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Research Article

An economic study of wheat crop production using improved wheat varieties and Laser Leveling Technology in Egypt

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Abstract

The main objective of the paper was to conduct an econometric analysis of the technologies used in wheat production, whether it was in individual form or in technological packages, with a statement and clarification of the effect of using the technology of modern varieties of seeds and the use of lasers on increasing wheat productivity. Descriptive and quantitative analysis was used, where production functions were estimated, which showed, that the most important factors affecting wheat production were the amount of municipal fertilizer, the number of seeds, the amount of human labor and the amount of nitrogen fertilizer, as increasing the previous elements by one unit leads to an increase in wheat production by about 0.078, 0.014, 0.029, 0.075, ardeb respectively. There was an extravagance in the use of phosphate. This study suggests increasing interest to provide good extension service, providing agricultural requirements to associations in the appropriate time and place, providing agricultural associations with mechanical technology from modern agricultural machines, and working to increase supply prices to encourage producers to increase their wheat production.

Keywords: Wheat crop production, Improved varieties, Laser land leveling, Technology, Egypt.

Introduction

The steady increase in the population in Egypt has made it difficult to keep track of the local production of wheat for consumption and to fill the wheat gap, imports are carried out, which affects the Egyptian agricultural trade balance negatively. The reason for this may be the lack of interest in using modern farming methods, such as modern improved varieties and the leveling of the land using lasers. The main objective of the paper is to study the economic effects of using modern varieties and lasers Leveling technology on wheat crop productivity, and to conduct an econometric analysis of used technologies in wheat production, whether it was in individual form or in technological packages.

Methodology

The study relied on the use of descriptive and quantitative economic analysis through mathematical, statistical and standard analytical tools and methods. Gradual regression and dummy variables were used in production functions in their linear and logarithmic forms, in order to obtain which images are better and whose results are consistent with

economic and statistical logic .Data was obtained from a Purposive sample of 100 producers from Qalyubia governorate, from the Toukh and Qaha centers, divided into two parts: 50 farmers who use improved varieties and laser leveling technology, and 50 farmers who do not use this technology.

Results and Discussion

The marginal product and production flexibility of the elements involved in the production process of the wheat crop can be obtained by estimating the production functions of farmers who use modern improved technologies and laser settlement and who do not use this technology. Table 1 indicated the marginal product of the following elements for farmers who do not use Studied technology: municipal fertilizer, seed quantity, human labor, automated work, phosphate quantity in effective units, nitrogen units' quantity, pesticide value, water quantity in cubic meters, which amounted to about 0.051, 0.034, 0.143, 0.021, 0.009, 0.062, 0.011, 0.001 ardeb respectively. While it was found that the productivity elasticity of the previous elements, respectively, are estimated at 0.063, 0.144, 0.242, -0.30, -0.088, 0.272, -0.026, 0.123, respectively. While in the case of using the technology of classes and laser leveling, the results indicated that the value of the marginal product of the previous elements is about. 0-0.006, 0.167, 0.003, 0.00001, 0.104, 0.122, 0.122, 0.002 ardeb, respectively, while the productivity flexibility of the previous elements, respectively, is estimated at 0.0001%, 0.392%, 0.044%, 0.012%, 0.184%, 0.071%, 0.056%, 0.123%.

Table 1. Marginal product and productive elasticity of the elements involved in wheat production for non-users of technology packages and users of packages in the study sample.

The productive element	Non packages Users		technological packages Users	
	Marginal product	Productive Flexibility	Marginal product	Productive Flexibility
Municipal fertilizer	0.051	0.630	0.006	0.0001
Seeds	0.034	0.144	0.167	0.392
Human labor	0.143	0.242	0.003	0.044
Automated work	0.021	0.030	0.00001	0.012
Phosphate fertilizer	0.009	0.088	0.104	0.184
Nitrogen fertilizer	0.062	0.272	0.122	0.071
Pesticide value	0.011	0.026	0.017	0.056
Irrigation water quantity	0.001	0.132	0.002	0.123

Sources: Field Survey, 2020

Wheat production function for technology package users and non-package user

To obtain the wheat production function, some mathematical models must be used in order to choose from them what is consistent with the economic and statistical logic, Therefore, the productivity function was estimated in linear and logarithmic form using multiple regression analysis and then using stepwise regression analysis, through which the most important factors affecting the quantity of wheat production were reached, as shown in Table No(2)., The dummy variables can be used in estimating the production function to show whether there is an effect of the technologies or not, and by using the dummy variables (d1) (d2) by setting the value (zero) for farmers who do not use the technology of varieties and laser, and the value (one) for the farmers who use these technologies, The linear and logarithmic form was used to show the best form of the productive function, the results of which are consistent with the economic and statistical logic.

The quantity of wheat production in ardeb (y) has been entered into the model as a dependent variable, and each of the quantity of municipal fertilizer in meters (x1), and the quantity of seeds in kilograms (x2), the quantity of human labor per man-day work (x3),

and the quantity of automated labor per hour (x4), number of effective units of phosphate fertilizer (x5), number of effective units of nitrogen fertilizer (x6), value of pesticides in pounds (x7), and quantity of water per square meter (x8) as independent variables.

Using step-wise regression, it was found that the most important factors affecting wheat production were the amount of municipal fertilizer, the number of seeds, the amount of human labor, and the amount of nitrogen fertilizer, as increasing the previous elements by one unit leads to an increase in wheat production by about 0.078, 0.014, 0.029 0.075, ardeb, respectively.

The significance of the dummy variables of varieties (d1) and laser (d2) was confirmed, which means that they have a positive impact on wheat production, meaning that agricultural technologies (modern varieties and laser) have a direct effect. The results also indicated that there is an extravagance in the use of phosphate fertilizers, where the limiting factor is estimated at about 0.75, which means that 75% of the changes in production are due to the previous factors, and the value of (P) reached about 30.3, which confirms the significance of the used model.

While the logarithmic form of the wheat production function using the gradient regression showed that the most important factors affecting wheat production are the amount of municipal fertilizer, the quantity of seeds and the amount of human labor, as an increase in the previous elements by 1% leads to an increase in wheat production by about 0.105 % 0.106 %, 0.180 %, respectively

The significance of the Dummy variables for the varieties (d1) was confirmed, but the effect of the laser was not confirmed (d2), which means the positive effect of the modern improved varieties on wheat production, While it was found that there is an extravagance in the use of phosphate fertilizers, and the coefficient of determination is about 0.75, which means that 75% of the changes in production are due to the previous factors, the value of (F) reached about 43.8, which confirms the significance of the used model

From estimating the production function, it became clear that the element of municipal fertilizer, the quantity and quality of seeds, the amount of human labor and nitrogen fertilizer are among the most important elements that the producer must pay attention to and work as much as possible to rationalize and not be extravagant in the use of phosphate fertilizer until the wheat becomes rational and the feddan productivity increases and thus the import of wheat decreases.

Table 2. The function of wheat production with gradual regression in linear and logarithmic form of study sample.

Mathematical form	The equation	R^2	F
Linear	Y = 7.2 +0.078 X1 + 0.014 X2+-0.029X3--0.005X5 +-0.075X6 (2.8) **+(2)*+(2)*+ (-3.5)**+ (2.9)**+ 1.06d1 + 5.9 d2 (2.6) ** (5.9) **	0. 75	30.2
double logarithmic	Ln Y = 1.6 + 0.105 Ln X1 + 0.106 Ln X2 +0.180 Ln X3 - 0.050 Ln X5 (2.7) **+(2.4)**+(8.6)**+(-3.1)**+ 6.296 d1 +(3.4)**	0. 75	43

** Level of significance at 0.01 * Level of significance at 0.05 - not significant

Where:

Y: the average produced quantity in ardebs / feddan). X1: the amount of municipal fertilizer (m^3 / feddan) X2: The seed quantity in kilograms X3: The human labor per man/working day. X4: Automatic work (hours/feddan) X5: the amount of phosphate fertilizer in active units X6: the amount of nitrogen fertilizer (effective unit / feddan) X7: the value of pesticides X8: the amount of irrigation water in cubic meter, d1. d2 Dummy variables for varieties and lasers take the value (zero) in the case of non-use and the value (one) for the user of the technologies.

The effect of using modern varieties and laser technology on the transmission of the production function of the wheat crop

Multiple regression can be used so that the dependent factor is the quantity of production of the wheat crop in ardeb (Y). As for the independent factors, it is the quantity of the productive elements involved in the production process, whose statistical significance was confirmed for each variable, (X), After that, the variable (X) is multiplied by the sham variable (d) in order to obtain (do) and in order to obtain an effect of technology on the element in the transition of the production function to the element, the value in front of (X) is collected with the value in front of (dx) and the result of the combination is known With the technological effect of the element on the transfer of the production function, which is about 0.149 ardebs in the first equation in the table, Which is about 0.149 ardeb in the first equation in the table (3) for the municipal fertilizer element using the technology of varieties. Thus, the rest of the elements are estimated by the equations as in Table (3). To clarify and demonstrate this, the following model was used.

Transmission of the production function in the manner of Dummy Variables

To identify the source of the difference using dummy variables, the model used can be described as follows: Yt=a+b1X+b2D+b3 X D

where Yt = dependent variable

X = independent variable (the factor of production that has a significant effect on the production of the crop)

D = a transitional variable that takes the value (zero) for not using the studied technologies, and the value (one) for the user of this technology; X D =D* X

From this equation, the equation representing the first period can be derived as follows:

Y X 1=a+b1 X

The equation representing the second period can also be derived as follows:

Y x2= (a=b2) +(b1+b3) X or Y x2=a+B X

It is clear from Table No. (3) the technological effect of the element (municipal fertilizer, seeds, human labor and nitrogen fertilizer) on the transmission of the production function using the technology of varieties and laser technology. It is shown how the production function is transmitted. It has been shown that wheat production has increased by about 0.149 ardeb in the case of introducing the municipal fertilizer component using varieties technology, compared to 0.096 ardeb in the case of using laser technology. The production function can be transferred to the human labor element by about 0.056 ardeb for the variety's technology, compared to 0.069 ardeb for the laser technology. It was also confirmed that the production function moved to the seed element in the case of using laser technology by about 0.230 ardeb, while the production function moved to the nitrogen fertilizer element, and the technological effect was about 0.069 ardeb in the case of using laser technology. It can be concluded from the above that the municipal fertilizer element is the most important element in the transmission of the production function using modern varieties technology, while it became clear that the seed element is the most important element in the transfer of the production function using laser technology.

The relative importance of the problems facing wheat producers

The results in Table No. (4) indicated that the most important problems facing wheat producers were the weakness and shortage of specialized agricultural extension agents, according to 62% of the respondents, followed by the problem of the high prices of modern seeds and the lack of a reliable source to obtain, as this was shown by 51% of the respondents. Then came lack of machinery by 48 % of the respondents, and the problem of the high level of groundwater, which affects the productivity, came in the last rank with 27% of the respondents, due to the lack of sufficient attention to the covered drainage.

Table 3. standard estimation of the effect of using the technology of improved varieties and laser levelling on the transfer of the production function of the wheat crop in the study sample.

Element	technology	The equation	R^2	F	Effect
Municipal fertilizer	Improved varieties	Y^ = 15.5 + 0.025X1 – 0.19 d1 +0.124 d1X1 (0.2) -0.07)- (1. 3) -	0. 41	17.8	01 49
human work	Improved varieties	Y^ = 14.7 + 0.47X3 + 1.1d1 +0. 5d1X3	0.66	48.3	0.056
Municipal fertilizer	laser leveling	Y^ = 15.8 + 0.046 X1 +2.1 d2 +0.049 d2X2 (0.97) (1.3)- (0.82) -	0. 64	45	0.096
seed quantity	laser leveling	Y^ = 17.1 -0.002 X2 – 6.96 d2 +0.232d2X2	0. 70	58	0.230
human work	laser leveling	Y^ = 15.2+ 0.057 X3 +3.1 d2 -0.038 d2X3	0. 64	45	0.019
Nitrogenous fertilizer	laser leveling	Y^ = 11.9 + 0.066X6 +2.4 d2 +0. 004d2X6	0. 78	70.5	0.069

Table 4. The relative importance of the problems facing wheat producers.

Problems	F	%
Weakness of agricultural extension role	62	62
The high prices of improved seeds and the lack of them from a reliable source	51	51
Unavailability of machinery and equipment	48	48
Decreased amount of water needed for irrigation	46	46
High prices of fertilizers and pesticides	38	38
High ground water level and poor drainage	27	27

Sources: Field Survey, 2020

The most important proposals from the point of view of wheat producer.

The results showed Table No. (5) that the most important proposals of wheat producers are to increase interest in the role of agricultural extension due to the importance of the role of extension in transferring research information on modern technologies to farmers by 65%. %, 50%, and ranked last, restoring interest in covered drainage, as it was suggested by 32% of the surveyed farmers.

Table 5. The relative importance of wheat producers' suggestions to overcome previous problems.

Suggestions	F	%
Increasing interest from the state to provide good extension service to producers	65	65
Providing agricultural supplies to the associations at the appropriate time for the producers	55	55
Providing agricultural associations with modern mechanical technology	50	50
Increasing control over fertilizers and pesticides by the state	47	47
Increased wheat supply prices to producers	42	42
Re-attention to covered drainage to maintain soil fertility	32	32

Sources: Field Survey, 2020

Conclusion and Recommendations

This study concludes that the municipal fertilizer element is the most important element in the transmission of the production function using modern varieties technology, while it became clear that the seed element is the most important element in the transmission of the production function using laser technology. As for the problems facing producers were the weak role of agricultural extension, followed by the high prices of improved seeds and their unavailability from a reliable source, then the problem of the lack of machinery and equipment. The producers suggest increasing the state's interest in providing a good extension service, providing the agricultural requirements to the associations at the appropriate time. They also suggest providing the agricultural associations with

mechanical technology, with increased control over fertilizers and pesticides, while working to increase supply prices to encourage producers to increase their wheat production.

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