow system was 81%, 86% Assuming stability and change in capacity returns, which indicates that a large percentage of farmers are working within optimum capacity returns, and that the average technical efficiency of the sample of the system for the crop of rice and wheat yields 80%, 88% assuming stability and change of capacity returns, which indicates that a small percentage of farmers are working Beyond the limits of optimum capacity returns. Therefore, the research recommends the need to adopt a system of planting successive rice and wheat crops and not to leave the use of land in the winter season of fallow.keywords :technical efficiency ,DEA ,sequencing system.*

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I. Introduction:

Agricultural economists are interested in studying the economics of cereal crops, and growing interest in rice and wheat yields, especially when it comes to the issue of food security, and rice is the second most important staple food commodity after the wheat harvest because of its integrated food, vegetable proteins and elements Food is multiple and necessary for the body, and is considered to be a complete food in some Asian peoples for hundreds of years. China ranks first with rice production globally. It reached 211 million tons in 2016 from 30.5 million hectares, followed by India, producing 158.8 million tons of 43 million hectares.

Importance of research:

The importance of research comes from the important place that rice and wheat crops represent in the nutritional pattern in Iraq, and their residues are also considered as fodder for animals and many industries. The steady development of population growth and high incomes, on the one hand, and lower production, have led to a decline in self-sufficiency, and the importation of large quantities of them to fill the widening food gap, which is why the research for the use of the model of successive crops of rice and wheat on the same land season After a season, exploiting resources more efficiently, leading to a higher level of production for both crops, increasing farmers ' incomes, encouraging agricultural work rather than moving away from it and migrating from the countryside to the city, which has become more visible in its negative impact on the agricultural sector.

Problem of research :

Rice growers have used to leave the land of Bora throughout the winter season after the season of summer rice cultivation and harvest harvesting, which means that production resources are not fully exploited

while another crop can be cultivated during the same year to ensure a more efficient use of resources. Especially the water supplier, and take advantage of the recent rice in the germination of wheat seeds before starting to harvest the rice crop. Abandoning the land of Bora and using a sequencing-cropping system adds a lucrative income to the farmer, leaving his land and displacing him to work in the service sector.
hypothesis of research : The researcher assumes what he is trying to prove or refute in the research
Agricultural production resources are not an impediment to achieving the technical competence to produce and cultivate rice crops, followed by planting wheat in the same area and for two consecutive seasons, and there is even a waste of those productive resources.

Objective of research :

Enhancing the farmer's ability to exploit productive resources, not abandoning rice cultivation, the possibility of deciding to expand its cultivation, and knowing the impact of the planting of wheat after rice on the economic efficiency of exploiting the Earth's resources to a great extent by which he maximizes the income of the farmer instead of leaving the land fallow after harvesting Rice crop, because the wheat harvest is a winter crop that is suitable for planting because of its low water needs and availability in the winter season.

Data sources and sampling method:

Preliminary data were obtained through direct interviews with rice growers in Najaf and Qadisiyah governorates, and a questionnaire was received, which was distributed to a randomly taken sample of 204 farmers planting rice in different areas, and distributed 100 forms to farmers using a sequencing-planting system After Rice, and 104 forms for farmers who leave the land after planting rice, the bulletins and periodicals issued by the Central Bureau of Agricultural Statistics and the Agricultural Planning Department in the Ministry of Planning and the Agricultural Statistics Division of the Ministry of Agriculture for secondary data, as well as available data, have been approved. Tables and reports of agriculture departments and Directorates of Agriculture in the governorates covered by the research.

Analysis Method :

The Data Envelopment Analysis Method (DEA) was used to estimate the technical production efficiency, economic efficiency and allocative efficiency of rice plantations in the research sample, and why this method was adopted in the analysis as it provides detailed information to farms that relate to the use of resources. Envelopment. For productivity and optimum mix by adopting the method of estimating the efficiency of the different farms by creating an envelope containing the data, because the label of the Data Envelopment to the fact that the production units (productive farms) have administrative and organizational efficiency that is encapsulated for less efficient or inefficient production units. Two trends are used in the method of analysis of this type of data, the first trend being the use of the VRS Variable return to Scale, and the second direction according to the stability of the return to capacity Constant return to Scale (CRS), allowing for the estimation of technical proficiency Efficiency (TE) , the efficiency of the Scale Efficiency (SE) capacity by input under the variables of the production function, as well as the allocative efficiency allocative Efficiency (AE) and economic efficiency (EE) were estimated according to the cost function variables. The use of the output side was not studied because it was not suited to the realities of agricultural work.

First: Technical Efficiency (TE):

Technical efficiency is defined as the efficient investment of resources technically, and in practice is to reach optimum levels in the area of investment of resources, which in turn achieves desirable goals and objectives, as it maximizes the production achieved under the range of resources available.
The value of technical efficiency is limited to the correct zero and one, and is inversely correlated with the level of technical inefficiency, as the farm is technically efficient when the technical efficiency is equal to one, but if it is less than the correct ones, it means that the farm can reduce the input percentage or provide a proportion of Input costs used in previous production. (Coelli 2005 and others).

TE = (actual input required)/(actual input)..... 1

Second: Economic efficiency Efficiency:

Efficiency is defined as the ratio between the output achieved relative to the resources used, which is to maximize the ratio between the farm products to the productive resources used in their production, in order to obtain the maximum possible output, the most efficient use of available resources (Steven 2008 :p 9). Economic efficiency in terms of inputs is defined as the ability to reduce inputs to reach the specific production for the farm or productive project, but in terms of output it is the ability to increase production quantities by optimizing the same amount of input (Debertn, 2012). Economic efficiency depends on both technical Efficiency (EE) Efficiency and price efficiency (allocative) allocative Efficiency (AE), where it is assumed that technical

efficiency reflects the productivity of the production of profit, so that economic efficiency is the product of efficiency. Professional in allocative efficiency. As explained in the following equation: (Farrell, 1957)

(EE economic efficiency) = (TE technical efficiency) × (AE allocative efficiency)

The Data Envelopment Analysis method is Parametric Non , (William 2004), and a relatively new "data-oriented" approach to evaluating the performance of a group of farms that transforms multiple inputs into multiple outputs, as recent years have seen a large variety of applications used in the evaluation Perform different types of farms working in many different activities in some countries. The motivation and need to develop a better model for assessing productivity, attempts to solve the problem were very restrictive and failed to combine multiple input measurements in a satisfactory measure to assess labour productivity, capital productivity, etc. In the article, which represents the beginning of the data envelope, which was prepared in 1957, Farrell suggested an approach to analyzing activities that could appropriately address the problem, and be applicable to any organization producing a workshop to a full economy. " The concept of "productivity" has thus been broadened to the overall concept of "efficiency". (Seiford 2014) The analysis of the Data Envelopment used in the analysis is defined as the method that uses mathematical programming to create the relative efficiency of the decision-making unit, which utilizes a variety of inputs and outputs by dividing the sum of outputs by the sum of inputs for each Established, by creating an envelope containing the data, the name of which is attributed to the data envelope, to the fact that the units with administrative efficiency are in the foreground and encapsulate the inefficient administrative units, and therefore the positions of those facilities, which are encapsulated by the competent units, represent (Figure 1) a set of unit The decision to produce Y1 and y2 by using income x, whereas the most efficient production area between y1/x and y2/x shows the competent limits of the units g-f-e-b which are considered to be of complete efficiency as compared with points d-c-a which do not allow the use of their inputs Pain (2007 Cooper and others).

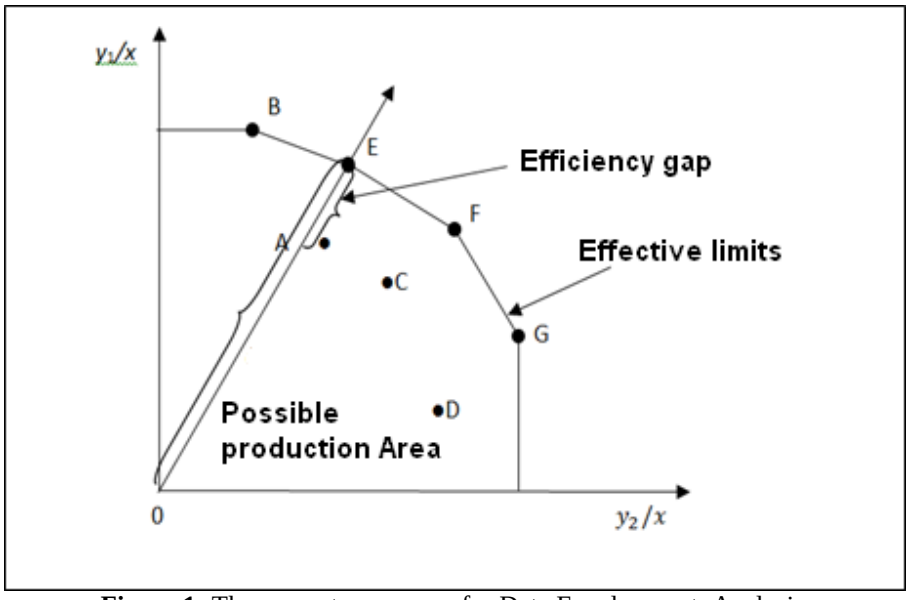

Figure 1: The competency curve for Data Envelopment Analysis

Source: W. W. Cooper: 2006 :p9.

II. Results and discussion:

First: Measure the impact of the system of sequencing rice and wheat crops on costs, revenue and profit.

1. Impact of the system of successive rice and wheat crops on average variable production costs :

When studying the impact of crop sequencing cultivation (rice and wheat) on the productive costs (variable costs of the dunum), the sample results showed that the average variable cost of the sequencing farms was 361.2 thousand dinars (table 1), while the average variable costs of the BOR system Farms 255.5 thousand dinars. The variation factor for the sequencing farms was 18.2% while the farmers of the fallow rice reached 14.10% and this is a sign that they are less volatile than the growers of sequencing.

Table 1: Average variable costs per dunem (1000 ID) for sample Research

Type of agriculture	Average variable costs	N	Variance coefficient% CV
System of sequencing	361.2	100	18.2
The fallow system	255.5	103	14.10

Source: Based on rice questionnaire and crop sequencing forms

2. The impact of the system of successive rice and wheat crops on the average of the individual:

When studying the impact of the sequencing of rice and wheat crops on the average income of the dunum, through the data shows that there is a variation in revenue between the two systems and as in (table 2) The average income of dunums for successive farmers 1372.4 thousand dinars and non-consecutive farmers 889.15 thousand dinars. The variation factor for 18.47% and non-consecutive rice growers was 15.02%, and from a note of the coefficient of variation, which indicates fluctuations in average total revenue, we conclude that the farmers of the fallow system are less volatile than their successive counterparts. They are less visible, showing the extent to which the farmers of the rice and wheat crops are more than the total income of the single dunem.

Table 2: Average income of acres for sample research

Type of agriculture	Average variable costs	N	Variance coefficient% CV
System of sequencing	1372.4	100	18.47
The fallow system	889.15	103	15.02

Source: Based on rice questionnaire and crop sequencing forms

3. The impact of the system of sequencing rice and wheat crops on average profits:

Through the data obtained from the sample of successive rice growers with wheat and non-successive, it was found that there was a variation in profit between the farmers of the sequencing system and the non-sequencing (table 3) The average profit of the dunum for the sequencing system was 1011 thousand dinars and the farmer's regime was 654.3 thousand dinars. The variation coefficient for the sequencing farms% 18.7% and rice plantations (the fallow system) was 15.5%, and the values of the variation coefficient conclude that the farmers of the fallow system are less volatile than those in the sequencing system. It is less profitable for each one, and shows the extent to which farmers of the system of rice and wheat crops are more profitable than single-dunem.

Table 3: Average profit for a sample of acres of research

Type of agriculture	Average variable costs	N	Variance coefficient% CV
System of sequencing	1011	1011	18.47
The fallow system	654.3	654.3	15.02

Source: Based on rice questionnaire and crop sequencing forms

Second: Measuring the technical competence of the Rice sample and the system of successive crops of rice and wheat:

The technical proficiency of the production of the 103-farm sample of the Bor system and the 100-yield sequencing system for the 2017 production season in Iraq was estimated using the DEA Data Envelopment Analysis method, and the factors influencing production were the area, seeds, fertilizers, and the SALESDA. C. Automation and human work.

1**. The Fallow system:**

The level of technical competence is assumed by the persistence of capacity returns for the farmers of the Bor sample system between 100% efficiency achieved by 12 farms constituting 11.6% of the sample farms and the lowest 0.302 for only one farm (table 4). The ratio of average technical efficiency of 81% indicates that production can increase by 19% at the same current cost, or achieve the same level of current production at a lower cost of 19%, i.e. reduce the cost by approximately 48.5 thousand per Dunam. Assuming the change in the capacity returns, the results of the technical proficiency indicate that 24 farms achieved 100% efficiency, which accounted for 23.3% of the sample farms, while only one farm achieved a minimum of 0.500, and the average technical efficiency of 86% indicates the possibility of increasing production by 14% without increasing the amount See the resources used, or achieve the same level of current production at a lower cost of 14%, that is, reduce the cost by about 36 thousand for almost one dunem

The variance is twofold, between the farms that have achieved a full level of technical competence on the assumption of stable capacity returns and the compromise of the capacity returns to the difference between the competence of farmers with technical capabilities and managerial skills.

The farms, which achieved 100% technical efficiency, which reached 52 farms by 50% of the total number of rice farms in the research, are typical farms for the remaining inefficient farms, as these farms operate within the production potential curve, and inefficient farms are the ones that move away from The possibilities of production are in different proportions, so technically competent farms can reduce the amount of

inputs used to obtain the same level of production, or use the same input quantities to obtain a higher level of production.

The results of capacity efficiency varied between the two (0.587-1) with an average of 95%, i.e. these farms can be increased by 5% or they lose some of their economic resources used in production, which increases the cost by 5%.

The farmer, which operates with a growing revenue capacity of 56 farms, accounts for 54.3% of the total number of rice farmer samples studied, while the number of farms with decreasing returns is DRS 31, with 30.2%, while the number of farms with fixed returns reached 16 farm by 15.5%.

2. **sequencing system**:

The level of technical competence was limited by the assumption of stable capacity returns for Iraqi sequencing system farmers for the 2017 production season of the sample, between 100% full efficiency achieved by 15 consecutive farms, which accounted for 15% of those farms and the lowest of 0.251 for only one farm. The average technical efficiency ratio of 80% indicates the possibility of increasing production by 20% at the same current cost, i.e. increasing production or achieving the same level of current production at a lower cost of 20% than it is, i.e. reducing the cost by a limit of 72.2 thousand dinars for almost one acre.

Assuming the change in the capacity returns, the results of the technical proficiency indicate that 34 farms achieved 100% complete efficiency, constituting 34% of the sample farms, while only one farm reached the minimum of 0.420, and the average technical efficiency of 88% indicates the possibility of increasing production by 12% Without increasing the amount of resources used. or achieve the same level of current production at a lower cost of 12%, i.e. reduce the cost by 43.3 thousand dinars for almost one dunem.

The large discrepancy between the number of farms that achieved a full level of technical competence, assuming stability and change in capacity returns, is due to the difference between the efficiency of farmers with technical capabilities and skills.

The farms, which achieved 100% complete technical competence, which numbered 65 and accounted for 65% of the total number of sample crops in the research (table 4), are typical farms for the remaining inefficient farms as these farms operate within the production potential curve. Inefficient plantations are those whose production departs from the curve of production possibilities in different proportions, so technically competent farms can reduce the amount of inputs used to obtain the same level of production, or use the same input quantities to obtain a higher level of production.

Table (4): Indicators of technical efficiency of the fallow system farms and the system of sequencing of rice and wheat crops

		crste		vrste		scale		Scale Efficiency		
		%100	Less %100than	%100	Less %100than	%100	Less %100than	100	irs	Drs
The fallow system	Number of farms	12	91	24	79	16	87	16	56	31
	Percentage%	11.6	88.4	23.4	76.6	15.5	84.5	15.5	54.3	30.2
	Average efficiency%		81		86		95			
System of sequencing	Farm Preparation	15	85	34	66	16	84	16	70	14
	Percentage%	15	85	34	66	16	84	16	70	14
	Average efficiency		80		88		90			

The results of capacity efficiency varied between(0.587-1) with an average of 90%, which means that these farms can be increased by 10% or lose some of their economic resources used in production, which increases the cost by 10%.

The farms, which operate with a growing revenue capacity of 70, account for 70% of the total number of studied sequencing farms, while the number of farms with decreasing returns DRS 14 farms, 14%, while the number of farms with fixed capacity returns is 16%.

Third: Measuring the economic efficiency of the rice sample of the fallow system and the sequencing the rice-wheat crops system:

Using the Data Envelopment Analysis Method to estimate the technical proficiency and specialized competence of the total economic efficiency of the research sample for the production season 2017 and assuming the change of the capacity returns and depending on the data of the quantities of production resources and their prices as variables for the function Costs, the prices of factors influencing production were land rent allowance, seed price, fertilizer price, pesticide price, automatic and human labor prices.

1**. The Fallow system:**

The results of the sample analysis of the FALLOW system show that the levels of technical proficiency ranged between (0.500 – 1) and an average of 86%, noting that there is little difference between them compared to the results of previous technical proficiency levels according to the production function variables. The results of the analysis converged on the value of the minimum, upper and intermediate levels of technical proficiency ,indicating the accuracy of the estimation according to the Data Envelopment Analysis method, due to the convergence in technical proficiency levels according to the production and cost functions in relying on technical relations between Inputs and outputs in the analysis of the model does not include the prices and costs of inputs and outputs in the estimation.

The allocative efficiency levels that were estimated for the sample of the fallow system ranged from the inclusion of the prices of productive resources used between full efficiency and 0.676 and an average of 90%, suggesting that the economic resources used in rice cultivation could be redistributed to be available at 10% Return productivity and reduce production costs in the same proportion of those resources, so the farmer can achieve the current production quantity using 90% of the total costs used only in the sense of lowering the level of costs without lowering the level of production, or can produce a higher amount of current output at costs Present itself. Thus the farmer can reach the optimum point of production that refers to the point of contact of the cost line with the equal output curve, at which time the output is maximized when the slope of the equal output curve (the marginal rate of substitution) and the slope of the cost line curve (allocative ratio) is equal.

It is noted that there is a waste and surplus in the amount of economic resources, with only 7 farmers achieving 100% full price efficiency (allocative), which accounted for 6.7% of the total sample of the fallow system (table 5). The average economic efficiency of the fallow system amounted to 77% at levels between a minimum of 0.429 and the highest 100% efficiency achieved by 7 farmers, averaging the possibility of reducing the costs of the farmer by 23%, i.e., the limit of 59 thousand dinars for almost one dunem, achieving the same level of production, or Farms can achieve the current amount of production using 77% of the resources or less to become economically efficient. It is noted that the levels of economic efficiency have been low compared to the levels of technical and specialized competence of the same sample farms, due to the lack of government support and the high cost of agricultural inputs, especially the high prices of seeds, fertilizers and pesticides, and that the nature of the land The composition of the soil increases the incremental costs of mechanization agriculture from tilling, sowing and servicing the crop, which increases the number of hours of mechanical work and raises the level of production costs, accompanied by a decrease in the productivity of one dunum, all these factors combined and others have helped to reduce efficiency Specialized and caused a low level of economic efficiency.

Table 5: Technical waltkhsish and economic efficiency of the fallow system and sequencing system

	Efficiency	fallow System			sequencing system		
		Minimum	maximum	Average %	Minimum	maximum	Average %
1	Technical competence	0.500	100	86	0.420	100	88
2	Efficiency altkhsish	0.676	100	90	0.543	100	83
3	Economic efficiency	0.429	100	%77	0.288	100	73

2**. sequencing system:**

Technical proficiency levels ranged from (0.420 – 1) to an average of 88% and the Allocative proficiency levels that were estimated for the sample of the rice and wheat crop sequencing system included the price of productive resources used between (0.543) and an average of 83%. The economic resources used to grow rice and wheat can be redistributed, with 17% of the production resources and a reduction in output costs of 17% of those resources, so the farm can achieve the current production by using 83% of the total costs. Used only. In the sense of lowering the level of costs without lowering the level of production, or a higher amount of

current output could be produced at the present costs themselves. Thus the farmer can reach the optimum point of production that refers to the point of contact of the cost line with the equal output curve, at which time the output is maximized when the slope of the equal output curve (the marginal rate of substitution) and the slope curve of the cost line (specialized ratio) are equal. There is a waste and a surplus in the amount of economic resources, with only 4 farmers achieving 100% full price efficiency (allocative), which accounted for 4% of the total sample of the growers of sequencing. That is, it has used all the inputs sufficiently or optimally to reach production without any surplus, it should be noted that farms that achieve optimum technical efficiency do not necessarily achieve optimal price efficiency, because of the costs of high production components to the extent that leads to reduced efficiency Specialized for optimum level, which means that production may be marketed at the point of technical proficiency but it does not achieve price efficiency. Therefore, farms will only achieve price and economic efficiency if production costs are reduced at the level at which the cost line affects the equal output curve. The improvement in technical efficiency is also reflected positively on the specialization efficiency by increasing, leading to a continuation of the rate of technical change until it reaches the maximum and if the levels of technical competence and the specialized competence of the farmer itself are compared using the variable cost function, the first level Higher than the last level. The number of farms for optimum technical efficiency is greater than the number of farms that are optimized for specialized efficiency, so these farms require them to pay attention to the specialized relationships between the economic resources used and to strive for the optimum use of the quantities of resources based on the prices of these Resources, especially seeds, fertilizers and pesticides. The average economic efficiency was 73% at levels between 0.288 and higher, with 100% efficiency achieved by 4 farmers, averaging the possibility of reducing farm costs by 27%, with a limit of 98 thousand dinars for almost one dunem, achieving the same level of production, or that the Elms They can achieve the current production capacity by using 73% of the resources or less to become economically efficient. Farms that managed to reach the best output with a specified number of inputs, which themselves achieved both technical efficiency and price efficiency, operated within the equal production curve, so they had to continue with the same production method and note that economic efficiency levels were low compared to the levels The technical and specialized competence of the sample farms itself, due to the lack of government support and the high costs of agricultural production, especially the high prices of seeds, fertilizers and pesticides, and that the nature of the land and the composition of the soil increases the additional costs of mechanization operations agriculture from Tilling, sowing and serving the crop, which increases the number of hours of mechanical work and works to raise the level of production costs, accompanied by a decrease in the productivity of the one dunum, all these factors combined and others helped to decrease specialized competence and caused a low level of economic efficiency.

III. Conclusions *:*

The research reached a set of conclusions that were based on the most important results, including the following:

1. Through the results of the analysis the average technical efficiency of the Rice sample of the fallow system 81% AssumingThe stability of the capacity returns and 86% assuming the change of the capacity returns indicates that a large percentage of farmers are working within optimum capacity returns. The average technical efficiency of the sample of the system for the sequencing of rice and wheat crops was 80% assuming The stability of capacity returns and 88% assuming the change of capacity returns indicates that a small percentage of farmers work beyond the limits of optimum capacity returns
2. The average efficiency of the allocative system of 90% indicates that the economic resources used in rice cultivation can be redistributed to provide a 10% reduction in production resources and a 10% decrease in the cost of output. The average allocative efficiency of the 83% sequencing system suggests that the economic resources used for rice and wheat cultivation can be redistributed with 17% of productive resources and a 17% reduction in production costs.
3. The results show the extent to which the farmers of the rice and wheat crops are more than the farmers of the fallow system in the total revenue and profit for the one-acre. This means that a sequencing-planting system is better than the fallow system.

IV. Recommendations:

In the light of the findings of the research, we recommend the following:

1. To follow a system of planting successive crops of rice and wheat and not to leave the use of land in the second season (winter) by its enlightenment.
2. The resources must be redistributed in a way that reduces wastage by reaching the optimum combination that maximizes profits and reduces costs and can be achieved through the use of experienced farmers and specialists in this field.

3. Farmers need to be committed to working within the limits of optimum capacity returns and to adopt a competent farmer approach.

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