Study of the most important factors affecting the production of wheat crop in the new lands in Egypt (Nubaria Area)

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ABSTRACT

The study results have found that optimal acre productivity should be up to about 21.6 ardab while the actual production is about 12.4 ardab. The study attributed this decline in productivity to some of the problems faced by the farmers of the study sample as about 22.41% of the sample individuals suffer from the problem of irrigation and the lack of access to water for their lands, and that the percentage of people who suffer from both the problem of fertilizers and seeds or lack of purity of seeds is about 15.52% of the sample for each of them, and the problem of diseases of the crop amounted to about 12.07% of the sample, while the percentage of those who suffer from high labor costs about 6.90%. The study recommended the need to follow the pricing policy stimulating and encouraging farmers to increase production of wheat and the adoption of the government of modern technologies by providing affordable prices for farmers, especially the new lands, in addition to activating the role of cooperatives in the new areas to provide techniques and modern varieties, and all production requirements.

Key word: of wheat crop - new lands – productivity- production costs.

Introduction

The provision of safe food for Egyptian consumers is considered one of the major concerns faced by the Egyptian government with all its different sectors and the Egyptian wheat crop is considered one of the most important problems that face Egyptian agricultural policy makers as one of the most important commodities on which low-income people in Egypt depend in the form of a loaf of subsidized bread, so Egyptian research centers have tended in recent years to work continuously to find new technologies to help in achieving this national requirement.

The country can achieve this requirement either through the application of modern technologies in agriculture, which is considered one magical solutions to solve many of the problems that face the agricultural policy of Egypt, or by the direction of the country to the cultivation of wheat crop in the new land in order to increase the production of this crop to provide the needs of the Egyptian people without relying on imports to fill the gap between food production and consumption.

Study Problem:

Despite the increase in productivity of acre of wheat, which amounted to (18.5 ardab / feddan) in 2011 as production average at the level of the Republic, but the production average in the new lands did not exceed (15.6 ardab / feddan), as there is still a large gap between production and consumption, where the country imports about 7.9 million tons annually.

Study Objective:

The study aims to identify the productive efficiency of the study sample and identify most important factors affecting the production of wheat, and it also aims to study the production costs in the study sample and compare the costs items with their counterparts at the level of the Governorate and the Republic, in addition to the study of the most important problems facing the farmers of wheat in the study sample as a model for the new land, and in order to reach the possibility of achieving a higher level of productive efficiency among farmers of wheat crop in the new lands.

Research Method & Data Sources:

The study used descriptive and quantitative statistical method to analyze the data of the study sample taken intentionally from wheat farmers in the area of Nubaria, in addition to relying on estimating production functions and costs in the different forms of linear, half linear or logarithmic in order to determine the optimal...
size of production and maximized size of profit. The study focused on examining the most important problems facing the farmers of wheat in the study sample. The study relied in achieving its objective on two types of data, primary data based on questionnaire and secondary data published by the Ministry of Agriculture and Land Reclamation and some websites relevant to the subject of the study.

Study Results:

Productive & Economic Efficiency:

The term efficiency generally expresses the optimal use of production factors,

By Productive Efficiency is meant:

To achieve the same amount of production with smaller quantities of used productive resources or larger production with the same quantities of used production resources, meaning the optimal use of inputs of the production process to get the best output including scientific methods in administration represented in planning, organizing, directing and controlling.

Productive efficiency can also be defined as the relationship between the amount of used resources in the production process and the product of that process, thus increasing productive efficiency means higher percentage of output to the used resources.

By economic efficiency is meant:

To achieve the same amount of production with lower production costs or to achieve larger production with the same costs.

Mathematical models used in production functions:

For the production functions, mathematical model of the function used in this study has been selected after making several exploratory studies to select the most important independent factors that attributed to high degree of change in the following amount. Several estimates of the image of production functions have been conducted and the logarithmic image has been selected which is expressed in the mathematical model for Cobb–Douglas function and quadratic function.

1-Cobb–Douglas Function Model:

\[ Y = A \times X^1 \times X^2 \times \ldots \times X^N \]

Where:
- \( Y \) = the amount of output of wheat crop
- \( X \) = the amount of used production resource
- \( B/N \) = the productivity flexibility of the productive resource \( (X^N) \)

This function is characterized by a set of mathematical properties that are consistent with the logical properties of the Egyptian wheat production, including:
- Not reaching the maximum end.
- Low marginal product at a decreasing rate.
- Logarithmic function assumes any output can be gotten no matter how small it is by using one variable resource.

And both production average and marginal production of this function can be evaluated as follows:
- Average production for the production resource \( x = y / x \)
- Marginal output of resource production has been estimated by finding the first differential derivative and marginal production function as has taken the following shape:
- Flexibility for the productive resource \( X = \frac{D^Y}{D^X} \)
- The average marginal output of Cobb-Douglas can be measured by using the following equation:
- Average marginal output of the entrance to the production of wheat \( x = b \times y / x \)

Where:
- \( B \) = the productivity flexibility of the entrance \( XN \).
- \( Y \) = the average amount of Egyptian wheat production.
- \( X \) = the average amount of entrance \( x \) used to achieve this production.
**Model of the quadratic & cubic function**

\[ Y = a + b x - b x^2 \]

\[ Y = a + b x - b x^2 + b x^3 \]

Where:

- \( Y \) = the amount of output of wheat.
- \( x \) = the amount of used resource.

**The most important results of the study sample:**

The results of the study sample, which was in the area of Nubaria representing the new lands (El Beheira Governorate), showed their increasing relative importance among the rest of the new lands in wheat production. The most important characteristics of the study area are:

- For holding size: it ranges from one acre to six feddan, while the average holding size in the study sample was about 4.23 feddan.
- For wheat crop area cultivated, it ranged between a minimum of seven carats to six feddan, with an average of approximately 2.188 feddan.
- For productivity, it ranged (from 10 ardab as minimum to 20 ardab as maximum) and productivity average in the study sample has reached about 12.4 ardab, while it amounted to about 15.6 ardab per feddan at the level of the republic.
- The most important cultivated varieties in the study area are Sakha 93, Sakha 94, Sakha 61 and Gemmeiza 9.
- The source of seeds for farmers is the Ministry of Agriculture and the trader located in the region.

**Statistical estimate of functions of the wheat crop production for the study sample:**

Conducting statistical analysis of each independent variable of variables involved in the production alone to indicate its impact on the production has proven the value of preparation land variable on production quantity in the study sample, while has not proven any value of the other variables under study and the result was as follows:

\[ X_{1H} = 12.038 + 0.04065 x_{10H} \]

\( R^2 = 0.357, F = 18.229, X_{1} = \text{quantity of production, where } X_{10} = \text{the value of land preparation} \)

By conducting analysis in the half logarithmic and double logarithmic images the best results were the double logarithmic image as follows:

\[ \log x_{1H} = 2.698 + 0.731 \log x_{3H} \]

\( R^2 = 0.781, F = 111.235 \)

Where \( \log x_{1} = \text{the logarithm of production, } \log x_{3} = \text{the logarithm of the cultivated area with wheat} \)

Studying the production function in the logarithmic image showed the significant proven relationship estimated at the level of significance 0.01%, and the value of productivity flexibility as illustrated by the equation indicates that change in the cultivated area by 10% leads to increase production by about 7.31%, and where the flexibility of production is less than one, it means diminishing returns to scale. The average production per feddan in the sample can be estimated at 12.4 ardab, and the marginal product also at 2.08 ardebs and the marginal product represents the amount of the increase in the total output of the crop as a result of increasing the cultivated area as one unit.

**Statistical estimate of the costs functions of the wheat crop and deriving some economic indicators, including:**

Agricultural costs include fixed costs and variable costs, and the fixed costs reflect the value of the fixed factors of production which does not change by change of production volume, while variable costs are those which their value changes by the change of the volume of production and include the costs of agricultural processes on the crop as well as the costs of the production factors required to complete cultivation.

Studying the variable costs in the study sample and comparing them with their counterparts at the level of El Beheira Governorate and the country's level, they have reached about 2911 pounds, for return of about 2921 and about 2712, respectively. The study of these costs as distributed on the most important items of wheat crop in the study sample, El Beheira Governorate where the study sample is located and at the level of the Republic shows that the most important costs items are represented in the costs of preparing the land which amounted to about 153 pounds per acre in the study sample in comparison with about 120 pounds and 0.212 pounds for each of El Beheira Governorate and the Republic, respectively, by about 5.2%, 4.1% and 7.8% in the same order.
As for the costs of seeds, they have amounted to about 175 pounds per feddan in the study area in exchange for about 240 pounds and 292 pounds for El Beheira Governorate and the country's level by about 5.9%, 8.2% and 10.8 %, respectively.

For irrigation costs, they have amounted to about 185 pounds in comparison with 360 pounds and 298 pounds on the three levels in the same order, each represents about 6.3 %, 12.3% and 0.11 %, respectively.

The costs of chemical fertilizer have reached about 1139 pounds per acre in the study sample in comparison with about 605 pounds and 0.633 pounds, respectively, by about 39.1%, 20.7 % and 23.3 %, respectively.

Table 1: The items of production costs of wheat crop in the study sample in comparison with the Governorate of El Beheira and at the level of the Egypt for the season 2011/2012

<table>
<thead>
<tr>
<th>Item</th>
<th>Sample %</th>
<th>Governorate %</th>
<th>Egypt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>land preparation</td>
<td>153</td>
<td>120</td>
<td>212</td>
</tr>
<tr>
<td>Seeds</td>
<td>175</td>
<td>240</td>
<td>292</td>
</tr>
<tr>
<td>Irrigation</td>
<td>185</td>
<td>360</td>
<td>298</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>1139</td>
<td>605</td>
<td>633</td>
</tr>
<tr>
<td>Harvest</td>
<td>301</td>
<td>680</td>
<td>607</td>
</tr>
<tr>
<td>Transportation</td>
<td>100</td>
<td>100</td>
<td>129</td>
</tr>
<tr>
<td>Other items</td>
<td>895.85</td>
<td>816</td>
<td>541</td>
</tr>
<tr>
<td>Total</td>
<td>2911</td>
<td>2921</td>
<td>2712</td>
</tr>
</tbody>
</table>

Source: Counted and collected from the data of the study sample, and the Bulletin of Agricultural Economics and Statistics.

Estimating the costs function:

Conducting analysis in the simple linear image and the quadratic and cubic image to determine the relationship between the total costs as the dependent variable and the amount of production as an independent variable and the best obtained results are the quadratic function image as follows:

\[ Y^H = -1283.2 + 238.841X^H - 1.7545X^2 \]

\[ F = 7.21 \quad \& \quad R^2 = 0.332 \]

The significance of statistically estimated relationship has been proven to be at the level of significance 0.01%, and the study has shown previously that the average total costs per feddan have amounted to about 1330 pounds / year (excluding rent), and the average produced quantity has amounted to about 12.4 ardab, which means that the average cost of produced quantity has amounted to about 108 pounds / ardab. The value of the coefficient of determination in the equation is estimated at about 33% of the changes in total costs due to the change in the produced quantity of the crop.

Estimating the optimal size of production and the maximized size of profit of wheat crop:

The optimal size of production can be gotten through equation of function of marginal costs and function of average costs on the one hand, or finding the minimum end of the function of total costs average on the other hand, it has been relying on finding the minimum end of the function of costs average total by making the first differentiation of the function of costs average and equating it to zero. The maximized size of profit is the size in which both the marginal costs and the marginal revenue (or unit price if the market is a full market competition) equal.

Using the double logarithmic model made it possible to get all of the optimal size of production, the maximized size of profit, and the production costs flexibility of the study sample and the economic analysis of the items of the production costs for the sample declares the relative importance of each item and its impact on the total costs and the statistical estimation of functions of production costs also indicates economic stage in which the sample is produced, to find the marginal costs and determine the optimal size of production and the maximized size of profit and estimate costs flexibility and productivity flexibility.

The optimal production size and achieved for the lowest cost is achieved when average costs with marginal costs equal (A = M C).

The derivation of average costs function and equating it with marginal costs function show that the optimal size of the production has amounted to about 21.6 ardebs / acre and this size is the lowest cost average according to the economic theory. Estimating costs flexibility, amounting to about 1.73 %, this flexibility explains the increasing relationship between costs and production with the consequent difficulty of increasing profits of the farmer in the light of the prices of farm inputs and outputs for this crop. To get the maximized size of profit, it requires the derivation of the marginal costs function and equating it with marginal revenue function or product price considering that the market is competitive, the maximized size of profit has reached about ardab 45.93 / feddan.
In order to achieve the optimal size of the production, amounting to about (21.6 ardab / feddan) and the maximized size of profit of about (45.93 ardab / feddan) requires working on increasing acre productivity and this can be achieved by several methods, including what is recommended by the research centers, especially centers that follow the Ministry of Agriculture to cultivate improved high productivity and resistance to disease varieties, as well as cultivating varieties that are resistant to lodging and follow the method of acclimatization in agriculture, as well as agricultural terraces, which work on exploiting more than the areas allocated for cultivation by about 25 %, as well as to the maximized production size of profit can be reached by providing production factors required for agriculture at lower costs through agricultural cooperatives and the elimination of the black market in agriculture, and trying to know the problems of the farmers and the development of appropriate solutions.

Problems face the Egyptian wheat farmers:

The study showed that the cultivation of wheat in the new lands in general and in the study sample, in particular, is facing many problems which directly affect the wheat production in Egypt in general, the most important problems can be limited to, as clarified by the study as follows: -

• The decreased amount of available water to cover the needs of the cultivated crops.
• Higher prices of chemical fertilizers.
• Unavailability of loans that help to purchase production supplies and rent the necessary equipment to carry out the necessary agricultural processes smoothly and efficiently.
• High costs of agricultural labor.
• High costs of rent of agricultural machinery.
• Lack of purity of available seeds as they contain grass seeds.
• The decreased efficiency of the role of agricultural extension in addition to the lack of agricultural extension workers.
• Diseases of the crop, which are represented mainly in the (lodging - rust - smut).

The most important problems face farmers in the research sample:

Searching the study sample declares that the most important problems that face farmers are the lack of knowledge of modern varieties, the rise in the value of modern seeds, decline of the role of cooperative societies, the limited number of areas available with seeds and production requirements, and the decreased efficiency of the role of agricultural extension. Table (2) Shows the relative importance of these problems for the farmers of the study sample.

Table 2: The relative importance of the problems for farmers in the study sample.

<table>
<thead>
<tr>
<th>Problem No.</th>
<th>Problem</th>
<th>Repetition</th>
<th>% of Total</th>
<th>Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fertilizers</td>
<td>9</td>
<td>15.52</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Seeds</td>
<td>9</td>
<td>15.52</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Irrigation</td>
<td>13</td>
<td>22.41</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Lack of knowledge of other good varieties</td>
<td>1</td>
<td>1.72</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Agricultural Extension</td>
<td>2</td>
<td>3.45</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Cooperatives do not respect the farmer</td>
<td>1</td>
<td>1.72</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>Unavailability of loans</td>
<td>1</td>
<td>1.72</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>Sales for traders</td>
<td>1</td>
<td>1.72</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>Rising costs of renting machines</td>
<td>2</td>
<td>3.45</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>Rising labor costs</td>
<td>4</td>
<td>6.90</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>Diseases affecting the crop (lodging / rust / smut)</td>
<td>7</td>
<td>12.07</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>Lack of purity of seeds (seeds of with grass)</td>
<td>9</td>
<td>15.52</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>59</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Source: Counted from the results data of the field sample. Improve crop production potential of wheat in the light of the economic variables and current environmental - internal project at the National Research Centre (2010-2013).

Table(2) shows that these problems can be arranged in descending order in terms of their repetition and importance as Table (2) shows that about 22.41 % of sample individuals suffers from the problem of irrigation and the lack of access to water for their lands and this problem occupies the first rank, while the percentage of those who suffer from each of the problem of fertilizers, seeds or lack of purity of seeds, are about 15.52 % of
the sample for each of them, and these problems occupy the second rank, while the problem of diseases of the crop such as (lodging- rust - smut ) was at the third rank and their percentage amounted to about 12.07 % of the sample, while the percentage of people who suffer from high labor costs was about 6.90 % of the sample and this problem occupies the fourth rank, and the two problems of rising of renting costs of machinery and agricultural extension occupy the fifth rank and the percentage of each is about 3.45% of the sample, while the problems of lack of knowledge of other good items, and lack of the role of cooperatives for the farmer, and the problem of sales to dealers ranked occupy the sixth and amounted for each about 1.72 % of the sample. Figure (1) shows the relative distribution of these problems among the members of the study sample.

Fig. 1: The relative distribution of these problems among the members of the study sample.

The study recommends a number of recommendations including:
• The need to follow the pricing policy stimulating and encouraging farmers to increase production of wheat.
• The attempt to adopt modern technologies by the government by providing affordable prices for farmers, especially in the new lands because of the limited physical condition and living condition.
• Activating the role of cooperatives in the new areas, to provide techniques and modern varieties, and all production requirements.

Summary:

The study aims to identify the production efficiency for the wheat crop in the new lands through a sample of the field study in the area of Nubaria and determine the most important factors affecting the production of wheat, also aims to study the production costs in the study sample and compare the costs items with their counterpart on the level of the Governorate and the Republic, as well as to study the most important problems facing the farmers of wheat in the study sample as a model for the new land, in order to reach the possibility of achieving a higher level of productive efficiency among farmers of wheat crop in the new lands.

In order to reach the objectives of the study, use the quantitative and descriptive statistical method is used to analyze the data for the study sample which were intentionally taken deliberate manner from wheat farmers in the area of Nubaria.

The study results have found that optimal acre productivity should be up to about 21.6 ardab while the actual production is about 12.4 ardab. The study attributed this decline in productivity to some of the problems faced by the farmers of the study sample as about 22.41 % of the sample individuals suffer from the problem of irrigation and the lack of access to water for their lands, and that the percentage of people who suffer from both the problem of fertilizers and seeds or lack of purity of seeds is about 15.52 % of the sample for each of them, and the problem of diseases of the crop amounted to about 12.07 % of the sample, while the percentage of those who suffer from high labor costs about 6.90 %. The study recommended the need to follow the pricing policy stimulating and encouraging farmers to increase production of wheat and the adoption of the government of modern technologies by providing affordable prices for farmers, especially the new lands, in addition to
activating the role of cooperatives in the new areas to provide techniques and modern varieties, and all production requirements.

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